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Veterans Health Administration discharge telephone follow-up and 30-day hospital readmissions

Tyler Goss
University of Iowa

VETERANS HEALTH ADMINISTRATION DISCHARGE TELEPHONE FOLLOW-UP AND 30-DAY HOSPITAL READMISSIONS

By:

Tyler Goss

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Graduate College
The University of Iowa
Iowa City, Iowa

CERTIFICATE OF APPROVAL

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PH.D. THESIS

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This is to certify that the Ph.D. thesis of

Tyler M. Goss

has been approved by the Examining Committee for
the thesis requirement for the Doctor of Philosophy degree
in Nursing at the December 2015 graduation.

Thesis Committee: _____
Jill Scott-Cawiezell, Thesis Supervisor

_____
Andrea Wallace

_____
Patricia Groves

_____
Tim Ansley

_____
Bonnie Wakefield

Dedicated

To my wife. Thank you for your patience.

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Abstract

Healthcare costs have risen from consuming 13.8% of the gross domestic product in 2000 to consuming 17.9% of the gross domestic product in 2009 (Gordon, Leiman, Deland, & Pardes, 2014). Poor transitional care has been identified as a cause of the high healthcare costs (Naylor et al., 2013; Obama, 2013). In 2009, the Department of Veterans Health Administration (VHA) implemented a national reform of outpatient care to create Patient-Aligned Care Teams (PACTs) with a goal to improve transitional care and reintegration into outpatient care through registered nurse case managers conducting discharge telephone follow-up calls. However, there is conflicting evidence regarding the effectiveness of discharge telephone follow-up calls, and the effectiveness of discharge follow-up calls has not been explored within the VHA.

This study explored the relationships among receipts of discharge telephone follow-up calls, selected Veteran characteristics including the length of index hospital stay, and 30-day all cause hospital readmissions from fiscal years 2011 and 2013. Hospital readmissions were explored by three clinically relevant time periods based off the recommended timing of discharge telephone follow-up calls (within two days of discharge, between three and seven days of discharge, between eight and thirty days of discharge). Study data were collected retrospectively from VHA inpatient and outpatient records. Descriptive statistics, measures of central tendency, bivariate statistics, and logistic regression were used to analyze the data.

Data from this study show that 124,069 Veterans were discharged from the VHA from 2011 to 2013. Of those discharges, 15,954 (12.86%) were readmitted to the hospital within 30 days, with 35.06% of readmissions occurring within the first seven days of discharge. Discharge telephone follow-up calls increased from 312 in 2011 to 26,549 in 2013. Increasing Veteran age, number of comorbidities, length of index hospital stay, and being identified as frequently hospitalized in the previous year were significantly related to hospital readmissions at each of three hospital readmission time frames (within two

days, between three and seven days, and between eight and thirty days after hospital discharge).

Receipt of discharge telephone follow-up calls was associated with a lower likelihood of hospital readmission, but was limited to receipt of discharge telephone follow-up calls within two days and a decreased likelihood of hospital readmissions within two days after discharge (OR=0.595). There are two explanations for why the relationship between discharge telephone follow-up calls and hospital readmissions was limited to follow-up within two days and readmissions within two days of discharge: Discharge telephone follow-up calls within two days of discharge may have a short, protective effect. However, the second explanation is that self-selection bias confounds the relationship between discharge telephone follow-up calls and hospital readmissions (i.e., those who do not receive the calls are those who are readmitted). This time-limited relationship could explain previously mixed results related to the effectiveness of follow-up calls on 30 days hospital readmissions. Both explanations suggest future research and clinical practice should focus on exploring more intensive transitional care interventions, particularly at the period immediately after discharge, as a method to reduce hospital readmissions.

Public Abstract

With growing concern over healthcare costs within the United States, healthcare organizations have begun looking for ways to curb costs while improving the quality of care. One potential area for improving care that can dramatically reduce costs through improving the quality of care is improving the transition from hospital to home through preventing hospital readmissions.

Discharge telephone follow-up calls by nurse case managers have been identified by the Veterans Health Administration (VHA) as a chosen method for transitioning Veterans from the hospital to home. However, discharge telephone follow-up calls have not been rigorously evaluated within the VHA. This study explored the relationships between discharge telephone follow-up calls conducted by nurse case managers within the VHA and hospital readmissions. The results showed discharge telephone follow-up calls are associated with reductions in the risk for hospital readmissions within two days after discharge, but not associated not reduce the risk of hospital readmissions beyond two days. Additionally, this study found several Veteran characteristics (age, number of comorbidities and previous hospitalizations) and length of previous hospital stay were identified to increase risk of hospital readmissions.

Overall, this research illustrates that discharge telephone follow-up calls within the VHA may be an ineffective method for reducing hospital readmissions. Therefore, future research is needed to explore alternative transitional care methods within the VHA to reduce hospital readmissions.

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Chapter 1

Introduction to the Study

Background

The United States (US) Healthcare System consumes nearly 18% of the national gross domestic product (Fuchs, 2013; Gordon et al., 2014). The President's Economic Report identified fragmentation and poor patient care transitions as significant contributors to healthcare costs (Obama, 2013). Furthermore, tax payers are spending approximately $12 billion dollars per year to offset the consequences of poor transitions from hospitals to home based care (Naylor, 2012). Poor patient transition from the hospital to home is one of the most pressing financial problems facing the healthcare industry, with many of the poor care transitions involving older Americans with complex chronic conditions. Several researchers have noted nearly one out of every five Medicare patients discharged from the hospital is readmitted within 30 days (Jencks, Williams, & Coleman, 2009; Jiang & Wier, 2009; Kaboli et al., 2012).

In 2013, the Center for Medicaid and Medicare Services (CMS) began reducing hospital payments for patients who were readmitted to the hospital within 30 days of discharge ("Patient Protection and Affordable Care Act," 2010). Changes in hospital payments for patients readmitted to the hospital within 30 days of discharge are incentivizing the improvement of care transitions. However, Naylor and colleagues (2012) noted healthcare policy changes may have unintended negative consequences on discharge follow-up and hospital readmissions through unfairly penalizing hospitals caring for larger proportions of patients at greater risk of hospital readmission. Many of the patients at greater risk for hospital readmission are older with complex medical conditions whose healthcare is fragmented between multiple providers (Grinspan et al., 2014; Tsai, Orav, & Jha, 2015).

Healthcare Fragmentation and Care Coordination within the VHA

Healthcare fragmentation has been described as the lack of a national or single set of policies guiding the healthcare system leading to providers within the same community working independently from each other with little communication or collaboration (Shih et al., 2008). Healthcare fragmentation leads to patients receiving care from multiple providers and poor health outcomes (Hempstead, Delia, Cantor, Nguyen, & Brenner, 2014). When patients see multiple providers for care, they have been described as having fragmented care. Reducing fragmented care and healthcare fragmentation has been identified as a significant national priority (Obama, 2013). One potential solution to reducing fragmented care and healthcare fragmentation is through improvements in care coordination and expansion of integrated health systems.

The Department of Veterans Health Administration (VHA) is a national health system with unified policies guiding providers and a national electronic medical record providing consistent sharing of health information among clinicians. However, even within the VHA, healthcare fragmentation significantly contributes to hospital and emergency room visits (Yoon, Zulman, Scott, & Maciejewski, 2014). Even within the VHA, many Veterans see multiple providers and may have contradicting care plan because of increased age and the number of chronic conditions.

Compared to patients outside the VHA, Veterans are more likely to be older males with complex chronic conditions causing Veterans to be at significant risk for having fragmented care (Cebul et al., 2009; West & Weeks, 2009; Yu et al., 2003). An observational study of patients with diabetes and chronic kidney disease found that increasing complexity of care related to chronic conditions and having care provided by multiple healthcare clinicians lead to significantly increased fragmented care and risk for emergency room use (Liu, Einstadter, & Cebul, 2010). Patients with highly fragmented care were 1.2 times more likely to have emergency room use within two years than patients with lower levels of fragmented care. To reduce healthcare fragmentation,

researchers and policy makers have identified care coordination among providers as a strategy to reduce fragmentation while improving the quality of healthcare (Bachman and Gonyea 2012; Obama 2013; Krueger et al. 2013).

Care coordination has been described as the "deliberate organization of patient care activities between two or more participants" (McDonald et al. 2010, p. 6). Care coordination across healthcare settings has been identified as a way to reduce healthcare fragmentation, improve patient outcomes, and decrease healthcare costs (Kersbergen, 1996; Obama, 2013; Phelan et al., 2009; Reuben, 2009). A specific strategy to reduce fragmentation through care coordination is improving patient transitions from inpatient hospital services to outpatient services. This subtype of care coordination has been identified as transitional care.

Transitional care "encompasses a broad range of services and environments designed to promote the save and timely passage of patients between levels of healthcare and across care settings" (Naylor & Keating, 2008, p. 58). National efforts to improve care coordination as a means to decrease healthcare fragmentation often implement transitional care strategies. For example, in 2010, the Department of Veterans Health Administration began reorganizing outpatient care services to improve care coordination and transitional care for Veterans. The reorganization of outpatient care in the VHA uses discharge telephone follow-up calls to improve transitional care as an element of care coordination. While transitional care is an important element of care coordination, it is not the only care coordination strategy.

In 2010, the VHA began implementing an outpatient reform called the Patient-Aligned Care Team (PACT) to improve care coordination (Klein, 2011; United States Department of Veterans Health Administration, 2013). The Patient-Aligned Care Team is the VHA equivalent to the Patient-Centered Medical Home outside the VHA. Each PACT contains a primary care provider, a registered nurse case manager, a licensed practical nurse, and a scheduling clerk to coordinate and provide outpatient services.

Registered nurse case managers within PACTs are expected to coordinate care of Veterans through increasing communication between providers and patients, organizing care plans, and coordinating hospital visits (Klein, 2011). Improving care coordination though PACT implementation has been identified as a national priority and strategy to improve Veteran care.

Implementation of PACTs in 2010 was designed to improve the quality of care for aging and medically complex Veterans. Since implementation of PACT, Veteran enrollment has increased to 8.9 million (United States Department of Veterans Health Administration, 2013). Increases in Veteran enrollment coincide with increases in outpatient visits and VHA hospital admissions. Historically, Veterans enrolled in VHA care have been older and less financially secure than Veterans who were not enrolled in care at the VHA (West & Weeks, 2009). When compared to Medicare, the median age of enrolled Veterans was 64, slightly less than the age of enrollment in Medicare (National Center for Veterans Analysis and Statistics, 2014). Increasing VHA enrollment combined with older and less financially secure Veterans increases the importance of focusing upon improving outpatient care coordination, quality, and efficiency of services through PACTs. Within the PACTs, improvements in care coordination are evaluated through the quality metric all cause 30-day hospital readmission, but since PACT implementation, there has yet to be an evaluation of 30-day hospital readmissions through the VHA (Klein, 2011). As a national system with a more centralized leadership structures, the VHA has been able to quickly implement their care coordination model (PACT) when compared to other health systems.

Outside the VHA, implementation of the patient-centered medical home model has provided mixed results on reducing hospital readmissions through improving care coordination (Gilfillan et al., 2010; Stone, 2008). A retrospective study comparing outpatient clinics implementing the patient-centered medical home model to clinics which were not implementing the model found no difference hospital readmissions

between 2002 to 2006 (Stone, 2008). Conversely, another retrospective study from 2005 to 2008 found a 36% cumulative decrease in hospital readmissions after implementation of the patient-centered medical home model in outpatient care (Gilfillan et al., 2010). Within the VHA, the patient-centered medical home model equivalent, the PACT, was implemented nationally in 2010 and the relationship between PACT implementation and 30-day hospital readmissions has yet to be full explored.

As a nationally integrated healthcare system, the VHA provides a structured bureaucracy through uniform implementation of policies. The additional bureaucratic control allows more opportunities for standardization. Through the national integration, the VHA's size and bureaucratic control make the VHA a unique health system and provide opportunities to integrate care for complex patients. For example, complex care transitions in the VHA may be easier with the large integrated health system of the VHA as evidenced by the lower hospital 30-day hospital readmission rates. Compared to the VHA 19.6% of patients with Medicare are readmitted to the hospital within 30 days while 16.7% of Veterans are readmitted to the hospital within 30 days at the VHA (Jencks et al., 2009; Kaboli et al., 2012). Although the VHA has lower 30-day hospital readmissions than public sector hospitals, poor transitions between health services are still a national concern. Furthermore, despite implementation of discharge telephone follow-up as part of PACT strategy, the VHA has yet to explore discharge telephone follow-up as a transitional care method within PACTs.

Transitional Care

Transitional care for Veterans includes a broad range of health services designed to promote the safe and timely passage of patients between settings of healthcare (Naylor & Keating, 2008). There are many different healthcare settings through which patients' transition; however, for the current study, only transitions between inpatient and outpatient services will be considered. Two of the most prominent US transitional care

programs, the Naylor Transitional Care Model and the Coleman Care Transitions Intervention, utilize extensive discharge planning and home-based follow-up. Both models rely heavily on nurses to facilitate patient transitions from the inpatient to outpatient services. Unlike PACT discharge telephone follow-up, both the Naylor Transitional Care Model and the Coleman Care Transitions Intervention originate from inpatient services and are integrated into the discharge process while the PACT provides a long term "medical home" for the patient and discharge telephone follow-up calls are part of this ongoing coordination and commitment.

In the early 2000's, Mary Naylor developed the Transitional Care Model focusing on improving hospital to home transitions for patients with congestive heart failure. Naylor's Transitional Care Model uses advance practice nurses to plan, coordinate, and follow patients discharged from inpatient care to home through reintegration into outpatient care services (M. Naylor et al., 1999; Naylor, 2000, 2002, 2004; Parry, Coleman, Smith, Frank, & Kramer, 2003; Phelan et al., 2009; Richardson & Cordasco, 2012). In a randomized controlled trial, patients who did not receive transitional care utilizing the Naylor Transitional Care Model were 1.8 times more likely to be readmitted to the hospital (M. Naylor et al., 1999). Naylor's model has demonstrated significant reductions in 30 day hospital readmissions for patients with congestive heart failure. However, patients with congestive heart failure are at an increased risk of hospital readmission compared to patients with other hospital diagnoses (Au et al., 2012; Haldeman, Croft, Giles, & Rashidee, 1999). Because Naylor's Transitional Care Model focuses primarily on patients with congestive heart failure, the generalizability of the model to all patients may be limited and the costs associated with advance practice nurses conducting home visits may not be feasible for all patient populations. Therefore, researchers have begun breaking down the Naylor Transitional Care Model components to see what components have the greatest influence on hospital readmissions and applicability to all patient populations. Within the VHA, PACT nurse case managers

focus on reintegrating Veterans into outpatient care services similar to transitional care nurses within the Naylor Transitional Care Model.

Similar to the Naylor Transitional Care Model, the Coleman Care Transitions Intervention has demonstrated significant decreases in hospital readmissions. However, unlike the Naylor model which focuses on APNs providing follow-up care, the Coleman model utilizes registered nurse-led follow-up telephone calls to reduce hospital readmissions (Coleman, Parry, Chalmers, & Min, 2006; Ohuabunwa, Jordan, Shah, Fost, & Flacker, 2013; Parry et al., 2003; Parry, Min, Chugh, Chalmers, & Coleman, 2009). The Coleman Care Transitions Intervention consists of four pillars to guide transitional care: encouraging self-management, using of electronic medical records, nurse-led follow-up, and teaching of 'red flags' which may lead to being readmitted to the hospital (Coleman et al., 2006). Similar to the Naylor Transitional Care Model, the Coleman Care Transitions Intervention utilizes both telephone and home visits for follow-up. However, home visits may not be possible transitional care method for many hospitals. Instead nurse-led telephone follow-up calls have been described as an effective and comparable alternative to the Naylor and Coleman transitional care interventions (Mistiaen & Poot, 2008).

Learning from both models, the VHA has adapted aspects of both transitional care programs such as the PACT nurse case manager discharge telephone follow-up calls. Like both the Naylor Transitional Care Model and the Coleman Care Transition Intervention, discharge telephone follow-up calls are nurse-led and strive to improve reintegration into outpatient services. The PACT nurse case manager utilizes structured discharge telephone follow-up calls similar to the Coleman Care Transitions Intervention to reinforce discharge teaching and medication management of discharged Veterans. While both Naylor and Coleman's models are a continuation of discharge services through transitional care providers, transition from VHA acute care involves the inpatient nurses conducting the discharge education and PACT nurse case managers providing the

discharge telephone follow-up calls as the Veteran is reintegrated into their outpatient "medical home." A recent systematic review and meta-analysis of transitional care programs noted interventions delivered through multiple modalities and emphasizing capacity building similar to VHA transitional care were about 1.3 times better at reducing 30-day hospital readmissions (Leppin et al., 2014). While PACT does not specifically follow either the Naylor Transitional Care Model or the Coleman Care Transitions Intervention, integration of discharge follow-up has become essential to increased patient-centered care coordination with the goal of improving transitional care of Veterans' care across settings (Rosland et al. 2013). Despite an emphasis on improving transitional care within PACT, the VHA has yet to explore how PACT implementation has affected 30-day hospital readmissions. Several researchers suggest the discharge follow-up telephone call is effective in improving hospital readmissions (Costantino, Frey, Hall, & Painter, 2013a; Dudas, Bookwalter, Kerr, & Patilat, 2001; J. D. Harrison, Auerbach, Quinn, Kynoch, & Mourad, 2014; Soong et al., 2014). At this time, it is unknown if PACT discharge telephone follow-up calls have any influence on 30-day hospital readmissions within the VHA. Furthermore, there has been limited research to explore potential variables influencing relationship between discharge telephone follow-up and hospital readmissions within the VHA. Therefore, this study will explore the relationship between discharge telephone follow-up calls within the VHA and potential Veteran characteristics influencing the relationship.

Exploring the relationships between discharge telephone follow-up and 30-day hospital readmissions will provide critical insight into the PACT transitional care process. Because discharge telephone follow-up care has not been evaluated in PACT, leaders and policy makers have relied on past transitional care and discharge telephone follow-up research to inform decisions. Previous research between discharge telephone follow-up calls and hospital readmission rates has been mixed (Bostrom, Caldwell, McGuire, &

Everson, 1996; Costantino et al., 2013a; Dudas et al., 2001; P. L. Harrison, Hara, Pope, Young, & Rula, 2011).

In one study, researchers did not find a statistically significant relationship between discharge telephone follow-up calls and readmission rates ($p=0.07$) (Dudas et al., 2001). While not statistically significant, the authors noted 30-day readmissions occurred in 15% of patients who received discharge telephone follow-up calls compared to 25% of patients who did not receive discharge telephone follow-up calls. Further research on discharge telephone follow-up in Medicare patients demonstrated clinically and statistically significant reductions in 30-day hospital readmissions (Costantino et al., 2013a; P. L. Harrison et al., 2011). Of the patients who were readmitted to the hospital within 30 days, fewer patients had received a discharge follow up telephone call (9.3% compared to 11.5%) (Costantino, Frey, Hall, & Painter, 2013b). Based upon inconsistencies among the results and the uniqueness of the VHA, establishing the relationship between the discharge telephone follow up and the outcome 30-day all cause hospital readmissions is an essential first step for exploring the impact of PACT upon 30 day all cause readmissions. Also critical to the exploration is the timing of the discharge telephone follow-up and how timing impacts 30-day all cause hospital readmissions.

Within the VHA, discharge telephone follow-up calls are expected to be conducted within two days after hospital discharge (Richardson & Cordasco, 2012). However, early discharge telephone follow-up may not be possible for PACT nurse case managers, so telephone follow-up calls are considered discharge telephone follow-up calls if within the first seven days after hospital discharge. Because the VHA has a created a national goal to have discharge telephone follow-up calls within two days after hospital discharge while tracking all discharge telephone follow-up calls, this study will explore how timing of the discharge telephone follow-up call influenced 30-day hospital readmissions.

Previous research teams have noted timing of the discharge telephone follow-up calls may have influenced 30-day readmissions. In a retrospective study on patients with Medicare or Medicaid, patients who receive discharge telephone follow-up calls 14 days after hospital discharge are 1.3 times more likely to be readmitted to the hospital within 30-days than patients who receive a discharge telephone follow-up call within 14 days of discharge (Costantino et al., 2013a). Additionally, patients who received a discharge telephone follow-up call within two days of discharge were 23.1% less likely to be readmitted to the hospital within 30-days than patients who did not receive any discharge telephone follow-up call (P. L. Harrison et al., 2011). Costantino and colleagues (2013) note "the intervention appeared to have the greatest impact when performed as close to the day of discharge as possible" (p. 313). Both authors demonstrated the importance of timing of the discharge telephone follow-up call, however; the optimal timing of the discharge telephone follow-up call remains a point of interest and requires further explanation.

Statement of the Problem

To improve transitional care, the VHA has integrated discharge telephone follow-up into PACT outpatient services. The goal of discharge telephone follow-up is to reduce hospital readmissions through improved Veteran reintegration into outpatient services. Despite national attention and discharge telephone follow-up implementation, discharge telephone follow-up calls as part of PACT has yet to be explored within the VHA. Therefore, the proposed study will explore the relationships between VHA discharge telephone follow-up and 30-day hospital readmissions, attempting to identify Veteran characteristics which may influence transitional care.

Conceptual Underpinnings

To explore the relationship between discharge telephone follow-up and 30-day hospital readmissions within the VHA, the Donanbedian Structure, Process, Outcome

theoretical framework provides guidance to considering the essential elements of the study. In the 1960's Avedis Donabedian developed a conceptual framework to evaluate the quality of medical care. Donabedian articulated that an organization's structure influences their processes, which then affect patient outcomes (Donabedian, 1966, 1968, 1969). The Structure, Processes, Outcomes (SPO) framework (see Figure 1-1) organizes quality of care into a systematic pathway stemming from clinician-patient interactions (Donabedian, 1966). While healthcare is not linear, Donabedian's SPO framework does provide a starting point for organizing the evaluation of healthcare outcomes by visualizing how structures lead to processes which lead to patient outcomes.

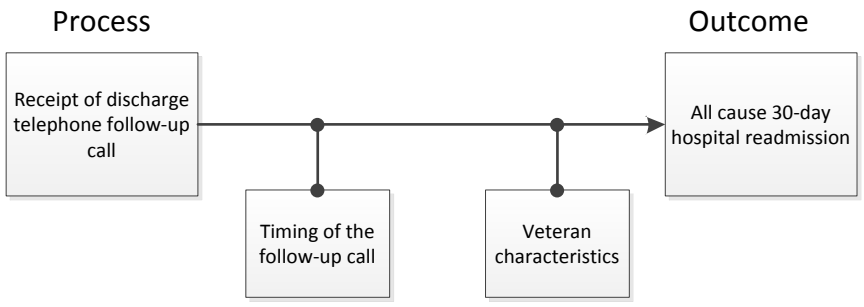
Figure 1-1 SPO Model

An axiom of Donabedian's SPO framework is appropriately defining quality of care prior to examining quality (Donabedian, 1966, 1988). In the SPO framework, assessing the quality of care encompasses an examination of both organizational structures and processes of care in relation to a specific outcome. Structure pertains to organizational resources used to provide care. Staffing levels, clinic volume, and patient population can be considered structural components influencing processes. Process of care describes how care is delivered. Interactions between clinicians and patients with the goal of improving health and wellbeing are processes. Finally, according to Donabedian, outcomes are the desired end results.

For this research project, the outcome of interest is Veteran all cause 30-day hospital readmissions. The process of interest is the PACT nurse case managers'

discharge telephone follow-up calls. The VHA National Healthcare System and PACT implementation provide the overall structure and serve as the structural constant for all Veterans providing study context. Timing of discharge telephone follow-up calls and Veteran characteristics will be evaluated as influencing variables which may affect the relationship between discharge telephone follow-up process and the outcome all cause 30-day hospital readmissions (Figure 1-2) to set the stage for future studies.

Figure 1-2 Conceptual Model



Purpose of the Study

The purpose of this study is to determine the relationships between VHA discharge telephone follow-up calls and 30-day hospital readmissions. A secondary purpose is to describe how timing of the discharge telephone follow-up call and Veteran characteristics influence this relationship. Timing of the discharge telephone follow-up call and Veteran characteristics will be explored in depth in Chapter 2. To achieve the purposes of this study, the following specific aims will guide the current study:

1. Describe 30-day hospital readmissions among Veterans discharged from the VHA between federal fiscal years 2011-2013 in terms of receipt and timing of discharge telephone follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalization).

2. Determine whether hospital readmissions are associated with receipt and timing of discharge telephone follow-up call, length of index hospital stay (LOS) and selected Veteran characteristics (age, number of comorbidities, frequent hospitalization) at clinically relevant time periods (within two days, between three and seven days, between eight and thirty days) during the first 30 days post discharge.

H1: Hospital readmissions between zero and two days post-discharge are associated with receipt of discharge follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalizations).

H2: Hospital readmissions between three and seven days post-discharge are associated with receipt of discharge follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalizations).

H3: Hospital readmissions between eight and thirty days post-discharge are associated with receipt of discharge follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalizations).

Summary

This chapter described the growing costs of US healthcare and how poor transitional care is a significant contributing factor to the cost and quality of care for patients with complex medical conditions. Effective transitional care has become a national priority. At the VHA, restructuring has resulted in the Patient-Aligned Care Team (PACT) which integrates patient centered coordination of care that includes discharge telephone follow-up after acute care episodes as a transitional care intervention to reduce 30-day hospital readmissions. While discharge telephone follow-up has been

clearly defined as a process within the PACT, the impact upon 30-day hospital readmissions within the VHA is not well known. Thus, the study will seek to explore the relationship between the discharge telephone follow-up process and 30-day all cause VHA hospital readmissions. Additionally, the study will examine how timing of the discharge telephone follow-up call and Veteran characteristics influence the 30-day hospital readmissions. The next chapter will expand on the current research on discharge telephone follow-up and 30-day readmissions.

Definition of Key Terms

30-day Hospital Readmission- A hospital admission within 30-days of a previous discharge (Podulka, Barrett, Jiang, & Steiner, 2012; Wier, Barrett, Steiner, & Jiang, 2011).

Care Coordination- The deliberate organization of patient care activities between two or more participants involved in the patient's care to facilitate the appropriate delivery of healthcare services (McDonald et al. 2010, p. 6).

Donabedian's Structure Process Outcome Model- A theoretical model used to evaluate the quality of care. Organizational structures influence clinical processes which in turn affect patient outcomes (Donabedian, 1968, 1988).

Discharge Telephone Follow-up- A discharge follow-up method in which a registered nurse case manager telephones the patient after being discharged from the hospital to reintegrate into primary care services (McIntosh & Worley, 1994).

Fragmented Care- Seeing multiple healthcare providers for health services leading to increased risk for poor health outcomes (Hempstead et al., 2014).

Healthcare fragmentation- The lack of a national or single set of policies guiding the healthcare system leading to providers within the same community working independently from each other with little communication or collaboration (A. Shih et al., 2008).

Patient-Aligned Care Team (PACT)- A primary care team within the VHA designed to improve chronic disease management, access to care, improve preventative health services and coordination of care (Klein, 2011).

Transitional Care- A broad range of services and environments designed to promote the safe and timely passage of patients among levels of healthcare and across settings (M. Naylor & Keating, 2008)

Chapter 2

Literature Review

Introduction

Healthcare costs consumes 17.9% of the US national gross domestic product, or approximately $2.7 trillion dollars (Gordon et al., 2014). Poor patient transitions from hospital to home are a significant contributor to high healthcare costs, thus the increasing focus upon improving care transitions. Researchers have identified fragmented care as a leading cause of poor transitional care as a contributor to growing healthcare costs in the US (Hockenberry, Burgess, Glasgow, Vaughan-Sarrazin, & Kaboli, 2013; Naylor, 2004; Riegel, Naylor, Stewart, McMurray, & Rich, 2004). In 2009, nearly one out of every five Medicare patients discharged from the hospital was readmitted within 30 days (Jencks et al., 2009). Furthermore, patients with complex chronic conditions are at an increased risk for being readmitted within 30 days (Bradley et al., 2013; Braunstein et al., 2003; Cloonan, Wood, & Riley, 2013; Donze, Lipsitz, Bates, & Schnipper, 2014; Enguidanos, Vesper, & Lorenz, 2012; Gooding & Jette, 1985; Holloway, Medendorp, & Bromberg, 1990; Iloabuchi, Mi, Tu, & Counsell, 2014; Jiang, Russo, & Barrett, 2009; Jiang & Wier, 2009; McMartin, 2013; Naylor, 2002; Phelan et al., 2009; Podulka et al., 2012; Shulan, Gao, & Moore, 2013; Silverstein, Quin, Mercer, Fong, & Haydar, 2008; Takahashi et al., 2013; Tsai, Orav, & Joynt, 2014). Because of the growing cost concern related to hospital readmissions, the VHA has implemented a national policy of contacting patients within two days of their hospital discharge as part of their outpatient healthcare reform strategies. However, there has yet to be an extensive evaluation of the relationship between the VHA discharge telephone follow-up program and hospital readmissions. The current study will explore the relationship between the VHA discharge telephone follow-up program and all cause 30-day hospital readmission rates and identify how timing of the discharge telephone follow-up call and Veteran characteristics influence relationship.

Fragmentation and Care Coordination

Healthcare fragmentation has been described as the lack of a national or single set of policies guiding the healthcare system, leading to providers within the same community working independently from each other with little communication or collaboration (Shih et al., 2008). Healthcare fragmentation has led to patients receiving care from multiple providers. For example, when a patient sees multiple providers within the community, care is fragmented if the multiple providers do not coordinate their care plans which leads to an increased risk for poor health outcomes (Hempstead et al., 2014). The greater number of providers the patient sees, the greater the level fragmented care. Therefore, fragmented care is the tangible result from the lack of national or single set of policies guiding the healthcare system. Fragmented care has been linked to increased healthcare costs through unnecessary medical testing, worse health outcomes, and conflicting plans of care due to poor communication and collaboration (Borus et al., 1975; Cebul, Rebitzer, Taylor, & Votruba, 2008; Fleming & Haney, 2013; Grinspan et al., 2014; Hempstead et al., 2014; Liu et al., 2010; Miller & Tucker, 2014; Montenegro et al., 2011; Shih et al., 2008; Skolarus, Zhang, & Hollenbeck, 2012; Tsai et al., 2015).

Over the past decade, healthcare costs have risen rapidly from 13.8% of the gross domestic product in 2000 to 17.9% of the US gross domestic product in 2009 (Gordon et al., 2014). As early as the 1970's, healthcare fragmentation has been identified as a significant contributor to healthcare costs (Freedman, 1975). Recently, fragmented care has been described as a significant contributor to the poor quality and high costs of healthcare in the US (Gordon et al., 2014; Obama, 2013). Patients who see multiple providers are more likely to receive additional medical tests (Grinspan et al., 2014). To prevent patients from receiving additional and often unnecessary medical tests, researchers have proposed the expansion of integrated health networks (Manser, 2014; Montenegro et al., 2011; A. Shih et al., 2008). Integrated health networks are organizations who work together within a community to provide comprehensive health

services across the continuum of care (Montenegro et al., 2011). However, many hospital providers operate independently or through specialty practices contracted with the hospital organization preventing effective integration of health networks and reduction in costs related to healthcare fragmentation (Cebul et al., 2008).

In addition to the increased costs associated with healthcare fragmentation, patients with multiple providers and fragmented care services are at an increased risk for poor health outcomes. For example, fragmented post-surgical care leads increases the risk for mortality after surgery. Patients who were readmitted to a hospital other than where their surgery was conducted were 1.41 times (95% CI[1.31, 1.51]) more likely to die during their hospitalization than patients who were readmitted to the hospital where the surgery was conducted (Tsai et al., 2015). Although the cause for hospital readmission was unknown in the study and may have significantly contributed to the increased mortality rate, the authors suggest that if the patient was readmitted to the hospital where the surgery occurred, there could have been less redundant clinical tests and earlier recognition of complications resulting in lower mortality rates. Improved communication and exchange of clinical data could potentially reduce patient mortality while decreasing healthcare costs. Similarly, patients with epilepsy who seek care from multiple hospitals receive more computerized tomography scans and are more often diagnosed with encephalopathy (OR=2.66, 95% CI[2.14-3.29]) (Grinspan et al., 2014). Again, the authors did not know the reason why patients received care from multiple hospitals. However, the authors did suggest that patients who received care consistently from one provider may have developed a relationship with that provider leading to timely identification of complications and preventing encephalopathy. Consistency in healthcare providers decreases fragmented care, resulting in better patient outcomes.

Although consistency of healthcare providers can reduce fragmented care, patients with multiple chronic conditions are seen by multiple providers, creating an increased risk for fragmented care (Bachman & Gonyea, 2012; Borus et al., 1975;

Hempstead et al., 2014; Liu et al., 2010; Skolarus et al., 2012; Stange, 2009). Fragmented care for patients with multiple chronic conditions occurs because providers managing the patient's chronic conditions focus on individual chronic conditions (Hempstead et al., 2014). For example, patients with diabetes are often having their diabetes managed by a primary care provider. If the diabetes management follows evidence based practice, patients with diabetes will potentially be seen a myriad of healthcare providers including: ophthalmology, endocrinology, podiatry, cardiology, neurology, nephrology, psychiatry, registered dietitians, and wound specialists (Association, 2015; Liu et al., 2010). Each provider specializes in one aspect of the patient's diabetic care and increasing specialization leads to increased fragmentation. When patients with complex chronic conditions are hospitalized, their care is coordinated and managed by the inpatient care teams, but when the patient transitions from the hospital to home, their care must then be coordinated and managed by their outpatient primary care team.

Patient transitions between health settings are a time when patients with complex chronic conditions are vulnerable to the effects of healthcare fragmentation (Manser, 2014; Walker, Johns, & Halliday, 2015). Transitioning from inpatient to outpatient services for patients with complex chronic conditions requires additional communication and collaboration between inpatient and outpatient providers (Fleming & Haney, 2013). The additional communication and collaboration requires additional resources to provide transitional care (Naylor et al., 2012). However, in 2013, the Center for Medicare and Medicaid Services began financially penalizing patients readmitted to hospitals within 30 days. The increased risk of poor patient transitions from the hospital to home for patients with complex chronic conditions combined with the increased financial penalty for 30-day hospital readmissions has made transitional care a national priority.

Transitional Care

In the 1980's, implementation of the prospective payment system led to elderly patients being discharged from hospitals without fully resolved health problems (Naylor, 2000). The prospective payment system reimburses hospitals for a set number of hospital days based upon medical billing data. After implementation of the prospective payment system, hospitals attempted to discharge patients from acute care to outpatient care according to the Medicare estimated length of stay (Newhouse & Byrne, 1988). Simultaneously researchers began to identify patients who were at risk for hospital readmissions (G. F. Anderson & Steinberg, 1985; Boydell, Malcolmson, & Sikerbol, 1991; Gooding & Jette, 1985; Smith, Norton, & McDonald, 1985). Examination of patients with Medicare funding revealed patients with prior readmissions or admission for chronic illnesses without surgical intervention were at the highest risk for hospital readmission within 60 days of discharge (G. F. Anderson & Steinberg, 1985). In 1990, VHA researchers noted Veterans with chronic illnesses were 2.02 to 2.67 times more likely to be readmitted to the hospital (Holloway et al., 1990). VHA researchers also noted older and rural Veterans were at increased risk for readmissions (OR = 1.10 and 1.18 respectively) (Holloway et al., 1990). Identification of patients at risk to be readmitted led to extensive research on discharge planning and follow-up care.

Early transitional care interventions in the 1980's focused on comprehensive discharge planning to reduce hospital readmissions (Larsen, 1988; Naylor, 2000). Since the 1980's comprehensive discharge planning has been integrated as a component in transitional care programs. Another component that has been integrated into transitional care programs is discharge telephone follow-up calls. In the early 1990's healthcare systems began implementing telephone discharge follow-up calls to assist with the patient's transition from hospital to home (McIntosh & Worley, 1994). However, early research on discharge telephone follow-up calls found no significant difference between hospital readmissions in groups who received discharge telephone follow-up calls

compared to no discharge telephone follow-up call (p=.486) (Bostrom et al., 1996). Lack of statistically significant differences in hospital readmissions between patients who received discharge telephone follow-up calls and patients who did not receive discharge follow-up calls led to the integration of discharge telephone follow-up into larger, bundled transitional care models.

Researchers began to explore bundled transitional care models, which include more intentional nursing interventions to bridge the gap between discharge and reintegration into primary care. Combining comprehensive discharge planning with post-discharge care led to several bundled interventions focused on improving transitional care from hospital to home. Two of the most prominent groups of researchers who developed care transition models interventions were Mary Naylor and her team from Pennsylvania and Eric Coleman and his team from Denver Colorado.

Mary Naylor and colleagues (1999) conducted a randomized controlled trial evaluating integration of comprehensive discharge planning and home follow-up (M. Naylor et al., 1999). The Naylor Transitional Care Model (NTCM) used APNs to provide comprehensive discharge planning and education, home visits, and telephone follow-up calls to discuss dietary changes, symptom management and follow-up care. The NTCM facilitated communication between patients, caregivers, and primary care teams. Further study of the NTCM demonstrated patients with congestive heart failure (CHF) were at increased risk for hospital readmissions and significantly more likely to be readmitted, receive less medication for CHF treatment, and were more hemodynamically stable (Naylor, 2004). Naylor and colleagues saved an average of $4845.00 per patient with their transitional care model through the reduction of hospital readmissions. Additionally, a quasi-experimental examination of the NTCM integrated into the Aetna Medicare Advantage program demonstrated significant reductions in hospital days, hospital readmissions, and cost savings (Naylor et al., 2013). Because of the effective reductions in hospital readmissions by the NTCM, it has become one of the most prominent US care

transition models. However, despite becoming one of the best known transitional care models, there are issues of feasibility when considering implementation at a large scale across the county.

Naylor's Transitional Care Model requires comprehensive discharge planning and home visits by an advance practice nurse (APN), which may not be feasible in under-resourced settings, such as areas with dense populations of socially and economically disadvantaged people and some rural settings. There are human resource issues and challenges related to payment. The US government has decided to provide reimbursement for patients with Medicare to pay for transitional care in 2013. Providing reimbursement for transitional care may improve feasibility of transitional care interventions similar to the NTCM in rural areas, but the new billing codes do not include all the elements of NTCM and will not reimburse providers to travel for home visits. Despite demonstrating significant cost savings and effectiveness, some healthcare systems have chosen to implement the Coleman Care Transitions Intervention (CCTI) because it is less reliant on APNs and may be more feasible for populations that have limited resources (human and fiscal).

While Naylor focused upon the APNs' pivotal role in the NTCM, Coleman and colleagues developed the CCTI, which utilizes registered nurses to lead care transitions. Unlike the NTCM, Coleman and colleagues focused on four pillars: 1) increasing medication self-management, 2) patient-centered record, 3) follow-up care, and 4) identification of 'red flags' (Coleman et al., 2006). As noted earlier, NCTM uses APNs; CCTI is a registered nurse-led program using comprehensive discharge planning, education, and telephone follow-up. Use of registered nurses decreases the nurse costs within the model and prevents the staffing challenges of having adequate numbers of APNs. Coleman and colleagues (2006) found significant reductions in hospital readmission rates at 30 and 90 days ($p = .048$, $p = .04$ respectively).

However, Coleman's intervention has produced conflicting outcomes over time. A single site non-randomized study of 104 patients did not find any significant difference in hospital readmissions between CCTI and routine discharge care (Ohuabunwa et al., 2013). Study participants were lower income older individuals with one or more common comorbidities (heart disease, type II diabetes, dementia and stroke) and were likely to require at home assistance. The intervention group received hospital discharge planning visits and post discharge telephone follow-up calls. Ohuabunwa and colleagues note "the role of conducting post discharge follow-up mostly through telephone calls rather than home visits is unclear and may explain the lack of effectiveness in part" (p. 990). Exploring the timing of the discharge telephone follow-up call and Veteran characteristics may identify possible differences between Coleman and Ohuabunwa et al.'s results. Additionally, Ohuabunwa and colleagues may have found non-significant changes because of a lack of statistical power (0.34).

Recently, researchers have focused their exploration upon the role of discharge telephone follow-up calls within transitional care. A recent literature review by McMartin and colleagues (2013) noted the low quality of research because of the lack of randomization, small sample sizes, or lack of a control group when evaluating post discharge care. The authors conclude that post-discharge care and discharge telephone follow-up, as part of a bundled transitional care intervention, is difficult to parse out in order to identify which element of the bundle may have the most substantial impact. The difficulty identifying which element of the bundled care intervention impacts hospital readmissions led to the development of this study to describe the relationships between discharge telephone follow-up and hospital readmissions within the VHA transitional care process. Because of the difficulty identifying the effect of individual elements of bundled interventions, this study will focus on exploring discharge telephone follow-up within the VHA transitional care process. In the VHA, discharge telephone follow-up has been integrated into outpatient services that are coordinated with inpatient discharge

education to facilitate reinforcement and clarification of discharge education. However, the VHA has not explored how discharge telephone follow-up relates to 30-day hospital readmissions after the implementation of the bundled PACT outpatient reform.

VHA Patient-Aligned Care Teams and Outpatient Reintegration

In 2010, the VHA began implementation of primary care reforms. Care teams were restructured into Patient-Aligned Care Teams (PACTs) to better facilitate coordination of patient care, access to care, and patient-centered decision making (Arend, Tsang-Quinn, Levine, & Thomas, 2012). Outpatient care teams were organized into PACTs including a primary care provider, registered nurse case manager, a licensed practical nurse, and a scheduling clerk (Klein, 2011). Each PACT member has defined roles and responsibilities to assist patients transitioning from the hospital to home. Critical to transitional care, PACT nurse case managers call the Veteran at home within two days of discharge to continue with discharge education, conduct medication reconciliation, and identify next clinic visits. The continuation of discharge education, medication management, and coordination of visits is the embodiment of patient-centered care in the Patient-Centered Medical Home (PCMH).

The Patient-Centered Medical Home is the private sector equivalent to the PACT. Both the PCMH and PACT are outpatient models based on the six foundational components: 1) enhanced access and continuity of care, 2) management of patient populations, 3) managed care by evidence based guidelines, 4) providing self-care support and community resources, 5) measuring and improving organizational performance, and 6) tracking and coordination of health services (Arend et al., 2012; Klein, 2011). Both PCMHs and PACTs utilize a team-based approach to outpatient care and use nurse case managers to organize and coordinate care for patients/Veterans (Arend et al., 2012; Christensen et al., 2013; Nutting et al., 2011).

Recent research on care coordination by nurse case managers within PCMHs found that the PCMH's nurse case managers decreased fragmentation by improving transitional care, resulting in decreased 30-day hospital readmissions from 27% to 7.1% ($p=0.02$) over a 12 month period (White, Carney, Flynn, Marino, & Fields, 2014). Additionally, a study exploring the role of PCMH pharmacists conducting discharge telephone follow-up calls, similar to the nurse case managers in PACTs, found significant reductions in 30-day hospital readmissions ($p<.01$) (S. L. Anderson, Marrs, Vande Griend, & Hanratty, 2013). Similar to the previous studies, this study explores the role of nurse case managers in PACTs providing transitional care through discharge telephone follow-up calls. Despite integration of PACTs into the transitional care process, there has been limited exploration of PACT transitional care processes by VHA researchers.

Discharge planning and education at the VHA are conducted by members of the inpatient care team while all transitional care from discharge is conducted by the Veteran's PACT nurse case manager. The current VHA discharge process requires comprehensive discharge planning by the inpatient care team followed by education and explanation of the discharge plan by an inpatient nurse. Following discharge the Veteran's PACT nurse case manager is to conduct a telephone follow-up call within two days focusing upon key elements identified in the electronic medical record by the inpatient nurse at discharge. The PACT nurse case manager reinforces the Veteran's knowledge regarding health conditions, conducts medication reconciliation, and coordinates follow-up care.

Within PACTs, registered nurse case managers are expected to call Veterans within two days of hospital discharge (Richardson & Cordasco, 2012). However, it is not always possible to reach a Veteran within two days of hospital discharge. A Veteran may have an incorrect telephone number in their chart; they may not answer the telephone, or the PACT nurse case manager unavailable. Because it may not always be possible to reach Veterans within two days of discharge, the VHA considers any telephone contact

with the Veteran a discharge telephone follow-up call if it is within a week of hospital discharge. The national goal for the VHA is to contact over 50% of Veterans by telephone within two days after hospital discharge. However, there has yet to be an exploration in how the differences in timing of the VHA discharge telephone follow-up calls influence 30-day all cause hospital readmissions.

Discharge Telephone Follow-Up

Early results of discharge telephone interventions provided mixed results (Bostrom et al., 1996; Dudas et al., 2001; Hanssen, Nordrehaug, Eide, & Hanestad, 2009). In 1996, Bostrom and colleagues evaluated the differences between three groups: patients who were called for follow-up by nurses, patients who called the nurses for discharge follow-up, and patients who received an educational brochure. The authors found no significant difference in 30-day hospital readmissions among the groups. However, unlike later discharge telephone follow-up interventions, there was no guided education from the electronic medical record, medication reconciliation, or coordination of services with primary care. In the study, discharge telephone follow-up was conducted by the discharging, inpatient nurses. Although the study was an initial examination of telephone use in the discharge process, the telephone follow-up calls lacked substance to address key problems of transitional care.

Later research by Dudas and colleagues (2001) demonstrated improvements in reducing hospital readmissions by focusing on medication management through discharge telephone follow-up calls by clinical pharmacists. While the authors did not report statistically significant differences at an alpha level of 0.05 between the telephone follow-up intervention and usual care groups, about 15% of patients who received a discharge telephone follow-up call were readmitted to the hospital compared to 25% of patients who did not receive a discharge telephone follow-up call. Additionally, authors found statistically significant decreases in 30-day readmissions to hospital emergency

rooms in patients who received discharge telephone follow-up calls compared to patients who did not receive discharge telephone follow-up calls. The decreases in hospital readmission and emergency department use could have been related to a focus on medication management and adherence. The focused discharge telephone follow-up calls were more structured than the calls by Bostrom and colleagues (1996). A significant lesson from both Bostrom et al. (1996) and Dudas et al. (2001) was the focus on improving health behaviors through discharge telephone follow-up.

Another discharge telephone follow-up program with limited influence on hospital readmissions is centrally located nurse call centers (Young et al., 2013). In a study of centrally located nurse call centers to coordinate transitional care and follow-up care for patients with colorectal cancer, no difference in hospital readmissions was found between patients who received discharge telephone follow-up calls compared to no follow-up care or coordination services. Young and colleagues (2013) found centrally located nurse call centers had no significant effect on improving care coordination or functional status, nor did the authors find any reduction in emergency department utilization or hospital readmissions at 30 days and six months for patients discharged with colorectal cancer.

Although the centrally located nurse call centers did follow structured discharge telephone follow-up calls, the authors found no improvements in care coordination, emergency department utilization, or hospital readmissions (Young et al., 2013). Structured discharge telephone follow-up calls may inadequately address the needs and questions of patients after discharge. Young and colleagues conclude telephone discharge interventions to be tailored to the patient transitioning between inpatient and outpatient services. Tailoring telephone discharge follow-up calls could be done by a healthcare provider who knows the patient, which is central to the PACT model. Within PACTs, development of a strong patient to provider relationship is a foundational element (Klein, 2011; Yoon et al., 2013). From the developed relationship between the patient and

providers, PACT discharge telephone follow-up calls integrated into outpatient care and tailored to the needs of the patient during discharge may increase the effectiveness of the discharge telephone follow-up calls.

The VHA uses nurse case managers already involved in the Veteran's care to tailor discharge telephone follow-up calls. Despite earlier findings that the relationship of the nurse case manager to the Veteran appears critical to the success of the follow-up, there has been limited exploration of the impact of this element of the PACT strategy upon reducing hospital readmissions. In a recent study, patients who received transitional care and discharge telephone follow-up calls by nurse case managers were less likely to be readmitted to the hospital within 30 days ($p= 0.075$) and had lower mortality rates ($p= 0.048$) (Shu et al., 2011). Although not statistically significant at an alpha level of 0.05, the authors demonstrated the role of discharge telephone follow-up calls within outpatient care as part of a bundled intervention.

Currently many transitional care programs utilize bundled interventions initiated by inpatient services. To address the limitations of earlier transition approaches, two recently developed transitional care programs have been developed, Re-Engineering Discharge (RED) and Better Outcomes for Older adults through Safe Transitions (BOOST). Both programs use risk stratification to identify patients at risk for hospital readmission combined with extensive inpatient discharge planning and education during hospitalization to prevent readmissions (Adams, Stephens, Whiteman, Kersteen, & Katruska, 2014; Cauwels, Jensen, & Winterton, 2013; Markley et al., 2013; Mitchell et al., 2014; Villanueva, 2010; Williams et al., 2014). Similar to PACT discharge telephone follow-up, RED and BOOST use nurse case managers to assist with patient transitions from inpatient to outpatient care. However, unlike PACT discharge telephone follow-up, RED and BOOST originate from inpatient services with minimal involvement of the patient's outpatient primary care team. Further differentiating PACT discharge telephone follow-up from RED and BOOST is the focus on face-to-face visits after hospital

discharge. Adams and colleagues (2014) describe the four components of RED as: quality of care during hospitalization, discharge planning, post-discharge face-to-face follow-up, and improved coordination between inpatient and outpatient care teams. Similarly, BOOST uses extensive training for nurse case managers to improve discharge processes and coordinating post-discharge services.

While RED and BOOST focus upon the use of hospital based resources with limitations to a long term relationship with the patient, PACT discharge telephone follow-up reengages the Veteran with their long term primary care team to continue discharge education and coordination of follow-up care. Further differentiating the PACT discharge telephone follow-up program from RED and BOOST is the importance of timely contact with Veterans after discharge. A standard of care for PACTs is monitoring timing of discharge telephone follow-up with the expectation discharge telephone follow-up will be within two days of hospital discharge. Neither RED nor BOOST stresses the importance of timely contact after hospital discharge, unlike the PACT discharge telephone follow-up program. Despite fundamental differences between RED, BOOST, and PACT discharge telephone follow-up, researchers are continuing to learn about the discharge and hospital readmission relationships to better refine transitional care interventions.

Recently, researchers have begun to question the effectiveness of discharge telephone follow-up calls outside a bundled intervention similar to the NTCM or CCTI (Harrison et al., 2014; Soong et al., 2014). Harrison and colleagues (2014) conducted a retrospective analysis of discharge telephone calls in general medicine patients. In the study, the authors created a propensity score to control for the probability of the patient receiving the discharge telephone follow-up call. Specifically, the authors used a propensity score to control for the probability of patients answering the telephone and receiving discharge follow-up information.

Without controlling for the probability of patients answering their telephone, Harrison and colleagues found a significant difference between 30-day hospital readmissions between the patients in the discharge telephone follow-up call group and the no discharge telephone follow-up call group. However, the authors found no significant difference between 30-day hospital readmissions when controlling for the probability of patients receiving the discharge telephone follow-up call. Harrison and colleagues conclude that the effectiveness of a discharge telephone follow-up call intervention is significantly influenced by whether or not the patient answers the telephone. The patient's ability or willingness to answer a discharge telephone follow-up call is a key influencing variable, but evaluation of ability or willingness to answer the discharge telephone follow-up calls is beyond the scope of this study. Within the VHA, discharge documentation of telephone follow-up calls is recorded after the nurse case manager completes a call with the Veteran.

The effectiveness of discharge telephone follow-up calls is limited by the patient's ability or willingness to answer the telephone (Harrison et al., 2011; Soong et al., 2014). Soong and colleagues (2014) explored discharge telephone follow-up intervention and found no significant difference in 30-day hospital readmissions ($p=0.68$) between patients who were in the discharge telephone follow-up group compared to the control (no discharge telephone call) group; however, only 69% of patients in the discharge telephone follow-up group actually answered their discharge telephone call. Because discharge telephone follow-up is limited by the ability to reach patients, both studies identified the ability to reach patients as a significant limitation of discharge telephone follow-up leading to the conclusion that discharge telephone follow-up should be a component of a more comprehensive bundled transitional care intervention. Within the VHA, comprehensive transitional care is a component of PACTs with discharge telephone follow-up calls by nurse case managers being critical to the transitional care

process. However, the relationship between discharge telephone follow-up calls and hospital readmissions within PACTs has not been explored within the VHA.

Furthermore, the inconclusive results by previous researchers may have been because of significant study limitations. First, the ability or willingness of patients to answer discharge telephone follow-up calls may prevent the effectiveness of discharge telephone calls because patients who may have benefited from a discharge telephone follow-up call did not receive one. Second, the studies often utilized administrative data to identify discharge telephone follow-up calls and hospital readmissions, which did not inform the content of the telephone follow-up call or who made the telephone call. While several studies only used nurse case managers to conduct the discharge telephone follow-up calls, a prior relationship with the patient may be necessary to effectively tailor the discharge call to meet the patient's transitional care needs. Furthermore, inpatient nurses who were used in several of the studies may not have adequate knowledge of the patient to tailor the discharge telephone follow-up call and address the transitional care needs of the patient. Finally, timing of the discharge telephone follow-up call has been identified as a potential influencing factor which was not unexplored in nearly all discharge telephone follow-up call studies.

Timing of Discharge Telephone Follow-up Calls

Timely contact after hospital discharge has been described as a potentially important factor influencing hospital readmissions (Costantino et al., 2013a; Harrison et al., 2011; Johnson, Laderman, & Coleman, 2013). However, how timing impacts the relationship between discharge telephone calls and hospital readmission needs further exploration (Johnson et al., 2013). Exploring how timing of discharge telephone follow-up calls impact hospital readmissions will lead to improved effectiveness of discharge telephone follow-up calls and transitional care programs, but current research has not defined what the optimal timing of a discharge telephone follow-up call should be.

In 2011, Harrison and colleagues conducted a retrospective analysis of patients with Medicare Advantage. The authors note over one third of patients readmitted were readmitted within one week of discharge. Because one third of hospital readmissions occur within one week of hospital discharge, timely discharge follow-up may have a significant influence on reducing hospital readmissions. In a randomized controlled trial comparing timing of discharge telephone follow-up calls for risk stratified patients, early discharge telephone follow-up calls were found to reduce the likelihood of hospital readmissions at both 30 and 60 days (Melton et al. 2012). Nurse case managers who conducted the discharge telephone follow-up calls used a series of questions to identify medication adherence and behavioral modifications similar to the intervention by Dudas and colleagues (2001). In a retrospective analysis, patients with Medicare Advantage who did not receive telephone follow-up call within two weeks of discharge were 1.259 times less likely to be readmitted to the hospital within 30 days (Harrison et al., 2011). Similarly, the retrospective analyses of Medicare patients by Costantino and colleagues (2013) and Harrison and colleagues (2011) found patients who received discharge telephone follow-up within two weeks of discharge had significantly fewer hospital readmissions.

Further substantiating the results of Harrison et al. (2011), Costantino et al. (2013) evaluated readmissions to the hospital within 30 days after an emergency department visit. The authors note discharge telephone follow-up calls within two weeks of hospital discharge was responsible for 88.35% of the variation in 30-day hospital readmissions, illustrating the importance of discharge telephone follow-up calls within the first two weeks. Furthermore, Costantino et al. (2013) note discharge telephone follow-up calls were more effective reducing hospital readmissions in patients who were at high risk to be readmitted; however, they did not provide an explanation of what patient risk factors accounted for the variation in 30-day hospital readmissions.

In addition to patient risk factors for hospital readmission, both Harrison and colleagues (2011) and Costantino and colleagues (2013) identified timing of the call as a potential influencer on readmission rates. A VHA national policy requires nurse case managers call Veterans within two days of hospital discharge (Richardson & Cordasco, 2012). However, there are inconsistencies in the ability of the nurse case managers to meet this requirement. Therefore, the current study will explore discharge telephone follow-up to evaluate the relationship between discharge telephone follow-up and 30-day hospital readmission rates in relation to timing.

Veteran Characteristics

The VHA provides care for over eight million Veterans annually, many of whom are older, financially insecure, and are challenged by multiple chronic conditions (National Center for Veterans Analysis and Statistics, 2014; United States Department of Veterans Health Administration, 2013; West & Weeks, 2009; Yu et al., 2003). Veterans may have unique challenges complicating their health status; for example, exposure to chemical weapons during military service is associated with development of debilitating chronic diseases (Matsumura, Michalek, & Fujiyoshi, 2006). Furthermore, combat experience can lead to development of mental health conditions, including PTSD and drug abuse (Yoon et al., 2012). The irreversible damage from war combined with enrollment of Veterans who are less financially secure and at increased likelihood to develop chronic conditions makes the Veteran population unique when compared to patients outside of the VHA system.

The VHA is the largest healthcare provider in the United States, allowing for Veterans to receive the same standard of care regardless of their geographic location. Although the size of the VHA has led to publicized challenges, VHA outpatient reform has been underway since 2010. Veterans who receive care from the VHA have had the experience of participating in the nation's largest outpatient reform designed to improve

the quality, access, and coordination of care to better manage the unique and chronic conditions associated with providing military service. Changes in outpatient structure have been designed to improve management of chronic diseases often associated with aging.

Patient Age

Even through enrollment in the VHA care has increased significantly due to Veterans from Operation Iraqi Freedom and Operation Enduring Freedom in Afghanistan, the largest proportion of Veterans receiving care continue to be older Americans from World War II and the Vietnam War (National Center for Veterans Analysis and Statistics, 2014). Veterans, like the larger population, have aging-associated health challenges and chronic conditions. Loss of artery elasticity, plaque collection in blood vessels, and development of chronic conditions complicate care for older Veterans. As the body ages, many patients experience a loss of independence, an inability to fully engage in the activities of daily living, and development of multiple chronic health conditions. In 1999, researchers found 80% of heart failure-related hospital readmissions were patients 65 years of age and older (Haldeman et al., 1999). Haldeman and colleagues' early results have been confirmed by multiple researchers (Au et al., 2012; Eastwood et al., 2014). Furthermore, Eastwood and colleagues (2014) found increasing age to significantly increase the risk of hospital readmission. Patients 75 years of age and older were 1.36 times more likely to be readmitted to the hospital within 30 days. In Joynt and colleagues' (2013) study, the authors found patients in their late 70s had significantly higher healthcare costs and hospital readmissions. The increased risk for hospital readmission as age increases has been noted consistently by previous researchers, with the most significant increase for 30-day readmission for patients in their 70s (Au et al., 2012; Eastwood et al., 2014; Haldeman et al., 1999; Joynt, Gawande, Orav, & Jha, 2013).

Contrary to previous research, in a recent study examining readmission risk factors for hospital readmissions among low-income elderly adults age was not found to be a significant risk factor for 30-day hospital readmissions (Iloabuchi et al., 2014). Iloabuchi and colleagues instead note living alone, low satisfaction with primary care provider, receiving a new assistive device within the last six months, and nursing home use were the significant predictors of early hospital readmission. While age was not included as a significant predictor of early hospital readmission, age is associated with living alone, receiving of an assistive device, and nursing home use. Furthermore, the authors note the more predictors an adult has, the greater the risk of hospital readmission. Unfortunately, the authors failed note that age is significantly associated with most of the identified risk factors and increases the complexity of care and quantity of chronic conditions that may require assistive devices (Bradshaw et al., 2013; Holloway et al., 1990). While the previous research describing the relationship between age and 30-day hospital readmissions may be inconsistent, most studies suggest that age is significant predictor of hospital readmissions. Therefore, age will be used as a Veteran characteristic in the current study.

Multiple Chronic Comorbidities

From 2001 to 2010, the prevalence of adults in the US with multiple chronic comorbidities increased from 21.8% to 26.0% (Ward & Schiller, 2013). Multiple chronic comorbidities are becoming a national concern because of costs and high readmission rates. In 2010, 28% of Americans had two or more chronic conditions and accounted for nearly two thirds of all healthcare costs (Robert Wood Johnson Foundation, 2010). In addition to higher costs of care, patients with multiple chronic comorbid conditions are more likely to be readmitted to the hospital or rehabilitation center within 30 days than patients with fewer comorbidities (Joynt et al., 2013; Ottenbacher et al., 2014). A recent

study describes the highest costing patients as older African American men with multiple chronic conditions (Ottenbacher et al., 2014).

Patients with multiple chronic comorbidities require additional health services, but strategic delivery of certain health services lowers the overall cost of care. In addition to high healthcare costs, patients with multiple comorbid conditions often have fragmented healthcare services among multiple providers (Ward & Schiller, 2013). Targeting care fragmentation for patients with multiple chronic comorbidities may reduce costs. At an academic medical facility in Boston, between 2009 and 2010, 22.3% of all discharges were readmitted to the hospital within 30 days for either the primary discharge diagnosis or a common comorbid condition (Donze et al., 2014). Donze and colleagues suggested that when reducing hospital readmissions, providers should not focus post-discharge care solely on the admitting diagnosis but include all patient comorbidities that could influence re-hospitalization. To decrease care fragmentation, the VHA has reorganized primary care services to longitudinally manage chronic comorbidities through the implementation of PACTs.

In order to address the growing cost and prevalence of patients with chronic comorbid conditions, VHA outpatient reform addresses care fragmentation through management of care across healthcare settings (A. Shih et al., 2008). One way healthcare providers have been managing chronic comorbid conditions across healthcare settings has been through implementing discharge telephone follow-up to reduce hospital readmissions. Because multiple chronic conditions have been associated with fragmentation of care, high costs and hospital readmissions, the relationship between discharge telephone follow-up and hospital readmission rates may be influenced by the quantity of chronic comorbidities.

Length of Index Hospital Stay

Length of index hospital stay has been described as a significant predictor for 30-day hospital readmission. However, unlike socioeconomic status, length of stay has been evaluated by VHA researchers (Kaboli et al., 2012; Kind et al., 2012). Kaboli and colleagues (2012) explored comprehensive discharge planning and 30-day hospital readmission rates in Midwestern Veterans for five selected conditions. The authors did not find any significant relationship between length of stay and 30-day hospital readmissions. Kaboli and colleagues' results differed significantly from other researchers exploring hospital readmissions for patients outside the VHA. Researchers outside the VHA did find increased hospital length of stay acted as a proxy for complexity of previous hospital admission and was associated with risk for 30-day hospital readmission (Kruse et al., 2013; Silverstein et al., 2008). Kruse and colleagues found that increasing length of stay past two days significantly increased patient risk for 30-day readmission (OR= 1.12-2.08). The potential difference between Kaboli and colleagues' study (2012) and other investigations was that Kaboli and colleagues examined 30-day hospital readmissions for a selected group of health conditions, which limits the generalizability of their findings. Furthermore, the VHA patient population differs from patients outside the VHA because of combat related injuries, higher proportions of older white males, and nationally organized structure of the VHA, further limiting the generalizability of Kaboli and colleagues' findings. Because of the conflicting findings regarding the relationship between length of stay and 30-day hospital readmissions, length of stay will be included as an influencing variable when exploring the relationship between discharge telephone follow-up and 30-day hospital readmission rates.

Frequent Hospitalizations

In previous studies, prior hospitalizations have been identified to increase the likelihood of future hospitalizations (Renom et al., 2010; Shadmi et al., 2015; Longman et al., 2012). Increasing the number of hospitalizations has been found to increase the

risk of hospital readmissions by 1.40 times per hospitalization (Shadmi et al., 2015; Wang et al., 2014). Additionally, emergency room visits within the past six months have been identified to increase the risk for hospital readmissions (OR=1.79) (Wang et al., 2014). The association between previous hospital use and future hospital use may be intuitive to clinicians, but researchers have struggled to define what constitutes frequently hospitalized.

Frequent hospitalization has an inconsistent operationalized definition in the literature making it difficult to compare frequent hospitalizations among different studies (Renom et al., 2010; Shadmi et al., 2015; Longman et al., 2012). Frequent hospitalization has been defined as one or more hospitalization or emergency room visit in the past year up to three or more hospitalizations in the previous year (Renom et al., 2010; Shadmi et al., 2015; Longman et al., 2012). However, each of these studies identified patients who were hospitalized for planned admissions and excluded them from the study. This study was unable to identify admitting diagnoses, so a higher level of prior hospitalizations was needed to help exclude planned hospital admissions. This study defined frequently hospitalized Veterans as having four or more hospitalizations in the previous year. Because the inconsistent definition of frequent hospitalizations and the known relationship between frequent hospitalizations and hospital readmissions, frequent hospitalizations were included in the study.

All Cause 30-day Hospital Readmission Rates

Recent changes in healthcare policy have healthcare leaders and clinicians focusing upon 30-day hospital readmission rates. Because of the Patient Protection and Affordable Care Act, healthcare systems may face lower reimbursement rates for patients readmitted to the hospital within 30 days of a prior discharge. Starting in 2014, the Inpatient Prospective Payment System adjusted payment for hospitals with high reimbursement rates ("Patient Protection and Affordable Care Act," 2010). While the

merit of 30-day readmission rates as a quality metric are debated by healthcare leaders and policy makers, it does provide a benchmark for organizations to strive to achieve. Furthermore, previous research on transitional care programs has found significant reductions in 30-day hospital readmission rates for all conditions (Hansen et al., 2013; Hockenberry et al., 2013; Naylor, 2004; Piraino, Heckman, Glenny, & Stolee, 2012).

Despite demonstrated reductions in 30-day readmission rates related to transitional care improvements and national adjustments to reimbursement; healthcare leaders have been very critical of associating reimbursement rates to 30-day hospital readmissions. Several critics note that larger hospitals, particularly hospitals caring for patients with minorities and patients with complex needs, may unfairly be penalized resulting in less resources to improve 30-day hospital readmissions (Averill, Goldfield, & Hughes, 2013; Gu et al., 2014; T. Shih, Ryan, Gonzalez, & Dimick, 2014; Tsai et al., 2014). Hospitals caring for higher proportions of patients at risk to be readmitted within 30 days are more likely to have higher 30-day hospital readmission rates when compared to hospitals that care for lower proportions of patients at high risk for 30-day hospital readmissions. Therefore, many researchers argue that hospitals with higher proportions of high risk patients should not be penalized.

Researchers and policy makers have expressed concern that 30-day hospital readmissions as a national quality standard would unfairly punish hospitals with higher proportions of patients at high risk for hospital readmission. While the concerns of connecting reimbursement to 30-day hospital readmission rates continue to be debated, changes in reimbursement represents seismic change in US healthcare where healthcare providers assume more risk for patient outcomes (Prabhakar, Harvey, & Oklu, 2013). The changes in reimbursement for 30-day hospital readmissions embody the shift in accountability and who bears the consequences of 30-day hospital readmission rates. Furthermore, concerns about tying reimbursement to 30-day hospital readmissions rates are negated by the VHA funding mechanism. Despite being a controversial quality

measure, the 30-day readmission rate has been chosen by the US government as the measure for assessing quality of transitional care making it an explicit outcome measure. Therefore, 30-day hospital readmission rates will be used as the outcome measure for this study.

Summary

Chapter Two explored the history of transitional care within the US and VHA and provided a more in-depth description of the variables to be tested. Transitional care has evolved significantly over the last three decades. While results of discharge telephone follow-up research programs yielded mixed results, researchers have found several potential factors that may account for the variability in effectiveness of discharge telephone follow-up programs. The timing of the discharge telephone follow-up call is to the hospital discharge may potentially influence its effectiveness.

The VHA has integrated nurse case managers into primary care outpatient services to provide the discharge telephone follow-up calls within two days of hospital discharge; however, there has been minimal evaluation of discharge follow-up call effectiveness upon reduction 30-day all cause hospital readmission rates. Additionally, Veteran characteristics may influence the relationship between discharge telephone follow-up and 30-day all cause hospital readmissions. This study will explore the relationship of VHA discharge telephone follow-up calls and 30-day hospital readmissions. Additionally the study will seek to identify how timing and Veteran characteristics influence this relationship. The following chapter will describe the methods used to explore the relationship.

Chapter 3

Methods

Introduction

Nearly one out of every five patients discharged from the hospital is readmitted within 30 days (Jencks et al., 2009; Kaboli et al., 2012). Of the patients readmitted to the hospital within 30-days, many are readmitted because of complex chronic conditions and fragmented healthcare services (Podulka et al., 2012). Because of the high costs and prevalence of hospital readmissions, The President's Economic Report identified poor transitional care as a significant contributor to growing healthcare costs and has become a national priority for patients with complex chronic conditions (Obama, 2013). Transitional care has been defined as a range of services and environments designed to promote safe and timely passage of patients among levels of healthcare and across settings (Naylor & Keating, 2008). In 2013, the Patient Protection and Affordable Care Act began to alter reimbursement rates for Medicare patients readmitted to the hospital within 30 days of a previous discharge ("Patient Protection and Affordable Care Act," 2010). Alteration of reimbursement rates incentivized transitional care for hospitals leading to creation of programs targeting patients with complex chronic conditions to lower their readmission rates.

Similar to many US hospitals, the Veterans Health Administration (VHA) provides care for many Veterans with complex chronic conditions. In 2010, the VHA restructured outpatient care into Patient-Aligned Care Teams (PACTs) to improve patient-centered care delivery and care coordination. Similar to restructuring health systems within the private sector, the VHA is concerned with effective structures, processes, and the distribution of resources that can be leveraged to improve transitional care (West & Weeks, 2009). Registered nurse case managers within PACTs provide

transitional care through discharge telephone follow-up calls to Veterans recently discharged from the hospital. However, while the PACT model has been implemented across VHA facilities, there has been little exploration of the relationship between VHA discharge telephone follow-up and hospital readmissions.

In 2011, an evaluation of Medicare patients found patients who received a discharge telephone follow-up call by a nurse had 23.1% fewer hospital readmissions than patients who did not receive a discharge telephone call (Harrison et al., 2011). Furthermore, patients who are at the highest risk of hospital readmission benefit most from discharge telephone follow-up calls (Melton, Foreman, Scott, McGinnis, & Cousins, 2012; Wong, Chow, Chan, & Tam, 2014). However, the effectiveness of discharge telephone follow-up calls as a transitional care method has been questioned by recent researchers (Bahr et al., 2014; Harrison et al., 2014; Soong et al., 2014). In 2010, the VHA integrated discharge telephone follow-up calls into outpatient care as a means to reintegrate Veterans into outpatient services. However, the VHA has not explored the relationships between discharge telephone follow-up calls and 30-day hospital readmissions.

Study Purpose

The purpose of this study was to explore the relationships between VHA discharge telephone follow-up and all cause hospital readmissions within 30 days. Secondarily the study will identify selected factors that influence the relationship between the follow-up phone call and the readmission. Determining the relationship between discharge telephone follow-up and 30-day hospital readmissions can serve as a foundation for future work evaluating the impact of the discharge telephone follow-up calls and strategic allocation of resources to address the needs of Veterans with specific characteristics. The specific aims and hypotheses guide this study as follows.

Research Aims and Hypotheses

1. Describe 30-day hospital readmissions among Veterans discharged from VHA between federal fiscal years 2011-2013 in terms of receipt and timing of discharge telephone follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalization).

2. Determine whether hospital readmissions are associated with receipt and timing of discharge telephone follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalization) at clinically relevant time periods (within two days, between three and seven days, between eight and thirty days) during the first 30 days post-discharge.

H1: Hospital readmissions between zero and two days post-discharge are associated with receipt of discharge follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalizations).

H2: Hospital readmissions between three and seven days post-discharge are associated with receipt of discharge follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalizations).

H3: Hospital readmissions between eight and thirty days post-discharge are associated with receipt of discharge follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalizations).

Data Collection and Instrumentation

The Veterans Health Administration (VHA) is the largest health system in the US, serving over eight million Veterans with the number of Veterans enrolling in care

increasing every year (United States Department of Veterans Affairs, 2013). Veterans enrolled in care at the VHA are eligible to receive primary care from one of the 820 primary care clinics and 150 VHA medical centers, and despite the growing enrollment of Veterans, inpatient hospitalizations have remained relatively steady at about 690,000 hospitalizations each year since 2010. In 2010, the VHA implemented outpatient healthcare reform called the PACT Implementation Project. The PACT Implementation Project initiated changes in outpatient care delivery to improve transitional care for Veterans recently discharged from the hospital. Along with many other services, registered nurse case managers' conduct discharge telephone follow-up calls to facilitate Veteran reintegration into primary care and transition from hospital to home. Data collected through the outpatient healthcare reform in the PACT Implementation Project detail key outcomes and processes fundamental to outpatient reform at each of the 820 VHA outpatient clinics and are recorded in the PACT Implementation Project Compass.

For this research study, discharge telephone follow-up calls by PACT registered nurse case managers recorded in the PACT Implementation Project Compass and Veteran electronic health record were linked with inpatient hospitalization data from the Department of Veterans Affairs Corporate Data Warehouse (CDW) collected in a previous national VHA study.

The PACT Implementation Compass contains all PACT implementation data by fiscal years between 2010 and 2014. However, for this research study, discharge telephone follow-up calls from fiscal year 2011 to 2013 were used because discharge telephone follow-up calls began implementation in fiscal year 2010. Using the data collected from fiscal years 2011 to 2013 ensured that all VHA facilities have had the opportunity to implement discharge telephone follow-up. Discharge telephone follow-up is classified by stop codes. The dates of telephone follow-up calls are recorded by the date the stop code was submitted and are classified as within two days or between three and seven days of previous hospitalization. The research study used PACT

implementation data from the PACT Implementation Project Compass from fiscal years 2011 to 2013 to identify the completion of discharge telephone follow-up calls and the dates the calls occurred in relation to the Veteran's previous hospital discharge.

Data from the PACT Implementation Project Compass were linked to the previous hospitalizations of Veterans abstracted from a previous research study using data from the CDW. The CDW is a collection of health data from all Veteran's electronic health records. All demographic information, laboratory tests, orders, medical visits, consults, and clinician notes are stored in the CDW. In a previous study, Veteran demographics, diagnoses, procedures, and selected Veteran characteristics were collected from inpatient hospitalizations from fiscal years 1998 and 2013. Data collected from the CDW were combined with PACT Compass Implementation Data using scrambled social security numbers (SSN). Data identifying the date of hospital admission and discharge, ICD-9 codes, previous length of index hospital stay, and Veteran age were abstracted from Veteran inpatient hospitalization data and used in the analyses to identify how Veteran characteristics influence the relationship between discharge telephone follow-up calls and 30-day hospital readmissions.

Using unique scrambled SSN Veteran identifiers, inpatient hospitalization data from the CDW were linked to the discharge telephone follow-up data in the PACT Implementation Project Compass to create an integrated data file. Using this integrated data file, a secondary analysis was conducted focusing upon Veteran discharge telephone follow-up call, hospital readmissions within 30 days, and Veteran characteristics from fiscal years 2011 through 2013.

Procedure for Aim One

Aim one was designed to explore 30-day hospital readmissions, discharge telephone follow-up calls, length of index hospital stay, and selected Veteran characteristics from fiscal years 2011 and 2013. Descriptive statistics by fiscal year and

days until hospital readmission were used to describe the sample. Distribution and measures of central tendency were used to describe length of index hospital stay, Veteran age, and number of comorbidities.

Procedure for Aim Two

The analyses conducted to address the second study aim were designed to determine if hospital readmissions were associated with receipt of timing of discharge telephone follow-up call, length of index hospital stay, and selected Veteran characteristics by clinically relevant time periods within the first 30 days after hospital discharge. Clinically relevant time periods were identified because they coincide with timing of discharge telephone follow-up calls (within two days, between three and seven days, and between eight and thirty days after hospital discharge). Previous exploration of data suggests hospital readmissions may coincide with timing of discharge telephone follow-up calls. Furthermore, hospital readmissions during these clinically relevant time periods were the outcome variables for each of the hypotheses.

Tests for each hypothesis followed the same statistical procedures. Bivariate analyses (χ^2 and student t-tests) were used to identify variables that were related to hospital readmissions at the different clinically relevant time periods. Statistical differences were considered significant in the bivariate analyses if the probability value was less than or equal to 0.05. Variables identified as significant were entered into a logistic regression equation to determine if the variables were significantly associated with increased risks in hospital readmissions at the different clinically relevant time periods. Inclusion in the logistic regression equations will require a probability value that was less than or equal to 0.5.

Limitations

As in all studies, the current study has limitations. First, use of secondary data to conduct a retrospective analysis is limited by the quality of data originally obtained. Data

quality will be limited by potential inconsistencies in ICD-9 codes used for comorbidities. Although the VHA administrative data used in this study have demonstrated reliability for research purposes (K=0.39-0.9), ICD-9 coding may vary in quality among VHA clinicians. Also of note, while the Veteran population may be similar to some Medicare patients, the two populations do have unique attributes. Veterans are more likely to be older white males thus potentially limiting the generalizability of these findings (National Center for Veterans Analysis and Statistics, 2013). Despite differences between Veteran and civilian patients, this work could provide a foundation to future researchers evaluating patient characteristics which may influence transitional care processes.

Second, the number of discharge telephone follow-ups may vary between VHA clinics and will require further exploration in future studies. Implementation of outpatient reforms to address patient population needs varies across clinics (Nutting et al., 2011). It is possible that VHA clinics throughout the nation differ in their implementation of discharge telephone follow-up procedures. The different implementation dates of discharge telephone follow-up calls led to limiting the data sample between the fiscal years of 2011 to 2013. A benefit of the bureaucratic structure of the VHA is the uniform guidance to organize and implement PACT reforms which may reduce variations between clinicians making discharge telephone follow-up calls. Exploration of the relationship between discharge telephone follow-up calls and 30-day hospital readmissions in the proposed study should set the foundation for further studies examining VHA discharge and role of PACT during care transitions.

Third, Veterans may have been readmitted to the hospital prior to receiving a discharge telephone follow-up call confounding the results. Being readmitted to the hospital prior to receiving a discharge telephone follow-up call creates a self-selection bias. Veterans who are readmitted prior to receiving a discharge telephone follow-up call self-select into the readmission group. Veterans who are unable to receive a discharge

telephone follow-up call prior to being readmitted limits the understanding of the relationship between discharge telephone follow-up calls and hospital readmissions because it is unknown if a discharge telephone follow-up call would have prevented the readmission. The self-selection bias confounds the relationship between discharge telephone follow-up and hospital readmissions and will limit this study.

Fourth, Veterans inability or unwillingness to answer the telephone will limit the effectiveness of discharge telephone follow-up calls (Harrison et al., 2014). This study will separate Veterans who received a discharge telephone follow-up call and those who did not receive a telephone follow-up call. It is possible that Veterans did not receive a discharge telephone follow-up call because the Veteran could not answer their telephone which could potentially confound the relationship between discharge telephone follow-up calls and hospital readmissions.

Fifth, use of all cause hospital readmissions may overestimate hospital readmissions. Veterans readmitted for planned surgical procedures or chemotherapy treatment may confound the results. The current dataset prevents removal of readmissions for planned surgical procedures or chemotherapy because admitting diagnosis is unknown and due to the nature of the secondary analyses, these types of planned readmissions should be excluded in future studies. In future studies, removal of Veterans readmitted for planned surgical procedures and chemotherapy should be done a priori. However, all cause readmissions within 30-days of hospital discharge is currently considered a Medicare quality metric. Because a better quality metric for measuring 30-day hospital readmissions is not available and due to limitations in the current dataset, this study used all cause 30-day hospital readmissions as the outcome variable.

Finally, use of logistic regression does not allow for an understanding of causality. However, the purpose is to understand the relationship between discharge telephone follow-up and all cause 30-day hospital readmissions in order to inform additional transitional care processes and future research.

Strengths

The VHA is the largest US healthcare provider, annually serving over eight million Veterans in outpatient visits (Arend et al., 2012). The VHA's size and integration allow for extensive exploration of discharge telephone follow-up and all cause 30-day hospital readmissions, which have been identified as critical national priorities. Thus this study is a start to a potentially highly relevant and useful topic for policy makers and clinicians. Exploring the relationship between discharge telephone follow-up and all cause 30-day readmissions should assist in further PACT developmental priorities. Identification of Veterans who may need additional resources during care transitions and the time which the Veteran's may benefit most from the additional resources will serve as a foundation for future work to improve care transition processes and risk stratification of hospitalized Veterans.

Additionally, PACT implementation of discharge telephone follow-up should be examined in future research. This project provides a brief examination of VHA discharge telephone follow-up currently used, so future projects will examine if current discharge telephone follow-up processes differed from pre-PACT implementation discharge follow-up processes when follow-up calls were not required by primary care staff. Understanding the current relationship between discharge telephone follow-up and all cause 30-day hospital readmissions and identification Veteran characteristics will provide a foundation to identify changes in PACT outpatient care during PACT implementation.

Summary

This chapter addressed the research aims, data collection, methodological approaches, limitations, and strengths of the current research study. The purpose of the current study was to explore the relationship between the VHA discharge telephone follow-up and all cause 30-day hospital readmissions and to describe whether hospital readmissions were associated with a receipt of a discharge telephone follow-up call,

timing of discharge telephone follow-up calls, length of index hospital stay, and selected Veteran characteristics at clinically relevant time periods. Secondary data were abstracted from previously collected inpatient data from Inpatient All VHA Admissions and PACT Implementation Project Compass Datasets. Descriptive statistics were be used to describe the sample by fiscal years. Bivariate statistics identified significant differences between Veteran discharges by clinically relevant time periods. Logistic regression was used to determine associations between hospital readmissions at different clinically relevant time periods and the identified significant variables. This study was limited by previously collected data, possible variations in discharge telephone follow-up calls between VHA outpatient clinics, generalizability to patients outside the VHA, use of all cause 30-day hospital readmissions overestimating hospital readmissions, and logistic regression preventing evaluation of causality. However, aims addressed by this current study will provide a basis for future research on discharge telephone follow-up and 30-day hospital readmissions. The following chapter reports findings from this study following the statistical procedures outlined in this chapter.

Chapter 4

Results

Poor patient transitions from the hospital to home significantly contribute to the overall costs of healthcare in the United States. Nearly one out of every five patients discharged from the hospital in the early 2000's was readmitted to the hospital within 30 days (Jencks et al., 2009). Patient risk for hospital readmission within 30 days has been linked to complex chronic conditions like CHF, COPD, diabetes, mental health disorders, and depression (Ketterer et al., 2014; Kruse et al., 2013; Shulan et al., 2013; Silverstein et al., 2008). Many patients with chronic conditions are older and receive government support for healthcare (Iloabuchi et al., 2014; Silverstein et al., 2008; Yoon et al., 2014; Yu et al., 2003). Because the prevalence of 30-day hospital readmissions contributes to the overall costs of poor patient transitions from the hospital to home, researchers have developed interventions to improve transitional care.

In the early 1990's, researchers began developing interventions to improve transitional care by focusing on improving the discharge process and patient reintegration into primary care services. Several transitional care programs begin during hospitalization and follow-up with patients to support reintegration into primary care (Bixby & Naylor, 2010; Coleman et al., 2006; Hansen et al., 2013; Jack et al., 2009; M. Naylor et al., 1999; M. Naylor & Keating, 2008). These transitional care programs bundle several interventions to reduce hospital readmissions. Through the development of transitional care programs, most researchers have focused upon improving transitional care by focusing on inpatient services. Considering a new approach in 2010, the leadership of the VHA decided to focus upon outpatient care services to improve coordination of services, quality of care, and transitional care of Veterans. Through their outpatient healthcare reform, the VHA has begun providing discharge telephone follow-up calls to improve transitional care. To date there has been limited evaluation of the

VHA discharge telephone follow-up program. The current study explored the relationship between the VHA discharge telephone follow-up program and 30-day hospital readmissions. The following aims and hypotheses were explored:

1. Describe 30-day hospital readmissions among Veterans discharged from the VHA between federal fiscal years 2011-2013 in terms of receipt and timing of discharge telephone follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalization).

2. Determine whether hospital readmissions are associated with receipt and timing of discharge telephone follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalization) at clinically relevant time periods (within two days, between three and seven days, between eight and thirty days) during the first 30 days post discharge.

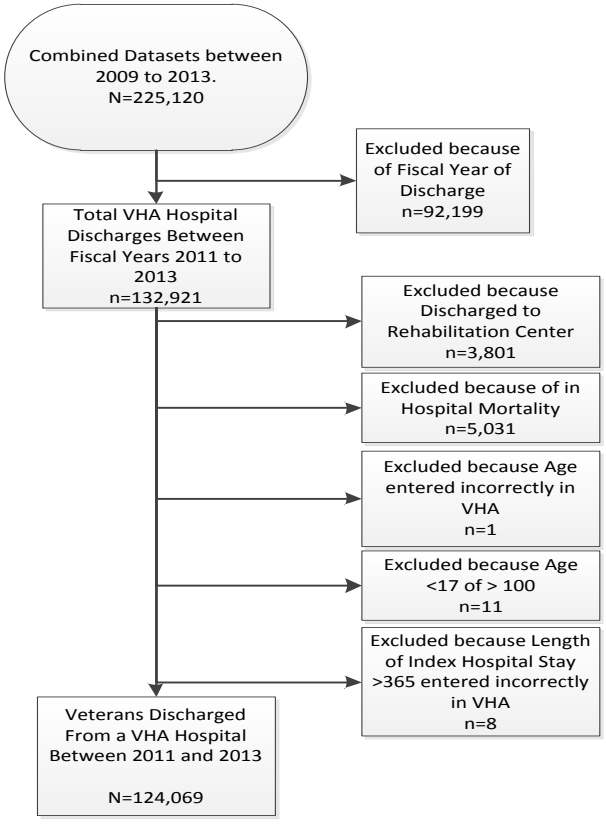
H1: Hospital readmissions between zero and two days post-discharge are associated with receipt of discharge follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalizations).

H2: Hospital readmissions between three and seven days post-discharge are associated with receipt of discharge follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalizations).

H3: Hospital readmissions between eight and thirty days post-discharge are associated with receipt of discharge follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalizations).

To address the aims and test the hypotheses, a secondary analysis of VHA data was conducted. Original data were collected from the VA Corporate Data Warehouse and PACT Implementation Project Compass databases. After combining both data from the VA Corporate Data Warehouse and PACT Implementation Compass, a total of 225,120 discharges were identified from fiscal years 2009 to 2013. The sample for this current study was limited to discharge telephone follow-up calls made by PACT staff from fiscal years 2011 to 2013. From fiscal years 2011 to 2013, the VHA had 132,921 discharges from a VHA hospital, rehabilitation, or nursing center (Figure 4-1). The sample for the study was limited to discharge from hospital to home. Further limiting the sample, hospital mortalities and partially missing data were excluded. The resulting sample was 124,069 hospital discharges between 2011 and 2013. Of the 124,069 hospital discharges, 15,954 (12.86%) were readmitted to the hospital within 30 days.

Figure 4-1 Sample



Aim One

Descriptive statistics and measures of central tendency describe characteristics discharged from VHA hospitals from fiscal years 2011 and 2013. Over the three year period, hospital readmissions showed minimal variation with a mean of 41,356.33 discharges per year ranging from 41,081 discharges in 2011 to 41,342 discharges in 2013. Each of the 124,069 discharges are linked to an index hospital admission. The index hospital admission refers to the hospitalization prior to discharge. Thirty-day hospital readmissions were further broken down into clinically relevant time periods from zero to two days, three to seven days, and eight to thirty days after hospital discharge.

Table 4-1 presents hospital discharges and readmissions within two, between three and seven, and between eight and thirty days by fiscal year. Hospital discharges and readmissions remained relatively steady throughout the duration of the study. Hospital readmissions from 2011 to 2013 decreased steadily from 13.28% in 2011 to 12.29% in 2013. From 2011 to 2013, there was a slight decrease in hospital readmissions within two days ranging from 591 (1.44%) to 550 (1.33%). Additionally, there was a slight decrease in hospital readmissions between eight and thirty days from 8.70% in 2011 to 7.84% in 2013.

Table 4- 1

Number and Percent of Hospital Readmissions within Two, between Three and Seven, and between Eight and Thirty days by Fiscal Year
N= 124,069 Discharges

	2011		2012		2013		Total	
	n=41,081	%	n=41,646	%	n=41,342	%	N=124,069	%
Within two days	591	1.44	583	1.40	550	1.33	1,724	1.39
Between three and seven days	1,291	3.14	1,287	3.09	1,291	3.12	3,869	3.12

Table 4-1 Continued

Between eight and thirty days	3,573	8.70	3,548	8.52	3,240	7.84	10,361	8.35
Total	5,455	13.28	5,418	13.01	5,081	12.29	15,954	12.86

Table 4-2 focuses only upon Veterans who were readmitted within 30 days of index hospital admission, presenting the number and percent of hospital readmissions within two days, between three and seven days, and between eight and thirty days for each of the three fiscal years of the study time frame. Of the 15,954 readmissions occurring within 30 days from 2011 to 2013 (12.86% of all discharges during the study period), there was a small steady increase in hospital readmissions within two days of discharge ranging from 591 (10.83%) in 2011 to 550 (10.87%) in 2013. Similarly, the number hospital readmissions between three and seven days increased while the percentage of patients readmitted during three and seven days decreased slightly from 2011 to 2013; however, hospital readmissions between eight and thirty days decreased from 3,573 (65.48%) in 2011 to 3,240 (64.04%) in 2013.

Among the 15,954 discharges readmitted within 30 days, a total percentage of 10.81% of hospital readmissions occurred within the first two days and 24.25% were readmitted between three and seven days. Thus, during the first post-hospitalization week, 35.06% (n=5,593) of discharges were readmitted to the hospital. Hospital readmissions between eight and thirty days were identified in 64.94% of discharges readmitted within 30 days.

Table 4-2

Number and Percent of Hospital Readmissions within Two, between Three and Seven, and between Eight and Thirty days by Fiscal Year for Veterans Readmitted Within 30 Days
N= 15,954 Discharges Readmitted Within 30 Days

2011	2012	2013	Total

Table 4-2 Continued

	n=5,455	%	n=5,418	%	n=5,081	%	N=15,954	%
Within two days	591	10.83	583	10.72	550	10.87	1,724	10.81
Between three and seven days	1,291	23.66	1,287	23.67	1,291	25.64	3,869	24.25
Between eight and thirty days	3,573	65.48	3,548	65.24	3,240	64.04	10,361	64.94

Table 4-3 below contains information regarding discharge telephone follow-up calls for Veterans discharged from 2011 to 2013. From 2011 to 2013, a total of 46,172 (37.21%) discharge telephone follow-up calls were made to Veterans. Of those discharge telephone follow-up calls, 30,003 (24.18%) were conducted within two days after hospital discharge and 16,169 (13.03%) of discharge telephone follow-up calls occurred between three and seven days. The number and percentage of discharge telephone follow-up calls increased over the three periods from 312 (0.76%) discharge telephone follow-up calls in 2011 to 26,549 (64.22%) discharge telephone follow-up calls in 2013. While the number of discharge telephone follow-up calls increased, the percentage of Veterans who received discharge telephone follow-up calls within two days also increased from 0.26% to 42.97%. The number and percentage of Veterans who received discharge telephone follow-up calls between three and seven days after hospital discharge also increased from 204 (0.50%) in 2011 to 8,784 (21.25%) in 2013. Discharge telephone follow-up calls occurring after seven days were not included in this study because they were not collected as part of the PACT Implementation Project. Only telephone follow-up calls within seven days were considered to be discharge telephone follow-up calls.

Table 4-3

Number and Percent of Discharge Telephone Follow-up Calls by Fiscal Year N= 124,069 Discharges

	2011		2012		2013		Total	
	n=41,081	%	n=41,646	%	n=41,342	%	N=124,069	%
Within two days	108	0.26	12,130	29.12	17,765	42.97	30,003	24.18
Between three and seven days	204	0.50	7,181	17.24	8,784	21.25	16,169	13.03
Total of Discharge Telephone Follow-up Calls	312	0.76	19,311	46.37	26,549	64.22	46,172	37.21

The selected Veteran characteristics associated with each index hospitalization suggests that Veterans discharged between 2011 and 2013 were primarily older with multiple chronic conditions (Table 4-4). Index hospitalization refers to the hospitalization prior to discharge. The term index hospitalization is used to identify only hospitalization prior to discharge and used to establish a link between the hospitalization and discharge follow-up. Because a Veteran can be hospitalized multiple times in a year and the level of measurement for this study is Veteran discharges (N= 124,069), the term index was used to identify the hospitalization prior to discharge. Among the 124,069 indexed hospitalizations, Veteran age ranged from 18 to 100 with a mean age of 65.08 years (SD=12.03), length of index hospital stay ranged from 1 to 307 days with a mean length of stay of 4.21 (SD= 6.24) days, and the number of co-morbid conditions ranged from 1 to 15 with a mean of 6.22 (SD= 3.86) comorbidities. Median values for length of index hospital stay, Veteran age, and comorbidities are consistently less than the corresponding means, illustrating a positively skewed sample. The positively skewed sample suggests that some Veterans were significantly older, had more comorbid conditions, and longer lengths of index hospital stay than the majority of the sample.

Table 4-4

Descriptive Statistics of Length of Index Hospital Stay, Age and Comorbidities N= 124,069 Discharges

	Median	*M*	SD
Length of Index Hospital Stay	3.00	4.21	6.24
Veteran Age	64	65.08	12.03
Number of Comorbidities	6	6.22	3.86

Over the three year period, 485 Veterans discharged for the VHA were identified as being frequently hospitalized in the previous year. Frequent hospitalizations were defined as four or more hospitalizations in the year prior to the index hospitalization. The definition of frequently hospitalized Veterans dramatically limited the possibility Veterans identifying frequently hospitalized Veterans in the sample. All Veteran discharges that met the criteria to be considered frequently hospitalized were in 2012. Of the Veterans identified as frequently hospitalized in 2012, 485 (1.16%) Veterans had four or more hospitalizations in 2011 prior to their index hospitalization in 2012.

Table 4-5

Number and Percent of Frequently Hospitalized Veterans by Fiscal Year N= 124,069 Discharges

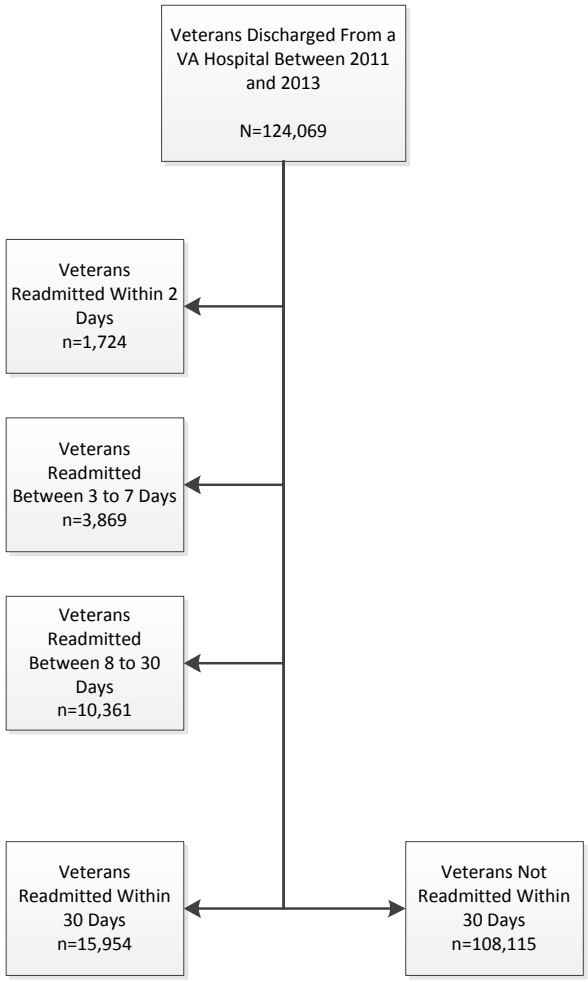
	2011		2012		2013	
	n=41,081	%	n=41,646	%	n=41,342	%
Frequent Hospitalizations	0	0	485	1.16	0	0

Aim Two

Analyses for Aim Two determined if hospital readmissions in this sample were associated with selected Veteran characteristics including length of index hospital stay and discharge telephone follow-up calls. Clinically relevant periods of hospital readmissions were selected and correspond with timing of discharge telephone follow-up calls. Hypotheses were evaluated based upon the clinically relevant time periods. Figure

4-2 below illustrates a breakdown of hospital readmissions by the clinically relevant time periods.

Figure 3-2 Breakdown of Readmissions



Hypothesis One

The analyses conducted to test hypothesis one were used to determine associations between hospital readmission within two days of discharge and selected Veteran characteristics including length of previous index hospital stay. Bivariate statistics were calculated to identify significant relationships between variables and hospital readmissions within two days. Variables with significant relationships to hospital

readmissions within two days were included in building the logistic regression equation. Forward selection was used to identify significant relationships.

Chi squared analyses presented in Table 4-6 found significant differences between discharged Veterans readmitted within two days and discharged Veterans not readmitted within two days. From the sample, 29,724 (24.30%) Veterans received a discharge telephone follow-up call within two days and were not readmitted to the hospital within two days, compared to 279 (16.18%) Veterans who received a discharge telephone follow-up call and were readmitted to the hospital within two days (χ^2=61.0153, p<.0001). Only 13 (0.75%) Veterans who were classified as frequently hospitalized were readmitted within two days after hospital discharge compared to 472 (0.39%) of discharged Veterans not readmitted within two days (χ^2=5.9212, p=0.02). Additionally, the low number of Veterans who were frequently hospitalized in the year prior to their index hospitalization should be noted because only 1.16% of Veterans were identified as frequently hospitalized and only occurred within 2012. Because both discharge telephone follow-up calls within two days and frequent hospitalization were significantly related to hospital readmissions within two days, they were included in the logistic regression analysis.

Table 4-6

Chi Squared Analyses of Veterans Readmitted within Two Days
N= 124,069 Discharges

	Not Readmitted Within Two Days *n= 122,345* (%)	Readmitted Within Two Days *n= 1,724* (%)	χ^2	P-Value
Discharge Telephone Call Within Two Days	29,724 (24.30)	279 (16.18)	61.0153	<.0001
Frequently Hospitalized Veterans	472 (0.39)	13 (0.75)	5.9212	0.02

Length of index hospital stay, Veteran age, and number of comorbidities were significantly related to hospital readmissions within two days (Table 4-7). Significant relationships were also identified through student t-tests. Of the 124,069 Veteran discharges, Veterans who were readmitted within two days to the hospital had longer mean length of index hospital stay (M = 5.17, SD=8.44, p<.0001) compared to discharged Veterans who were not readmitted within two days. Similarly, discharged Veterans who were readmitted to the hospital within two days were older Veterans (M = 66.73, SD= 0.32, p<.0001) than Veterans who were not readmitted within two days. Finally, Veterans readmitted to the hospital within two days had a significantly greater number of comorbid conditions (M =6.81, SD= 0.10, p<.0001) compared to Veteran's who were readmitted within two days. Because length of index hospital stay, Veteran age, and number of comorbidities were significantly related to hospital readmissions within two days, they were included in the logistic regression analysis.

Table 4-7

T-Test Analyses of Veterans Readmitted within Two Days
N= 124,069 Discharges

	Not Readmitted Within Two Days *n= 122,345*	Readmitted Between Within Two Days *n= 1,724*	T-Test	P-Value
	M (SD)	M (SD)		
Length of Index Hospital Stay	4.21 (6.20)	5.17 (8.44)	-6.38	<.0001
Veteran Age	65.06 (0.04)	66.73 (0.32)	-5.30	<.0001
Number of Comorbidities	6.21 (0.01)	6.81 (0.10)	-6.38	<.0001

Logistic regression analysis (Table 4-8) was used to identify significant relationships for the selected Veteran characteristics identified during the bivariate analyses and hospital readmissions within two days. Veterans who received discharge telephone follow-up calls within two days after hospital discharge were 0.595 times less

likely to be hospitalized during the first two days after hospital discharge. However, increased number of comorbidities (OR= 1.031), longer length of index hospital stay (OR=1.031), higher age (OR= 1.008) and frequently hospitalizations (OR=1.970) were significant risk factors for hospital readmissions within two days after hospital discharge. Increased number of comorbidities, length of index hospital stay, age, and frequent hospitalization were identified as positive risk factors for hospital readmissions within two days after discharge.

Table 4-8

Logistic Regression for Veterans Readmitted within Two Days N= 124,069 Discharges

	χ^2	P-Value	Odds Ratio	Confidence Intervals
Discharge Telephone Call Within Two Days	61.0153	<.0001	0.595	[0.523, 0.677]
Number of Comorbidities	43.4917	<.0001	1.031	[1.018, 1.043]
Length of Index Hospital Stay	19.1533	<.0001	1.010	[1.005, 1.015]
Veteran Age	18.6714	<.0001	1.008	[1.005, 1.012]
Frequently Hospitalized Veterans	5.9834	0.0144	1.970	[1.132, 3.429]

Hypothesis Two

Similar to the analysis for testing hypothesis one, significant relationships between hospital readmissions between three and seven days and the selected variables were evaluated prior to being entered into a logistic regression analysis. Chi squared analyses presented in Table 4-9 below identified significant relationships between discharge telephone follow-up calls between three and seven days and hospital readmissions between three and seven days (χ^2= 3.948, p= 0.05). However, discharge telephone follow-up calls within two days had no significant relationship to hospital readmissions between three and seven days (χ^2= 0.6188, p= 0.43). Frequent hospitalizations were significantly related to hospital readmissions between three and

seven days (χ^2= 6.6821, p= 0.01). Because of these significant relationships, discharge telephone follow-up calls between three and seven days and frequently hospitalized Veterans were included in the logistic regression analysis.

Table 4-3

Chi Squared Analyses of Veterans Readmitted between Three and Seven Days N= 124,069 Discharges

	Not Readmitted Between Three and Seven Days *n=120,200* (%)	Readmitted Between Three and Seven Days *n=3,869* (%)	χ^2	P-Value
Discharge Telephone Call Within Two Days	29,088 (24.20)	915 (23.65)	0.6188	0.43
Discharge Telephone Call Between Three and Seven Days	15,624 (13.00)	545 (14.09)	3.948	0.05
Frequently Hospitalized Veterans	460 (0.38)	25 (0.65)	6.6821	0.01

Significant differences between Veterans readmitted to the hospital between three and seven days and Veterans who were not were identified for length of index hospital stay, Veteran age and number of comorbidities (Table 4-10). Veterans who were readmitted between three and seven days were identified as having significantly longer mean length of index hospital stays (*M* =5.16, SD = 7.11) compared to Veterans who were not readmitted between three and seven days (*M* =4.19, SD=6.21). Additionally, Veterans readmitted between three and seven days had a higher mean age (*M* = 66.09, SD= 12.49) and number of comorbidities (*M*= 6.86, SD= 3.98) when compared to Veterans who were not readmitted between three and seven days. These significant relationships led to the inclusion these variables in the logistic regression analysis.

Table 4-40

T-Test Analyses of Veterans Readmitted between Three and Seven Days

N= 124,069 Discharges				
	Not Readmitted Between Three and Seven Days *n= 120,200*	Readmitted Between Three and Seven Days *n= 3,869*	T-Test	P-Value
	M (SD)	M (SD)		
Length of Index Hospital Stay	4.19 (6.21)	5.16 (7.11)	-9.54	<.0001
Veteran Age	65.05 (13.05)	66.09 (12.49)	-4.87	<.0001
Number of Comorbidities	6.20 (3.86)	6.86 (3.98)	-10.20	<.0001

Logistic regression analysis revealed that the number of comorbidities, length of index hospital stay, Veteran age, and frequently hospitalization were significantly related to hospital readmissions between three and seven days. Discharge telephone follow-up calls between three and seven days were found to not be significantly related to hospital readmissions between three and seven days (χ^2= 3.8343, p= 0.0502). Frequently hospitalized Veterans had the highest risk of being readmitted to the hospital between three and seven days (OR= 1.632, CI [1.090, 2.445]). Veteran age, although significantly related to hospital readmissions between three and seven days, was the lowest risk for hospital readmissions (OR=1.004, CI [1.001, 1.006]). The number of comorbidities and length of index hospital stay also had slightly elevated risks for hospital readmissions between three and seven days (OR= 1.036 and OR=1.011 respectively).

Table 4-5

Logistic Regression for Veterans Readmitted between Three and Seven Days N= 124,069 Discharges				
	χ^2	P-Value	Odds Ratio	Confidence Intervals
Number of Comorbidities	110.1682	<.0001	1.036	[1.027, 1.044]
Length of Index Hospital Stay	47.2351	<.0001	1.011	[1.008, 1.014]
Veteran Age	8.3319	0.0039	1.004	[1.001, 1.006]
Frequently Hospitalized Veterans	5.7573	0.0164	1.632	[1.090, 2.445]

Hypothesis Three

Analyses to test hypothesis three identified significant relationships between Veterans readmitted to the hospitals between eight and thirty days and the selected variables through bivariate analyses. Significant variables were then included in the logistic regression analysis. Tables 4-12 and 4-13 below present the results from the bivariate analyses.

Chi squared analyses found only frequent hospitalizations in the previous year were significantly related to hospital readmissions between eight and thirty days (χ^2=68.9771, p<.0001). Neither discharge telephone follow-up calls within two days (χ^2= 0.1207, p=0.73) nor discharge telephone follow-up calls between three and seven days (χ^2=.01203, p=0.73) were significantly related to hospital readmissions between eight and thirty days. Only frequently hospitalized Veterans was included in the logistic regression analysis after chi squared analyses were conducted.

Table 4-2

Chi Squared Analyses of Veterans Readmitted between Eight and Thirty Days N= 124,069 Discharges

	Not Readmitted Between Eight and Thirty Days *n= 113,708* (%)	Readmitted Between Eight and Thirty Days *n= 10,361* (%)	χ^2	P-Value
Discharge Telephone Call Within Two Days	27,562 (24.24)	2,441 (23.56)	0.1207	0.73
Discharge Telephone Call Between Three and Seven Days	14,850 (13.06)	1,319 (12.73)	0.1203	0.73
Frequently Hospitalized Veterans	396 (0.35)	89 (0.86)	68.9771	<.0001

Student t-tests evaluated significant relationships between continuous variables (Table 4-13). Veterans readmitted to the hospital between eight and thirty days were

identified to have a significantly increased length of index hospital stay (*M*= 5.16, SD=7.29) compared to the length of index hospital stay for Veterans not readmitted between eight and thirty days (*M*=4.14, SD= 6.13). Similarly, the mean Veteran age and number of comorbidities were significantly higher in Veterans who were readmitted to the hospital between eight and thirty days (p<.0001 and p<.0001 respectively) compared to Veterans who were not readmitted to the hospital between eight and thirty days. After identifying significant relationships between length of index hospital stay, Veteran age, and number of comorbidities, the variables were included with frequently hospitalized Veterans in a logistic regression analyses.

Table 4-13

T-Test Analyses of Veterans Readmitted between Eight and Thirty Days N= 124,069 Discharges

	Not Readmitted Between Eight and Thirty Days *n= 113,708*	Readmitted Between Eight and Thirty Days *n= 10,361*	T-Test	P-Value
	M (SD)	M (SD)		
Length of Index Hospital Stay	4.14 (6.13)	5.16 (7.29)	-15.70	<.0001
Veteran Age	64.98 (13.09)	66.23 (12.21)	-9.21	<.0001
Number of Comorbidities	6.16 (3.84)	6.95 (4.02)	-19.75	<.0001

Table 4-14 below presents the results from the logistic regression analyses for hypothesis three. All variables included were significantly related to hospital readmissions between eight and thirty days. Frequently hospitalized Veterans were identified as having the highest likelihood for hospital readmissions between eight and thirty days. Veterans who were identified as being frequently hospitalized in the previous year were 2.466 times more likely to be readmitted to the hospital after the index hospitalization. The number of comorbidities (OR= 1.043), length of index hospital stay

(OR= 1.013), and Veteran age (1.005) slightly increased the risk of hospital readmissions between eight and thirty days.

Table 4-6

Logistic Regression for Veterans Readmitted between Eight and Thirty Days N= 124,069 Discharges

	χ^2	P-Value	Odds Ratio	Confidence Intervals
Number of Comorbidities	388.8639	<.0001	1.043	[1.038, 1.049]
Length of Index Hospital Stay	114.5319	<.0001	1.013	[1.010, 1.015]
Frequently Hospitalized Veterans	62.6024	<.0001	2.466	[1.956, 3.109]
Veteran Age	30.1277	<.0001	1.005	[1.003, 1.006]

Summary of Aim Two

Analyses for aim two determined whether hospital readmissions were related to the receipt of a discharge telephone follow-up call, selected Veteran characteristics, and length of index hospital stay. Each hypothesis under Aim two evaluated the relationships between the receipts of discharge telephone follow-up calls and selected Veteran characteristics including length of index hospital stay at different clinically relevant time periods.

Differences in the relationships between receipt of discharge telephone calls and hospital readmissions were noted at the different clinically relevant time periods. Discharge telephone follow-up calls within two days were significantly associated with hospital readmissions within two days. Additionally, receipt of discharge telephone follow-up calls between three and seven days were significantly related to hospital readmissions between three and seven days, but the relationship was not strong enough to be included in the final logistic regression model. Receipt of a discharge telephone follow-up call within two days and between three and seven days were not related to hospital readmissions between eight and thirty days. However, selected Veteran

characteristics including length of index hospital stay were related to hospital readmissions at all clinically relevant time periods.

Summary

This study explored 30-day hospital readmissions among Veterans discharged from fiscal years 2011 and 2013. Aim one described analyses resulting in a description of 30-day hospital readmissions among Veterans discharged from the VHA in terms of receipt and timing of discharge telephone follow-up call, selected Veteran characteristics, and length of index hospital stay. Thirty day hospital readmissions were broken into clinically relevant time periods from zero to two days, three to seven days, and eight to thirty days after hospital discharge. Hospital discharges were split evenly over the three fiscal years evaluated in the study. Over the three fiscal years, discharge telephone follow-up calls within two days and between three to seven days increased from a total of 312 discharge telephone follow-up calls in 2011 to 26,549 discharge telephone follow-up calls in 2013.

Several aspects of the selected Veteran characteristics including length of index hospital stay should be highlighted. Length of index hospital stay, Veteran age, and number of comorbidities were positively skewed suggesting a minority of Veterans were hospitalized for longer periods of time, were older and had a larger number of comorbidities. Also, the 485 frequently hospitalized Veterans were only identified in fiscal year 2012. These aspects must be considered when evaluating aim two and will be explored further in chapter five.

Analyses within aim two determined whether hospital readmissions are related to receipt and timing of discharge telephone follow-up calls, selected Veteran characteristics, and length of index hospital stay at clinically relevant time periods. One hypothesis was tested for each of the different clinically relevant time periods.

Discharge telephone follow-up calls within two days was significantly associated with hospital readmissions within two days (χ^2=61.0153, OR= 0.595). Discharge telephone follow-up calls between three and seven days were significantly related to hospital readmissions between three and seven days (χ^2= 3.948, p= 0.05) in univariate analyses, but when entered into the logistic regression, discharge telephone follow-up calls between three and seven days was not significantly related to hospital readmissions between three and seven days. There was no significant relationship between discharge telephone follow-up within two days or between three and seven days and hospital readmissions between eight and thirty days. Only discharge telephone follow-up calls within two days was identified as a potentially protective factor (OR= 0.595) against hospital readmissions within two days. While discharge telephone follow-up calls were not consistently related to hospital readmissions during the clinically relevant time periods, selected Veteran characteristics including length of index hospital stay were consistently and significantly related to hospital readmissions.

The number of comorbidities, length of index hospital stay, Veteran age, and frequently hospitalizations in the previous year were identified as positive risk factors for hospital readmissions at each of the clinically relevant time periods. Frequently hospitalized Veterans were identified as being at the highest risk for hospital readmissions with odds ratios ranging from 1.970 to 2.466. Increasing Veteran age was the smallest risk factor for hospital readmissions ranging from being 1.004 to 1.008 times more likely to be readmitted to the hospital.

In the following chapter, the results in Chapter Four will be discussed. Clinical implications of the results will be explained. Limitations of the current study and areas for future research will be described, and a summary and conclusions from the study will be reviewed.

Chapter 5

Discussion

Introduction

Over the past decade, healthcare costs have risen rapidly, from consuming 13.8% of the gross domestic product in 2000, to 17.2% of the gross domestic product in 2012, or approximately 2.79 trillion dollars in annual spending (Hockenberry & Thorpe, 2014; Gordon et al., 2014). With the rapidly growing costs of healthcare, decreasing unnecessary healthcare costs has become a national priority (Obama, 2013). Contributing to the unnecessary healthcare costs is poor patient transitions from the hospital to home. The poor management of these critical transitions is a significant contributor to the overall healthcare costs within the United States (Kangovi & Grande, 2014; Kind et al., 2012; Naylor & Sochalski, 2010; Obama, 2013).

While there are now years of research in this area, significant challenges remain regarding how to identify patients at risk for poor outcomes post-discharge, and to ensure they have high quality care and support in the transition from hospital to home. Patients at risk for poor transitions from the hospital to home are older with multiple chronic conditions that require multiple specialties to address their health challenges (Piraino et al., 2012; Podulka et al., 2012). What is often missing in the midst of these patients' complex needs is a single healthcare provider, such as the nurse case manager who is coordinating, integrating, and monitoring the complex care required by complex patients. In response, some efforts have focuses on large scale restructuring of the continuum of healthcare services such as Naylor and colleagues who have developed and tested methods to improve care transitions using nurse case managers (Naylor & Keating, 2008; Naylor et al., 2012), while others have proposed that monitoring and coordinating the needs of complex patients can be done remotely, through telephone follow-up (Bahr et

al., 2014; Costantino et al., 2013a; Harrison et al., 2014; Harrison et al., 2011; Soong et al., 2014; Young et al., 2013).

A large scale restructuring utilizing telephone follow-up is the Patient Aligned Care Team (PACT) implemented by the VHA. The VHA PACT model has placed outpatient services as the primary point of reintegration after acute hospitalizations. The PACT model uses nurse case managers to coordinate, integrate, and monitor transitions from the hospital to home using multiple strategies. However, conducting telephone follow-up calls with patients within two days and up to seven days of discharge has been a central focus of the transitional care. Previous research suggests that discharge telephone follow-up calls close to the time of discharge is effective at reducing hospital readmissions (Constantino et al., 2013a; Dudas et al., 2001; Harrison et al., 2011; Harrison et al., 2014; Melton et al., 2012). Based upon previous research, this study explored timing of the VHA discharge telephone follow-up calls in relation to timing of the hospital readmission.

Previous researchers have identified patterns in timing of hospital readmissions within 30 days (Dharmarajan et al., 2013, Eastwood et al., 2014; Merkow et al., 2015). When exploring hospital readmissions within 30 days, about two out of every five readmissions occur within the seven days after hospitalization (Dharmarajan et al., 2013). Despite the large proportion of hospital readmissions occurring within the first seven days after discharge, transitional care in relation to timing of the hospital readmission has not been explored extensively within the VHA. This study described hospital readmissions during time periods which corresponded to the timing of discharge telephone follow-up calls by PACT nurse case managers.

To date little research has been done to evaluate the impact of discharge telephone follow-up calls upon hospital readmissions, with a particular focus on understanding how the timing of calls may contribute to variability in effectiveness. Using a secondary VHA data collected from the Department of Veteran Affairs CDW and PACT Implementation

Project Compass databases, which provided a sample of 124,069 hospital discharges from fiscal years (October to September) 2011 and 2013, the current study sought to explore this critical VHA transitional care process, receipt, and timing of discharge telephone follow-up calls on 30-day hospital readmissions.

Aim one

The first aim of this study was to describe 30-day hospital readmissions among Veterans discharged from the VHA from federal fiscal years 2011 to 2013 in terms of receipt and timing of discharge telephone follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalization).

Findings from this study demonstrate that hospital readmissions remained relatively steady from 2011 to 2013 (41,081, 41,646, and 41,342 respectively) in the VHA, with 12.86% of all discharged Veterans during the study period readmitted within 30 days. Among discharged Veterans readmitted within 30 days, 35.06% occurred within the first week after hospitalization. During this same time period, discharge telephone follow-up calls increased after implementation of PACTs. In 2011, 108 Veterans received discharge telephone follow-up calls within two days after hospital discharge compared to 17,765 Veterans receiving follow-up calls within two days in 2013. Similarly, follow-up calls between three and seven days increased from 204 in 2011 to 8,784 in 2013. Mean length of index hospital stay, Veteran age, and number of comorbidities were similar to previous research describing Veteran hospitalizations and hospital readmissions. Finally, frequently hospitalized Veterans, or Veterans identified as having four or more hospitalizations in the previous year, comprised 1.16% of those who were readmitted, but were only found during the 2012 fiscal year of the study timeframe. Each of these study findings will be explored within the context of the current research.

Hospital Readmissions

Understanding readmissions is complex and must consider not only hospital readmission rates but the characteristics of the index hospitalization, characteristics of the patient, and the type and timing of transitional care methods. For example, patients who have planned admissions for ongoing care, diagnostic workups, and surgical interventions have different index hospitalization characteristics than patients admitted to through the emergency room with a myocardial infarction. Although exploration of admitting diagnosis is beyond the scope of this study, this study did explore one characteristic of hospital admissions, several patient characteristics, and type and timing of transitional care used by the VHA. Before exploring characteristics which may influence hospital readmissions, VHA hospital readmissions between 2011 and 2013 within the context of current literature will be described.

In the current study, hospital discharges remained relatively steady during the study period (41,081, 41,646, and 41,342 respectively), although 30 day all cause hospital readmissions decreased from 13.28% in 2011 to 13.01% in 2012 to 12.29% in 2013. The decreasing rate of readmissions among the 15,954 (12.86%) Veterans readmitted to the hospital within 30 days is lower than previously reported 13.8% 30-day VHA readmission rate from Kaboli and colleagues (2012) 2009-2010 study. This is consistent with other previous VHA research describing 30-day hospital readmission rates for surgical specialties that found all surgical specialties, except thoracic and cardiac surgery, decreased hospital readmissions from 2001 to 2010 (Han et al., 2014). Looking back a few more years, between 1999 and 2002, French and colleagues (2008) found 18.3% of Veterans treated for hip fractures were readmitted to the hospital within 30-days. During 2001 and 2010, hospital readmissions became a national concern because of the high costs associated with them (Naylor et al., 2004).

From 1999 to 2010, studies completed outside of the VHA reported higher 30-day hospital readmission rates, ranging from 16.80% to 24.50% (Jencks et al., 2009; T. Shih

et al., 2014; Wang et al., 2014). From 2003 to 2004, 19.6% of patients with Medicare were readmitted to the hospital within 30 days (Jencks et al., 2009). Additionally, from 2008 to 2010, patients with Medicare were readmitted to the hospital at similar rates to Jencks colleagues (Shih et al., 2014). Shih and colleagues (2014) found that hospitals serving more minorities had higher hospital readmissions compared to hospitals serving fewer minorities (19.2% compared to 17.2% respectively). Although ethnicity was not explored in this study, this study reports lower hospital readmissions than hospital readmissions in non-VHA facilities. The lower hospital readmission rate reported in this study is unlikely to be related to differences among the study samples.

When examining samples from the studies within the VHA and outside the VHA, patients who were readmitted within 30 days were often socioeconomically disadvantaged, older, had more comorbidities, experienced complications during their hospital stay (Han et al., 2014; Kaboli et al., 2012; Kind et al., 2007; Jencks et al., 2009; T. Shih et al., 2014; Wang et al., 2014). Participants from both VHA and non-VHA studies identified similar risk factors for hospital readmissions. Furthermore, both VHA and non-VHA studies identified history of chronic conditions as a risk factor for hospital readmission. Jencks and colleagues (2009) also identified that 70.5% of hospital readmissions within 30 days was due to a medical condition. Diagnoses of medical conditions, specifically chronic diseases, are known to be related to hospital readmissions (Eastwood et al., 2014; Iloabuchi et al., 2014; Shadmi et al., 2014; Shih et al. 2014; Wang et al., 2014). Patients with complex chronic conditions tend to be older and see multiple providers leading to fragmented care (Hempstead et al., 2014). Additionally, 22.3% of all discharged patients were readmitted to the hospital within 30 days for either the primary discharge diagnosis or a common comorbid condition (Donze et al., 2014). This study identified an increasing number of comorbid conditions as a significant contributor to hospital readmissions. This finding is explored in greater detail below. Despite differences in hospital readmissions, both VHA and non-VHA studies identified similar

risk factors for hospital readmissions. This study contributes to the literature by further substantiating those similarities in patients readmitted to the hospital within 30 days. However, this study goes further than previous VHA research by describing timing of hospital readmissions.

Hospital Readmission Time Periods

Although the VHA is the largest healthcare provider in the United States, to date, there has been limited focus on hospital readmissions earlier than 30 days. In the current study hospital readmissions within two days, between three and seven days, and between eight and thirty days were explored. Of the 15,954 discharged Veterans readmitted to the hospital within 30 days, hospital readmission patterns within these timeframes were consistent with previous research outside the VHA (Dharmarajan et al., 2013; Eastwood et al., 2014).

As noted in chapter four, among the 12.86% of Veterans who were readmitted within 30 days of hospitalization, 10.81% were readmitted within two days and 24.25% were readmitted between three and seven days for a total Veterans readmitted within 30 days 35.06% were readmitted within the first seven days. These rates are similar to results reported by Dharmarajan and colleagues (2013), who found readmissions within the first three days ranged from 13.4% to 19.1% and readmissions within the first seven days ranged from 31.7% to 40.1%. In a study describing hospital readmissions for patients admitted for acute myocardial infarctions, 43% of all hospital readmissions occurred most frequently between two and four days (Dreyer et al., 2015). This study confirms that a large percentage of hospital readmissions occur within the first seven days after hospital discharge. Identifying causes for these early hospitalizations has become a topic of concern for researchers.

Previous researchers identified having history of chronic diseases and several characteristics of the index hospital stay to be related to hospital readmissions within

seven days (Dharmarajan et al., 2013, Eastwood et al., 2014; Merkow et al., 2015). This study concurs with the previous research. Patients with chronic diseases (CHF, COPD, chronic kidney disease, and arrhythmias) have significantly more hospital readmissions with the first seven days (Dharmarajan et al., 2013; Eastwood et al., 2014). In a study of complications after surgical procedures, hospital readmissions with seven days are often from complications of chronic conditions such as congestive heart failure, peripheral vascular disease, cardiac arrhythmias, and renal disorders not from surgical complications (Merkow et al., 2015). This study identified Veterans discharged from the VHA from 2011 to 2013 had multiple chronic comorbid conditions and were older similar to previously identified risk factors for early hospital readmission. Similar to previous research, this study highlights the large percentage of hospital readmissions occurring within the first seven days after hospital discharge at the VHA. In addition to highlighting the large percentage of hospital readmissions within the first seven days, this study described discharge telephone follow-up calls in relation to early hospital readmissions.

PACT Discharge Telephone Follow-up Calls

Similar to describing hospital readmissions at discrete time periods (within two days, between three and seven, and between eight and thirty days) this study explored discharge telephone follow-up calls during parallel time periods. As noted previously, a key element of transitional care management within the VHA is the discharge telephone follow-up calls by PACT nurse case managers. PACT guidelines suggest telephone calls are to be completed within the first two days after hospital discharge. However, any telephone call within the first week after hospital discharge is considered a discharge telephone follow-up call. For the current study, discharge telephone follow-up calls were divided into two groups to align with the VHA guidelines and national goals, within two days and between three and seven days.

After PACT implementation in 2010, discharge telephone calls within seven days increased greatly (0.76% to 65.22%). Among Veterans who received a call, the percentage who received the call within two days went from 0.26% to 43.97%. While the increase in Veterans called within two days increased dramatically, it did not reach the national goal of 50% of Veterans receiving a call within two days of hospital discharge. Despite not reaching the 50% goal, the discharge follow up telephone call exceeded rates reported by Melton and colleagues (2012) where they found that nurse case managers conducted discharge telephone follow-up calls within the first several days after discharge for 33% to 44% of patients. In Melton and colleagues study, patients who were deemed to be at high risk for hospital readmission received more discharge telephone follow-up calls (44%) than patients who were not deemed to be at risk for hospital readmission (33%). The current study found 43.97% of Veterans discharge from the VHA in 2013 received follow-up calls within the first two days after discharge and 21.25% received a follow-up call between three and seven days after discharge. Costantino and colleagues (2013) found that discharge telephone follow-up calls "appeared to have the greatest impact when performed as close to the day of discharge as possible. The closer to the provision of the [discharge telephone follow-up call] to the date of discharge the more likely a readmission was averted" (p. 313). Based upon findings for Costantino and colleagues (2013) and Melton and colleagues (2012), the VHA was correct in implementing discharge telephone follow-up calls as a method for transitional care. The large increase in follow-up calls within the first two days after discharge suggests that early telephone follow-up is a significant priority for PACT nurse case managers and the VHA.

Because of the increases in discharge telephone follow-up calls within two days after discharge, clearly the VHA has allocated substantial resources to increase the number of Veterans who are receiving timely follow up after hospitalizations. This study suggests there is still room for improvement with more than 35% of Veterans not

receiving a discharge telephone follow-up call during the first seven days. Further exploration is required to understanding issues related to not receiving a telephone call within seven days and more importantly, not receiving a phone call within two days. Better understanding of both available VHA resources and logistical challenges of connecting to Veterans outside of the hospital are required.

Length of Index Hospital Stay

From 2011 to 2013, 124,069 index hospitalizations occurred. Index hospitalizations refer to the hospitalization prior to a Veteran's discharge. Length of index hospital stay has been identified by previous researchers as a possible risk factor for 30-day hospital readmission which led to its inclusion in the study (Eastwood et al., 2014; Jencks et al., 2009; Kruse et al. 2013).

Jencks and colleagues (2009) found that the mean length of index hospital stay was 0.6 days longer in patients who were readmitted to the hospital within 30 days compared to patients in similar diagnosis-related groups (DRGs). Similarly, Kruse and colleagues (2013) found an increasing length of index hospital stay beyond two days in the hospital increased the risk of hospital readmission from 1.19 to 2.81 times. Of the 124,069 hospital discharges, the length of index hospital stay was positively skewed (median= 3.00, *M*= 4.21, SD= 6.24). Furthermore, the large standard deviation for length of index hospital stay and the large range in length of index hospital day from 1 to 307 days among Veteran's length of stay suggests some Veterans may be at higher risks for hospital readmissions. The Veterans who had longer lengths of index hospital stay may have influenced hospital readmissions and may have been readmitted to the hospital sooner than Veterans with shorter length of index hospital stays.

A study by Eastwood and colleagues (2014) found patients with increasing length of index hospital stay were more likely to be readmitted to the hospital within seven days. However, the authors found no relationship between length of index hospital stay and 30-

day readmissions. A potential reason for the lack of significant relationship identified by Eastwood and colleagues is the wide distribution in length of index hospital stays. The large sample size in this study, the wide range in the length of index hospital stays, and the positively skewed distribution may explain the results from Eastwood and colleagues. The relationship between length of index hospital stay and timing of hospital readmission were explored further in aim two.

Number of Comorbidities

In addition to describing length of index hospital stay, this study described the number of comorbid conditions for Veterans discharged from 2011 to 2013. Further exploration of Veteran characteristics during the index hospitalizations estimates that hospitalized Veterans were primarily older males with multiple comorbid conditions. Veterans in the study had multiple chronic conditions (median=6, *M*= 6.22, SD= 3.86). Study finding align with previously reported chronic conditions research. In the United States, an estimated 28% of people have one or more chronic conditions (Robert Wood Johnson Foundation, 2010).

Veterans readmitted to VHA hospitals within 30 days between 2009 and 2010 were identified as having multiple comorbid conditions (Kaboli et al., 2012). Kaboli and colleagues (2012) also found that Veterans served by the VHA had high rates of specific comorbid conditions (26.0% COPD, 17.3% CHF, 16.3% renal disease, and 35.4% diabetes). As previously discussed, patients with a history of comorbid conditions are at an increased risk for hospital readmissions (Eastwood et al., 2014; Jencks et al., 2009; Kruse et al. 2013; Merkow et al., 2015; Ottenbacher et al., 2014). The increased risk for hospital readmission because of a history of comorbid conditions is also associated with fragmented care (Hempstead et al., 2014). Patients with multiple comorbid conditions often see multiple providers who may not communicate and coordinate their treatment plans to the Veterans overall plan of care. Among the Veterans in the study the number of

comorbid conditions (*M*=6.22) is concerning because of the likelihood of further fragmentation of care thus increasing the risk of 30-day hospital readmissions.

The VHA has attempted to improve chronic care management through implementation of PACTs. The PACT teams help facilitate the longitudinal management of chronic conditions (Arend et al., 2012; Klein 2011). However, there has been limited exploration of how PACT implementation has influenced management of Veterans with chronic conditions (Yoon et al., 2012). This study confirms that Veterans discharged from the VHA have multiple chronic comorbid conditions which inform PACT providers about the risks the Veterans have for 30-day hospital readmissions.

Veteran Age

Veterans in the study are consistent with previously reported research identifying majority of Veterans using the VHA over 65 years old (median= 64, *M*= 65.08, SD= 12.03) (West & Weeks, 2009; National Center for Veterans Analysis and Statistics, 2014). The current sample reflects a transition point among the Veterans served by VHA. Although the distribution of the sample is influenced by the very elderly in the sample (18-100 years of age), the increasing enrollment of Veterans from Operation Iraqi Freedom and Operation Enduring Freedom in Afghanistan also contribute to the large range and thus the large standard deviation (SD=12.03).

As noted above, increasing age has been found to increase the risk of hospital readmission within 30 days from 1.07 to 1.74 (Eastwood et al., 2014; Kruse et al., 2013). Compared to patients below the age of 65, patients who are over the age of 65 have been identified as being at a higher risk for hospital readmissions with patients over 85 years of age at the highest risk for hospital readmission within 30 days (Au et al., 2012; Eastwood et al., 2014; Kruse et al., 2013). The mean age of Veterans in this sample (*M*= 65.08) suggests that Veterans are at high risk for hospital readmission and those at the higher end of the range are at the highest risk for readmission.

As previously noted, Operation Iraqi Freedom and Operation Enduring Freedom has led to a large influx of younger Veterans would are at lower risk for hospital readmissions. This influx of younger Veterans enrolled in the VHA will lower the mean age of Veterans receiving care over time. Although the mean age of Veterans receiving care may decrease in the future, there will continue to be a large percentage of Veterans who are older and at an increased risk for hospital readmission for years to come. This study highlights that increased risk and suggests future research within the VHA should consider all Veterans to be at increased risk for hospital readmissions.

Frequently Hospitalized Veterans

In this study, frequently hospitalized Veterans were identified by four or more hospitalizations within the previous year to their index hospitalization. The study identified 485 Veterans (1.16%) who were frequently hospitalized in the previous year, all during 2012. Identifying frequently hospitalized Veterans only in 2012 is likely related to the conservative operational definition of frequently hospitalized Veterans. The conservative operationalizing of the definition was selected because the inability to control for the wide range of reasons that Veterans could be returning for planned readmissions such as unrelated and minor surgical procedures.

In previous studies, frequent hospitalizations have been defined widely with some studies considering one or more hospitalizations in the previous year (Renom et al., 2010; Shadmi et al., 2015; Longman et al., 2012). Researchers defining frequent hospitalization as one or more hospitalizations within the previous year found 15,152 (45%) patients are hospitalized more than once in the previous year including emergency room visits (Shadmi et al., 2015). Increasing the operationalized definition of frequent hospitalization to three or more hospital admissions in the previous year only identified 512 participants in the entire North Coast of Australia (Longman et al., 2012). Defining frequent hospitalization as four or more hospital admissions in the previous year found a similar

number of frequently hospitalized Veterans as Longman and colleagues (485 compared to 512). The higher number of hospital admissions required in the prior year to be classified as frequently hospitalized contributed to the low number of Veterans identified as frequently hospitalized.

Frequent hospitalization has an inconsistent operationalized definition in the literature making it difficult to compare frequent hospitalizations among different studies (Renom et al., 2010; Shadmi et al., 2015; Longman et al., 2012). Despite the inconsistent operationalized definition of frequent hospitalization, researchers agree that past hospital use does contribute to the prediction of future hospitalization and significantly increases the risk of hospital readmissions.

In another study, increasing hospitalizations and emergency room visits lead to an increased risk for hospital readmissions by 1.40 times per hospitalization (Shadmi et al., 2015; Wang et al., 2014). Additionally, emergency room visits within the past six months have been identified to increase the risk for hospital readmissions (OR=1.79) (Wang et al., 2014). The previous studies by Wang and colleagues and Shadmi and colleagues defined frequent hospitalization by the frequency of emergency room use and/or hospital use. Including both emergency room use and hospital use within the operationalized definition of frequent hospitalization further increases the chance previous hospitalizations will be identified and associated with future hospitalizations. This study however, only included hospitalization within the operationalized definition making it far more conservative than any previous definition in the literature. The conservative definition of frequent hospitalization used in this study led to a lower number of frequently hospitalized Veterans being identified.

The conservative definition of frequent hospitalization will need to be adjusted in future studies. However, future studies will need to control for reason for admission and align the operational definition with the most meaningful definition based upon other

studies. However, this study still identified a group of frequently hospitalized Veterans (485) who are at high risk and could provide a sample for further exploration.

Aim Two

Aim two of this study was to determine whether hospital readmissions are associated with receipt and timing of discharge telephone follow-up call, length of index hospital stay (LOS), and selected Veteran characteristics (age, number of comorbidities, frequent hospitalization) at clinically relevant time periods (within two days, between three and seven days, between eight and thirty days) during the first 30 days post discharge. Three hypotheses were addressed according to three clinically relevant time periods (within two days, between three to seven days, and between eight to thirty days after discharge). Differences between Veterans readmitted were explored using bivariate statistical tests (chi squared and t-tests), and variables associated with readmission were explored using logistic regression.

A brief summary of the relationships identified between Veteran characteristics including length of index hospital stay and hospital readmissions from hypotheses one through three is that Veteran characteristics including length of index hospital stay were significantly related to hospital readmissions at each of the clinically relevant time periods and align with earlier studies (Jencks et al., 2009; Kaboli et al., 2012; Kruse et al., 2012; Merkow et al., 2015; Shadmi et al., 2015). Bivariate statistics found that Veterans who were identified as frequently hospitalized, older, had more comorbidities, and had longer lengths of index hospital stays had significantly more hospital readmissions at each of the readmission time periods. Previous researchers have noted increasing age, number of comorbidities, longer hospital length of stay, previous hospitalizations are significantly related to hospital readmissions (Eastwood et al., 2014; Jencks et al., 2009; Merkow et al., 2015; Shadmi et al., 2015). The significant relationships identified in the bivariate analyses led to inclusion of all Veteran characteristics including length of index

hospital stay in the logistic regression analyses. Again, consistent with previous research, logistic regression analyses found significant relationships between Veteran characteristics including length of index hospital stay and hospital readmissions at each of the time periods. While the study is aligned with earlier research, there is little noted in the literature about the consistency of the relationship across within two days, three to seven days, and eight and thirty days. This study highlights the consistent and increased risk of hospital readmission for the selected Veteran characteristics.

Divergent from previous research, this study explored timing of discharge telephone follow-up in relation to timing of hospital readmissions reveling potential explanations for the previously mixed research results. First, discharge telephone follow-up calls were not consistently related to hospital readmissions at each of the clinically relevant time periods. Chi squared analyses found significant differences between discharge telephone follow-up calls within two days and hospital readmissions within two days (χ^2= 61.0188, p<.0001) and significant differences discharge telephone follow-up calls between three and seven days and hospital readmissions between three and seven days (χ^2= 3.948. p= 0.05). However, discharge telephone follow-up calls within two days did not relate to hospital readmissions between three and seven or between eight and thirty days (χ^2= 0.6118, p= 0.43; χ^2= 0.1207, p= 0.73 respectively), nor were discharge telephone follow-up calls between three and seven days related to hospital readmissions between eight and thirty days (χ^2= 0.1203, p= 0.73). Furthermore, when included in the logistic regression analyses, only discharge telephone follow-up calls within two days were identified as having a significant relationship between hospital readmissions with two days. The inconsistencies identified in the relationships between discharge telephone follow-up calls and hospital readmissions at different clinically relevant time periods may explain the mixed results of previous research. The following sections provide explanations of the results within clinical context and provide potential explanations for the relationships between discharge telephone follow-up calls and hospital readmissions.

Veteran Characteristics and Length of Index Hospital Stay

All three hypotheses explored Veteran characteristics including length of index hospital stay each at different clinically relevant time periods. Bivariate statistics identified significant differences between Veterans who were readmitted with Veterans who were not readmitted suggesting that those readmitted had a higher proportion of frequent hospitalizations comorbid conditions, age, and longer lengths of index hospital stay at all clinically relevant time periods. Furthermore, logistic regression analyses found all Veteran characteristics including length of index hospital stay were significantly related to hospital readmissions at each of the clinically relevant time periods.

For each of the three hypotheses, the mean length of index hospital stay for Veterans readmitted was significantly greater than the mean length of index hospital stay for Veterans not readmitted to the hospital. Student t-tests ranged from $t= -6.38$ ($p<.0001$) to $t= -15.70$ ($p<.0001$) for the three hypotheses. Because length of index hospital stay was identified as being significantly different in Veterans who were readmitted to the hospital for each of the hypotheses, it was included in the logistic regression analyses. Logistic regression analyses found the longer length of stay increased the likelihood that the discharged Veterans would be readmitted to the hospital; odds ratios ranged between 1.011 and 1.043 for Veterans. The likelihood that Veterans would be readmitted to the hospital after an increased length of index hospital stay is slightly below previously reported research.

Previous research has found that increasing length of the indexed hospital stay increased the likelihood of readmissions (Jencks et al., 2009; Kaboli et al., 2012; Kruse et al., 2012). According to Kruse and colleagues (2012), increasing length of the indexed stay by two days has been found to increase the risk for 30-day hospital readmissions by 1.19 to 2.81 times. Increased risk for hospital readmissions as length of index hospital stay increased is slightly higher than the reported risk in this study. The differences

between the study findings could be attributed to the operationalization of the variable and comparisons. This study explored the relationship between increasing length of index hospital stay and hospital readmissions at different clinically relevant time periods. Kruse and colleagues (2012) compared length of index hospital stays into intervals and explored 30-day hospital readmissions at those different intervals but did not explore hospital readmission at different time periods. As mentioned previously, other researchers also compared increasing length of index hospital stay to 30-day hospital readmissions finding the longer the length of index hospital stay increased the risk of hospital readmission (Eastwood et al., 2014; Jencks et al., 2009). This study affirms that the longer length of index hospital stay increases the risk for hospital readmissions; however, the current study goes beyond previous research by identifying that longer length of stay increases the risk of hospital readmissions at three critical time points within 30 days. Breaking hospital readmissions into different time points may also explain why this study had a lower range of odds ratios for hospital readmissions compared to previous length of index hospital stay research.

In addition to exploring length of index hospital stays at different clinically relevant time periods, this study confirms that the number of comorbid conditions is related to an increased likelihood of hospital readmissions at all clinically relevant time periods. Veterans readmitted to the hospital at any point within 30 days, were found to have significantly more comorbid conditions than Veterans who were not readmitted to the hospital within 30 days (t= -6.38 to -19.75). Furthermore, this study found that greater the number of comorbid conditions increased the likelihood of hospital readmissions from 1.031 to 1.043 times. Consistent with previously reported research, the greater number of comorbid conditions, the greater likelihood the patient will be readmitted to the hospital (Joynt et al., 2013; Ottenbacher et al., 2014). Unlike previous studies, this study contributes to the literature by identifying that the increasing number of comorbid

conditions was related to an increased likelihood of hospital readmissions at three critical points in time within the first 30 days.

Furthermore, unlike many earlier studies, this study looked at the total number of comorbidities not specific comorbid conditions which will inform transitional care research. Previous transitional care research has focused on improvements in hospital readmissions for specific chronic conditions. This study confirms that the quantity of chronic conditions is also a risk factor for hospital readmissions which may be beneficial for future transitional care researchers and clinicians. The number of comorbid conditions was identified to increase the risk for hospital readmissions at each of the readmission time periods (ORs= 1.031-1.043). The consistently elevated risk of hospital readmissions at each of the clinically relevant time periods highlights the importance of providing effective transitional care for Veterans with comorbid conditions. The consistently increased risk for hospital readmissions within 30 days suggests that Veterans with multiple comorbid conditions should be closely followed during transitional care prevent hospital readmissions.

Similar to Veterans with multiple comorbid conditions, Veterans who were identified as being frequently hospitalized should also be followed closely for transitional care because of the significant relationship between frequent hospitalization and hospital readmissions at each of the clinically relevant time periods. As it often noted in the literature, the current study found that frequently hospitalized Veterans in this sample were consistently identified as being at the highest risk for hospital readmission (OR= 1.970-2.466) for each of the three time frames. Patients with frequent hospitalizations have been identified to be at increased risk (OR= 1.79) future hospital readmissions (Ganesh et al., 2013; Wang et al., 2014). Results from this study suggest Veterans identified as frequently hospitalized are at a higher risk than previous research. However, the conservative definition of frequent hospitalization may account for the higher risk for hospital readmission. Creating a uniform definition of frequent hospitalization is

necessary to inform future research. Further research is needed to describe how the number of prior hospital readmissions or admitting diagnoses influences future hospital readmissions, and if transitional care targeting frequently hospitalized Veterans decreases hospital readmissions.

Discharge Telephone Follow-up Calls

As discussed, discharge telephone follow-up calls are within seven days but emphasized within two days, and are a critical component of the VHA transitional care plan for Veterans discharged from the hospital. The current study was one of the first to explore VHA discharge telephone follow-up calls and 30-day hospital readmissions at three critical points within the first 30 days after hospital discharge. The results from this study provide two complementary explanations to some of the previously mixed research. Exploring timing of the telephone follow-up call and timing of the hospital readmission were fundamental to identifying potential explanations to the previously mixed literature results.

The first complementary explanation of the previous literature identified by this study was that the study results suggest discharge telephone follow-up calls have a short duration of protective effects on hospital readmissions. The short duration of discharge telephone follow-up calls is seen by the significant relationships between discharge telephone follow-up calls and hospital readmissions in parallel time periods. The limited effect of discharge telephone follow-up calls are further illustrated through the logistic regression analyses which found only discharge telephone follow-up calls within two days decreased the likelihood of hospital readmissions within the same time period (OR= 0.595). The limited effect of discharge telephone follow-up calls partially explains why some researchers found significant relationships between telephone follow-up calls and hospital readmissions.

This study also provides a complimentary explanation to the limited effect of discharge telephone follow-up calls which suggests that selection bias may obfuscate the relationship between telephone follow-up calls and hospital readmissions. Evidence of selection bias is potentially seen in the lack of relationships between discharge telephone follow-up calls and the time frames after the calls. Both explanations of the results are explored within the context of current literature.

Explanation One: Limited Effect of Discharge Telephone Follow-up

As mentioned previously, 30-day hospital readmissions were divided into clinically relevant time periods corresponding to the timing of the discharge telephone follow-up calls leading to exploration of three separate hypotheses for each of the time period. By breaking hospital readmissions into clinically relevant time periods, it was possible to identify when discharge telephone follow-up calls had the greatest impact on hospital readmissions. Breaking hospital readmissions into clinically relevant time periods led to identifying a potential explanation to the previously mixed research results which suggests discharge telephone follow-up calls have a limited effect on preventing hospital readmissions.

The limited effect is evidenced by the discharge telephone follow-up calls within two days reducing the likelihood of hospital readmission within two days (OR= 0.595) after discharge but not reducing the likelihood of hospital readmissions from three to thirty days. Furthermore, chi squared analyses identified a significant difference between Veterans who received discharge telephone follow-up calls between three and seven days and hospital readmissions between three and seven days (χ^2= 3.948; p=0.05), but no protective effect was identified the logistic regression. Further evidence for the limited effectiveness of discharge telephone follow-up calls is seen by comparing the relationships between follow-up calls and the parallel hospital readmission time periods.

Breaking hospital readmissions into time periods parallel to the timing of the discharge telephone follow-up calls identified a limited relationship and short effect of the follow-up calls. As mentioned previously, the limited relationship is seen in the bivariate analyses which identified significant relationships between discharge telephone follow-up calls and hospital readmissions at parallel time periods. Exploring timing of both the discharge follow-up call and hospital readmission is a unique contribution to the literature. In most studies hospital readmissions across the 30 days after discharge was explored without any discrete time frames. Previous researchers explored timing of discharge telephone follow-up calls finding that earlier calls were more effective at reducing hospital readmissions (Costantino et al., 2013; Melton et al., 2012; Johnson, Laderman, & Coleman, 2013). However, without including timing of the hospital readmission in relation to the discharge telephone follow-up call previous researchers missed identifying the limited effect of the follow-up call.

The current study raises the point that the protective effect may be limited to a very short time frame. The limited time effect of discharge telephone follow-up calls would explain why studies which included timing of the follow-up call often found significant relationships between the follow-up call and hospital readmissions. However, this study goes further than previous studies and suggests that a second, complementary explanation might explain the results and previously mixed research.

Explanation Two: Selection Bias Limits and Explains Results

A complementary explanation to the results from this study is that selection bias may have influenced the results limiting the true effect of discharge telephone follow-up calls from being explored. The effectiveness of discharge telephone follow-up calls is limited by the patient's ability or willingness to answer the telephone (Harrison et al., 2014; Soong et al., 2014). If Veterans were readmitted to the hospital prior to receiving a discharge telephone follow-up call, they would not be available to receive the discharge

telephone follow-up call. It is unknown if an earlier discharge telephone follow-up call would have prevented that hospital readmission, but the Veterans who did not receive a call prior to readmission potentially biased the results. Veterans who did not receive a discharge telephone follow-up call prior to hospitalization create a potential selection bias. The section bias obfuscates the relationship between discharge telephone follow-up calls and hospital readmissions which may explain some of the previous mixed results while simultaneously being a limitation to this study.

This study suggests a potential for selection bias as influencing results. Potential evidence of self-selection bias is seen through two sources of evidence. First, the lack of relationships between discharge telephone follow-up calls and the hospital readmissions time periods following the discharge telephone follow-up call. Second, significant differences in hospital readmissions were identified between Veterans who received the discharge telephone follow-up call during the parallel readmission time period.

The first potential evidence for selection bias is seen in the lack of relationship between the follow-up call and hospital readmission time period after the follow-up call. For example, discharge telephone follow-up calls within two days and hospital readmissions between three and seven days had no significant relationship (χ^2= 0.6188, p=0.43). As noted previously, this could also be evidence of the short duration of protective effects from discharge telephone follow-up. However, selection bias is suggested because there were significant differences in the chi squared analyses for hospital readmissions for Veterans who received discharge telephone follow-up calls compared to Veterans who did not receive telephone follow-up calls in both hypotheses one and two. Furthermore, when the relationships identified between discharge telephone follow-up calls and hospital readmissions within hypotheses one and two were explored further, only reduction telephone follow-up calls within two days were shown to reduce the likelihood of hospital readmissions within two days. Contacting a Veteran within two days is a very narrow timeframe. Patients who are unstable may need

immediate contact in order to prevent hospital readmissions may be unreachable within two days. This leads to the suggestion that selection bias may be present because after the Veteran had an opportunity to receive the discharge telephone follow-up call no relationship was found between discharge telephone follow-up calls within two days and hospital readmissions at any other time period.

Selection bias explains and limits the results from this study. Furthermore, selection bias explains some of the previously mixed results. Previous authors note the discharge telephone follow-up calls are limited by the patient's ability or willingness to answer the telephone. Future research and clinical practice will need to consider this limitation in order to maximize the benefits of follow-up care. Also, both complementary explanations discussed will help provide direction for further research to determine if limited effects of the follow-up calls, selection bias, or both have contributed to the previously mixed results. Both explanations have significant practical implications for both clinicians and researchers.

Practical Implications

This study contributes to the current literature and answers several important questions. First, it affirms with previous research that a significant percentage (35.06%) of the 15,954 hospital readmissions occurred within the seven days after hospital discharge. The large percentage of Veterans readmitted to the hospital within the first seven days stresses the importance of timely and effective transitional care. Additionally, the large percentage of hospital readmissions within the first seven days raises the question that transitional care may be more effective if implemented from inpatient services instead of outpatient care services.

The study also confirms that the number of comorbidities, age, frequent hospitalizations, and length of index hospital stay are significantly related to hospital readmissions further supporting the need to address these critical attributes as the VHA

aligns resources to manage care. Veterans at higher risks for hospital readmission should be identified by these characteristics so that resources can be utilized prior to the Veteran's discharge from the hospital. Identifying Veterans at the greatest risks for hospital readmissions should be information that is utilized when developing a comprehensive transitional care plan.

The study identified that discharge telephone follow-up calls were only related reductions in hospital readmissions at the same time period of the discharge telephone follow-up call and that only telephone follow-up calls within two days were associated with reduced likelihood of hospital readmissions. Combined with the finding that a large percentage of hospital readmissions occur within the first week after discharge, the limited effect of discharge telephone follow-up calls suggests early transitional care may be a more appropriate method. Initiating transitional care within the inpatient setting rather than originating transitional care from PACT nurse case managers may provide more timely transitional care. Furthermore, the complexity of the patients transitioning from inpatient to outpatient care may require more than just a telephone call. Therefore, a practical implication of this study would suggest that a bundled transitional care intervention would be more effective at reducing hospital readmissions.

Recent development of bundled transitional care interventions like Project RED and BOOST have been identified as effective and comprehensive methods to prevent hospital readmissions (Adams, Stephens, Whiteman, Kersteen, & Katruska, 2014; Cauwels, Jensen, & Winterton, 2013; Markley et al., 2013; Mitchell et al., 2014; Villanueva, 2010; Williams et al., 2014). Project RED and BOOST are transitional care programs originating from inpatient care where discharge nurses coordinate transitional care and follow-up services for patients through structured communication between providers, patient education, and telephone follow-up (Mitchell et al., 2014; Villanueva, 2010). Research on both Project RED and BOOST has found significant decreases in hospital readmissions after implementation of the transitional care programs. One study

found a decrease in hospital readmissions from 14.7% to 12.7% 12 months after implementation of BOOST (Hansen et al., 2013). These comprehensive transitional care programs focus on improvements in hospital discharge and reintegration into primary care. Bundled transitional care interventions provide more comprehensive transitional care than discharge telephone follow-up calls alone. Therefore, the VHA should pursue implementation of bundled care interventions instead of solely relying upon discharge telephone follow-up calls to transition Veterans from the hospital to home.

Study Limitations

There were several limitations to this study. First, the reason for readmission was unknown. Veterans who were readmitted to the hospital for a planned procedure, chemotherapy, or an outpatient surgery likely influenced the hospital readmissions. Future studies should control for Veterans who were readmitted to the hospital for planned procedures.

Second, understanding the effectiveness of the discharge telephone follow-up call within two days is limited by the Veterans who were unable to receive a call. Selection bias provides a complementary explanation of the results. To reduce self-selection bias, future research will need to control for patients who did not have the opportunity to receive the discharge telephone follow-up call prior to being readmitted.

Third, the content of the discharge telephone follow-up call is unknown creating a treatment fidelity problem. Because this study was a secondary analysis of administrative data, the content of discharge telephone follow-up notes was unknown. For example, medication counseling within discharge telephone follow-up calls has been found to reduce hospital readmissions (Dudas et al., 2001); however, it is unclear if PACT nurse case managers provided medication counseling. Further qualitative research is needed to explore the content of PACT nurse case manager discharge telephone follow-up calls and hospital readmissions.

Fourth, differences among Veteran characteristics by days until hospital readmission time periods need to be evaluated with caution because of the unequal sample sizes among readmission time periods. The unequal samples led to potentially unequal variances violating the homoscedasticity assumption. However, the large sample size (N=124,069) decreases the risk of violating the homoscedasticity assumption and potentially mitigates any negative effects of the assumption was violated.

Finally, it is unknown if Veterans were readmitted to a hospital outside the VHA within 30 days after discharge. As a secondary data analysis, it is unclear if hospital admissions to healthcare facilities outside the VHA were reported. Any further study will need to include Veteran hospital admissions to facilities outside the VHA in addition to hospital readmissions within the VHA.

Future Research

Despite the limitations of this study, it did provide a foundation for future research. Future research will build on this study through further examination of the VHA discharge and transitional care processes. Exploring the VHA transitional care processes beyond discharge telephone follow-up calls would provide further insight into the relationships between transitional care processes and hospital readmissions.

Furthermore, future research will need to understand the reason for hospital readmission and time frame of hospital admissions. Understanding the reason Veterans were hospitalized within the first seven days after hospital discharge compared to Veterans who were readmitted between eight and thirty days is needed to identify complications related to the discharge process or the natural progression of the disease. Understanding the reason for hospital readmission could lead to either improvements in transitional care processes or expansion of end-of-life services to reduce hospital readmissions. Future research identifying the reason for hospital readmission will need to

include both the admitting diagnoses and the psychosocial reasons for hospital readmissions which can be obtained from chart reviews of Veteran notes.

Additionally, Veterans who missed discharge telephone follow-up calls may have biased the relationship between discharge telephone follow-up calls hospital readmissions. Missing a discharge telephone follow-up call could be for a variety of reasons including but not limited to: incorrect Veteran contact information, the Veteran was unable to answer the telephone while at home or the Veteran was already readmitted to the hospital. Patient willingness or ability to answer discharge telephone follow-up calls significantly influences the effectiveness of the discharge follow-up calls (Harrison et al., 2014). Patient willingness or ability to answer discharge telephone follow-up calls may have caused previous researchers to not find relationships between discharge telephone follow-up calls and hospital readmissions (Costantino et al., 2013a; Dudas et al., 2001; Harrison et al., 2014). Thus, Veterans who miss discharge telephone follow-up calls within two days after discharge potentially miss the opportunity to identify errors in transitional care or coordination of outpatient services. The missed discharge telephone follow-up calls limit the effectiveness of the intervention potentially confounding the results. Further research is needed to explore why Veterans missed the discharge telephone follow-up call or be eliminated from the study to prevent self-selection bias.

Additionally, interactions between face-to-face contact and discharge telephone follow-up were not explored. It is possible that Veterans who received a discharge telephone follow-up call were also seen by their primary care providers. The relationship between face-to-face visits with primary care providers after a discharge telephone follow-up is unknown and could potentially impact hospital readmissions. Future research is needed to explore interactions between face-to-face contact with primary care providers and discharge telephone follow-up calls by nurse case managers.

Finally, understanding the content of discharge telephone follow-up up calls is needed to improve the VHA transitional care process. Although PACT nurse case

managers have a standardized template for discharge telephone follow-up calls, it is unknown if the use of the template results in standardized calls. Lack of standardization in the call potentially confounds comparing discharge telephone follow-up calls among nurses, PACTs, and VHA facilities. Understanding the content of discharge telephone follow-up calls will improve the knowledge of care coordination of services, Veteran education, and potentially improve patient outcomes. Furthermore, implementation of telehealth visits into the transitional care process similar to face-to-face visits may be integrated into transitional care. However, integration of telehealth as part of transitional care has not been fully explored but potentially could dramatically alter the transitional care process. Future research is needed to explore the transitional care process and any potential changes which may occur from integration of telehealth services.

Summary and Conclusions

This study was a secondary data analysis of 124,069 hospital discharges from the VHA between 2011 and 2013. The purpose of this study was to explore hospital readmissions, timing and receipt of discharge telephone follow-up calls, and Veteran characteristics. Of the 124,069 Veterans discharged, 15,954 (12.86%) were readmitted to the hospital within 30 days. Of the Veterans readmitted within 30 days, 10.81% were readmitted within two days, 24.25% were readmitted between three and seven days, and 64.94% were readmitted between eight and thirty days. The large percentage of Veterans readmitted within the first seven days (35.06%) illustrates the importance of timely and effective transitional care.

This study concurs with previous research that suggests patients who are older, have more comorbid conditions, longer lengths of index hospital stay, and are identified as having frequent hospitalizations are at increased risks for hospital readmissions. However, in future studies, frequently hospitalized Veterans will need to be identified by admission diagnoses and the definition of frequently hospitalized should be refined to as

having two unplanned hospitalizations in the previous year. Changing this definition will allow for a better comparison to the current research on frequently hospitalized patients.

Finally, discharge telephone follow-up calls were identified as having a limited effectiveness in relation to hospital readmissions at clinically relevant time periods. Only discharge telephone follow-up calls within two days were associated with a decreased likelihood of hospital readmissions within two days. Discharge telephone follow-up calls within two days were unrelated to hospital readmissions at any other clinically relevant time period. Furthermore, discharge telephone follow-up calls were identified to have only relationships with corresponding hospital readmission time periods suggesting a limited effectiveness of discharge telephone follow-up calls or possible selection bias. Selection bias is suggested by no significant relationship between discharge telephone follow-up calls and any clinically relevant time period after the Veteran had the chance to receive the discharge telephone follow-up call. Despite the complementary explanation that selection bias influenced the results, this study contributes to the current literature by offering two complementary explanations for previously mixed results regarding the relationship between discharge telephone follow-up calls and hospital readmissions. The study suggests that discharge telephone follow-up calls have a very limited effectiveness and Veterans may not be able to receive the intervention in a timely manner, so hospitals may benefit more from implementing bundled transitional care interventions to overcome the shortfalls of discharge telephone follow-up calls.

Furthermore, the study was limited by the secondary data. Because the admitting diagnoses were unknown, this study was unable to limit Veterans who were admitted for simple procedures, chemotherapy, or surgical procedures then discharged. Self-selection bias created an alternative explanation of the results, so it is unknown if Veterans who were readmitted prior to receiving the discharge telephone follow-up call would have benefited from the follow-up call. Self-selection bias and unknown content of the

discharge telephone follow-up call limit this current study. The limitations of the study will need to be accounted for in future research.

This study was one of the first to explore timing of both the discharge telephone follow-up call and hospital readmission and provides a foundation to explore further transitional care processes within the VHA. Future research will need to focus on understanding the entire VHA transitional care process and any advancement in transitional care such as the integration of telehealth visits into the transitional care process. Furthermore, this study provides a foundation to explore why Veterans were unable or unwilling to answer discharge telephone follow-up calls. Therefore, future research will need to explore the Veterans reason for not answering telephone follow-up calls including timing of hospital readmissions in relation to the discharge telephone follow-up call and face-to-face visits. Finally, future research is needed to understand the content of discharge telephone follow-up calls, and what happens as a consequence of those calls.

From this study, researchers have been provided with two complementary explanations to the previously mixed literature on discharge telephone follow-up calls. This study was one of the first to explore timing of discharge telephone follow-up calls and hospital readmissions leading to the conclusion that there may be more effective interventions to reduce early hospital readmissions. Therefore, this study provides a foundation for future research on the transitional care process within the VHA while providing a unique and important description of the current transitional care process.

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