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The Impact of Occupational Therapy Acute Care Services on Readmission Rates for Patients in Medicare's Hospital Readmission Reduction Program

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

by
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Table of Contents

List of Tables

List of Figures

Abstract

THE IMPACT OF OCCUPATIONAL THERPAY ACUTE CARE SERVICES ON READMISSION RATES FOR PATIENTS IN MEDICARE'S HOSPITAL READMISSION REDUCTION PROGRAM

By Jessica Edelstein, Ph.D.

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The United States (US) health care system is faced with the daunting challenge to make healthcare payments commensurate with quality of care provided. To assess quality, metrics for reimbursement have been established by Medicare. One such quality metric is hospital readmissions (readmissions). Readmissions are associated with poor patient outcomes and costly. Associated poor patient outcomes include higher risk for mortality, deconditioning, nutritional issues and cognitive impairments. As a result, readmissions cost Medicare $26 billion annually. Current strategies for reducing readmissions in the US are fragmented and hospital-specific. While specific strategies may vary, hospitals that have low readmissions rates tend to prioritize interdisciplinary care. It is unknown how the individual disciplines contribute to the interdisciplinary care needed to reduce readmissions. Evidence has shown that Occupational Therapy (OT) has strong potential to be a leading profession in the nation-wide effort to reduce readmissions but the exact mechanisms in the acute care setting that may result in readmission reduction have yet to be determined. This dissertation aims to address gaps in the literature through three separate studies.

Vita

Jessica Edelstein was born on April 24th, 1986 in Marshalltown, Iowa. She graduated from Center Grove High School, Greenwood, Indiana in 2004. She received her Bachelor of Science in Exercise Science from Ball State University, Muncie, Indiana in 2009. Then, she attended graduate school at the University of Indianapolis, Indianapolis, Indiana and graduated in 2011 with a Master's degree in Occupational Therapy. After receiving her Master's degree in Occupational Therapy, she worked as an occupational therapist for 5 years before starting the Health Related Sciences Ph.D. program with a concentration in Occupational Therapy at Virginia Commonwealth University.

1. Introduction

The overarching purpose of these dissertation studies was to determine if acute care occupational therapy service delivery factors and client factors, including patients' level of independence with self-care tasks and patients' social factors, were associated with reduced risk of readmission for Medicare patients with a Hospital Readmission Reduction Program-qualifying diagnosis. Using current procedural terminology codes, acute occupational therapy billing practices were also explored. A list of frequently used acronyms can be found in Appendix A.

1.1 Background

With the passage of the Patient Protection and Affordable Care Act of 2010, the United States (US) health care system has been faced with the daunting challenge of making healthcare payments commensurate with quality of care provided in order to increase value (ACA; Pub. L. 111–148). Linking reimbursement to performance has incentivized health care providers and organizations to deliver evidence-based care that is known to improve quality-focused outcomes. Occupational therapy (OT) has yet to clearly demarcate its role in the US's quality-focused health care system. Evidence has shown that OT has the potential to impact patient outcomes after hospitalization, specifically by improving functional status (Greysen, Cenzer, Auerbach, & Covinsky, 2015; Middleton, Downer, et al., 2018). However, there is minimal research on how factors related to the delivery of acute OT services, such as duration of services, frequency of services, specific services provided, and consideration of relevant client factors, may impact readmission risk (J. F. Burke, Skolarus, Adelman, Reeves, & Brown, 2014; Rogers, Bai, Lavin, & Anderson, 2017).

The OT profession is unique because it holistically addresses both clinical and social factors during a patient's recovery processes following illness or injury requiring hospitalization (American Occupational Therapy Association, 2017). Importantly, both clinical and social factors can be associated with poor patient outcomes if they are *not* addressed during the hospital stay (Bradley et al., 2013; Calvillo-King et al., 2013; Dharmarajan & Krumholz, 2014). A clearer definition of the role for OT in the quality-focused

health care system would enable the OT profession to more effectively fill this gap in care. OT is also at risk of being marginalized in regard to the value of care provided by the profession compared to other professions. Physicians, for example, have been working for years to create quality metrics for patient care through programs including Medicare's Physician Quality Reporting System and the American Medical Association's Physician Consortium for Performance Improvement (Commission on Accreditation of Rehabilitation Facilities, 2014; Joint Commission, 2014). OT needs to create similar quality metrics so that its distinct value is demonstrated, its role identified, proportionate reimbursement is allocated, and, most importantly, patient outcomes are optimized. OT has shown the potential to make a substantial impact on hospital readmissions, however there are no quality metrics to evaluate OT's impact on the outcome (J. F. Burke et al., 2014; Rogers et al., 2017).

Reducing readmissions is a top priority in the US health care system. Readmissions are associated with high, potentially avoidable, costs and poor patient outcomes (Boozary, Manchin, & Wicker, 2015; Jencks, Williams, & Coleman, 2009; McIlvennan, Eapen, & Allen, 2015). The estimated costs associated with readmissions have increased more than 50% in the past 10 years to $26 billion annually (Boozary et al., 2015; Jencks et al., 2009). Poor patient outcomes associated with hospital readmission include higher risk of mortality, sleep disturbances, nutritional issues, and deconditioning as a result of bedrest or inactivity (Fernandez et al., 2015; Krumholz, 2013; Luan, Barrantes, Roth, & Samaniego, 2014). Caregivers of hospitalized individuals are also at risk. The risk of death for the spouse of an individual who is hospitalized is significantly increased and remains elevated for two years post hospitalization. Their greatest risk for death is within 30 days of their spouse's hospitalization (Christakis & Allison, 2006). Caregivers are also at increased risk for psychological ailments such as anxiety, depression, and post-traumatic stress symptoms (Rückholdt, Tofler, & Buckley, 2017). To address the negative patient and caregiver outcomes and high costs associated with readmissions, Medicare created the Hospital Readmission Reduction Program (HRRP).

The primary aim of HRRP is to reduce readmissions. HRRP is one of the three original valued-based programs created by Medicare in 2012 and has continued to grow since its inception ("Centers for

Medicare & Medicaid Services", 2019). HRRP penalizes hospitals by withholding up to 3% of Medicare's reimbursement if the hospital has excessive readmissions for patients with specified diagnoses. Initially the specified diagnoses in HRRP included only heart failure (HF), acute myocardial infarction (AMI), and pneumonia (PN). Now the program has expanded to include the three original diagnoses (HF, AMI, and PN) plus four more diagnoses: chronic obstructive pulmonary disease (COPD), coronary artery bypass graft (CABG), and elective primary total hip arthroplasty/total knee arthroplasty (THA/TKA) ("Centers for Medicare & Medicaid Services", 2018). This expansion highlights the US's ongoing effort to reduce readmissions. More than three quarters of hospitals in the US participate in HRRP ("Inpatient PPS," 2019). For fiscal year (FY) 2018, the approximate amount of financial penalties from HRRP for US hospitals was $564 million, which was an increase from $528 million in FY2017 (New England Journal of Medicine Catalyst, 2018).

There are several factors that may influence acute OT's potential impact in reducing readmissions. Factors include acute OT service delivery factors, patient level of independence with activities of daily living (ADL) after receiving acute OT services, patient social factors, and specific types of services delivered by acute occupational therapists. For the purposes of these dissertation studies, OT service delivery factors were defined as (1) receipt of any OT services, (2) duration of OT services, (3) frequency of OT services, and (4) types of OT services billed. To date, research examining the impact of OT on reducing readmissions has mostly been conducted in post-acute settings (Galloway et al., 2016; Middleton, Downer, et al., 2018; Middleton, Graham, & Ottenbacher, 2018; Silverstein, Qin, Mercer, Fong, & Haydar, 2008). However, recent research has begun to examine the impact of acute rehabilitation services (i.e. duration of treatment) on readmission risk; the evidence is limited, conflicting, and lacking practical implementation details. In one study, Burke and colleagues (2014) determined that higher use of acute OT services was associated with reduced readmissions. However, higher use of OT services was defined as a higher percentage of patients that received any OT services. There were no details on the frequency, duration, or specific OT services that may have been associated with reduced readmissions. Andrews, Li, & Freburger (2015) also identified a link between higher utilization of rehabilitation services

and reduced readmission but did not differentiate between the three separate rehabilitation services (i.e. OT, physical therapy (PT), and speech therapy (SLP)).While there can be overlap in care provided by the three rehabilitation services depending on a facility's rehabilitation structure, it is important to understand the unique contribution of each discipline in improving patient outcomes. Lastly, Kumar and colleagues (2019) found that only higher durations of PT services, not OT or SLP, resulted in lower readmission risk. Use of PT services was defined as low, < 30 minutes; medium, >30 to ≤ 75 minutes; and high, > 75 minutes. Cut off values were assigned arbitrarily, and the categorization of the variable created data loss on a more accurate amount of time spent by the therapists with patients. All of the aforementioned studies used state databases making it difficult to examine the rehabilitation services at the granular level needed to guide practice change. Finally, there has been no examination of differences between current procedural terminology (CPT) codes (i.e. types of services billed) billed for patients who were readmitted versus not readmitted. Analysis of data at the individual hospital-level on OT service factors is needed.

Occupational therapists are trained to evaluate and provide skilled interventions for patients who have clinical deficits while simultaneously considering their unique social factors (American Occupational Therapy Association, 2017). Both clinical and social factors are associated with readmission risk. Specific social factors associated with higher readmission risk are lack of social support and housing instability (Calvillo-King et al., 2013). Clinical factors associated with readmission risk are independence level with ADLs (e.g., lower level of independence results in a higher risk of readmission), mobility, cognition, discharge planning and patient education (Bradley et al., 2012; Dharmarajan & Krumholz, 2014; S. R. Fisher, Graham, Krishnan, & Ottenbacher, 2016; Middleton, Downer, et al., 2018; Middleton, Graham, et al., 2018). One-third of patients over the age of 70 experience a new or additional impairment with ADLs when hospitalized (Chodos et al., 2015). Special attention should be paid to the impact that ADL dysfunction has on readmission risk. The evaluation and treatment of deficits associated with ADLs is uniquely within the scope of OT practice (American Occupational Therapy Association, 2017). Acute occupational therapists often implement interventions for the following ADLs: feeding, upper body dressing, lower body dressing, bathing, grooming and toileting. As such, OT services are well suited to

prevent or remediate ADL impairment during hospitalization which may result in reduced readmission rates. Investigation of patients' level of independence with ADLs after acute OT services are provided is needed to determine the impact on readmission risk.

Discharge planning is also within the scope of OT practice and includes determining if patients are safe to return home or require further inpatient rehabilitation (Crennan & MacRae, 2010). Occupational therapists use an integrated approach and consider clinical deficits and social factors when determining discharge plans. Specific social factors include who the patient lives with and their housing situation. Quality discharge plans are associated with lower risk of readmission (Henke, Karaca, Jackson, Marder, & Wong, 2017). Due to OT's holistic approach to patient care, the profession is integral to the discharge planning process. Occupational therapists frequently provide education to patients and their caregivers regarding new functional impairments, physical assistance levels, assistive devices and home modifications, all of which are factors associated with readmission risk (De Craen, Westendorp, Willems, Buskens, & Gussekloo, 2006; Leland, Crum, Phipps, Roberts, & Gage, 2015).

As noted previously, post-acute settings have been the primary setting for research evaluating the impact of OT on readmissions. After completion of rehabilitation in post-acute facilities, patients who have continued functional impairments are at higher risk for readmission, particularly if those functional impairments are related to self-care (i.e., ADLs), mobility and cognition (Fisher et al., 2016; Fisher et al., 2013; Galloway et al., 2016; Graham et al., 2017; Middleton, Downer, et al., 2018; Middleton, Graham, et al., 2018; Ottenbacher et al., 2012). Identification of these areas is important. However, only an aggregated definition of self-care, mobility, and cognition is provided in the evidence. This makes the results of these studies difficult to apply to practice. One study done by Galloway et al. (2016) examined individual ADLs and their association with readmission. A higher level of independence with lower body dressing was found to be the only ADL protective against readmission at 90 days after discharge. Further research needs to individually examine the different types of ADL training received by patients who are readmitted versus not readmitted. This information could provide the groundwork for acute OT clinical practice guidelines aimed at reducing readmissions.

Another mechanism by which outcomes can be studied is through examination of OT billing codes (i.e., CPT codes) which may provide information on the content of OT sessions. Currently minimal evidence exists on the actual content of OT sessions (DeJong et al., 2009; Latham et al., 2006; Richards et al., 2005), and there are inherent barriers to this type of research. Rehabilitation clinicians frequently cite intuition and trial and error as approaches to practice (Zanca & Dijkers, 2014). As a result, rehabilitation practice, including OT, varies greatly between clinicians, rehabilitation centers, and geographical locations. To describe the great variation and unknowns of rehabilitation practice the term the "black box" of rehabilitation practice has been used (DeJong, Horn, Gassaway, Slavin, & Dijkers, 2004). Rehabilitation research has effectively characterized what goes into the black box (i.e., the patient) and what comes out of the black box (i.e., the patient) but there is limited evidence on what goes on inside the black box (DeJong, Horn, Conroy, Nichols, & Healton, 2005). Without being able to clearly describe the activities and interventions provided during OT sessions according to a universally understood language, it is difficult to optimize OT's role in improving targeted quality outcomes such as readmissions. There has been research done on "stand alone" interventions (e.g. constraint induced movement therapy) and aggregated services (e.g. self-care domain) but there is no research on how or if OT activities and interventions applied in the practice setting as part of the entire rehabilitation program according to the universally used CPT codes are effective in improving outcomes (DeJong et al., 2004). The OT process is dynamic and multiple activities and interventions can be offered in one session. CPT codes are the current method used by acute occupational therapists to categorize OT activities and interventions. CPT codes are used nation-wide. The American Medical Association offers limited definitions of services provided by occupational therapists according to CPT codes (Appendix B) (American Medical Association, 2019). More details are needed to better understand the specific services occupational therapists provide during their sessions with patients and how this maps onto CPT codes that are subsequently billed. Findings could potentially be applied to future research to determine which OT mechanisms in the rehabilitation process are responsible for targeted outcomes.

1.2 Study Goals and Research Questions

The primary goal of these dissertation studies was to elucidate the distinct value and role of OT in reducing readmissions. The dissertation studies were done at one large academic hospital to allow for a granular examination of the variables. Previous studies on the topic have only used state or national databases to evaluate rehabilitation services and factors related to readmissions (Andrews, Li, & Freburger, 2015; J. F. Burke et al., 2014a; Kumar et al., 2019). Using state or national databases does not allow for inclusion of a more precise measure of duration and frequency of OT services, self-care status, or client factors. It is important to identify a more precise measure of duration of services provided because even small differences in duration, when summed across all the treatment sessions that occur in a single day, make a large impact on the day-to-day practice for acute care occupational therapists. No studies thus far have examined frequency of OT services, self-care status, or client factors in the acute care setting related to readmission outcomes. The acute care setting does not have a standardized functional assessment like the Inpatient Rehabilitation Facility Patient Assessment Instrument or Minimum Data Set, which are only used at inpatient rehabilitation (IRF) and skilled nursing facilities (SNF), respectively. Therefore, two methods to evaluate self-care status were created for the study. One method included a composite score of all the self-care indicators (i.e., eating, grooming, upper body dressing, lower body dressing, bathing, and toileting hygiene). The second method required that only one self-care indicator be documented by occupational therapists and would be representative of the patient's self-care status. The second method was created in anticipation of large amounts of missing data on the self-care indicators. Further details on the methods related to self-care status is presented in Section 3.4. Table 1 depicts the dissertation studies three goals and objectives.

Table 1.

Project Goals and Objectives

Goals	Objectives
Determine if acute OT service delivery factors are significant predictors of readmission.	Examine if receipt of any OT services, total duration of OT services, and frequency of OT services are significant predictors of readmission for patients with a

	HRRP-qualifying diagnosis. Evaluate the difference between OT services billed according to CPT codes for patients readmitted versus not readmitted with a HRRP-qualifying diagnosis.
Identify OT client factors that are significant predictors of readmission in the acute care setting.	Evaluate if self-care status, specifically patient level of independence with eating, grooming, bathing, upper body dressing, lower body dressing and toileting hygiene, and social factors (i.e., social support and housing situation) are significant predictors of readmission.
Explore and categorize OT activities and interventions provided during OT sessions according to CPT codes. Determine if changes are made to OT billing after submitted by acute occupational therapists.	Conduct focus groups of acute care occupational therapists to discuss the activities and interventions provided and subsequent CPT codes selected. Perform interviews with billing experts to identify if changes occur to OT billing after submitted by occupational therapists.

The benefits yielded from these dissertation studies include:

- Detailed results on the risk of readmission for hospitalized patients with a HRRP-qualifying diagnosis based on receipt of OT services, duration of OT services, and frequency of OT services. Information on the difference between OT services provided to patients with a HRRP-qualifying diagnosis who were readmitted compared to patients with a HRRP-qualifying diagnosis who were not readmitted. This information can be applied to hospital budgetary decisions, productivity expectations, training requirements, and staffing levels of occupational therapists in hospital settings.
- Determination if client factors, specifically self-care status and social factors, in the acute care setting are significant predictors of readmission. Aggregated data on the self-care domain at discharge has already been confirmed as a predictor of readmission in post-acute settings (Middleton, Downer, et al., 2018; Middleton, Graham, et al., 2018) but not in the acute care setting. Findings on self-care status may help acute occupational therapists create best practice guidelines that provide targeted therapy interventions for patients at high risk for readmission. Social factors were also evaluated as predictors of readmission in the acute care setting.

Identification of patients with specific levels of social support or housing situations who are at high risk for readmission will help occupational therapists and the interdisciplinary team provide targeted, early interventions to ensure a safe transition to the next level of care for patients.

- Identification of OT activities and interventions according to CPT codes billed. Exploration and categorization of the acute OT activities and interventions according to CPT codes will inform the findings from the first studies and may contribute to future research on OT "active ingredients" that produce targeted outcomes like reduced readmissions. Additionally, interviews were performed with billing experts to determine if any changes occur to OT billing after submitted by the occupational therapists. This will help to determine if the results accurately represent the practice setting.

The final product of these dissertation studies includes three manuscripts that are ready to submit to peer-reviewed journals. Table 2 displays the research questions for each manuscript and the corresponding paper number. Crosswalks of all the three papers' goals, objectives, research questions and hypotheses are provided in Appendix C. The first paper (Paper 1) assessed if OT service delivery factors are predictors of readmission risk and if there is a difference between the OT services provided for patients who were readmitted and not readmitted with a HRRP-qualifying diagnosis. OT service delivery factors included receipt of (1) OT treatment, (2) duration of OT, and (3) frequency of OT. The second paper (Paper 2) examined client factors, self-care status and social factors, and whether these factors can predict readmission risk. The third paper (Paper 3) used focus groups with acute care occupational therapists to identify OT activities and interventions provided according to CPT billing codes. Interviews were also conducted with billing experts to determine if there were any changes to billing after submitted by occupational therapists. Definitions for the study variables are provided in Appendix D.

Table 2.

Research Questions for Each Proposed Paper

Research Questions	Research Paper
For patients with a HRRP-qualifying diagnosis, does receipt of OT services, total duration of OT services, and frequency of OT services predict readmission risk? Is there a difference between the OT services provided to patients who were readmitted compared to patients who were not readmitted with a HRRP-qualifying diagnosis?	1
For patients with a HRRP-qualifying diagnosis, does self-care status and/or social factors at discharge predict readmission risk?	2
What OT activities and interventions do occupational therapists provide to patients with a HRRP-qualifying diagnosis according to CPT billing codes? Are there changes to OT billing after submitted by occupational therapists?	3

1.3 Theoretical Framework

These dissertation studies used the guidance of the Donabedian Model. The model was applied to all three papers. Three domains comprise the Donabedian model: structure, care processes, and outcome. The model is hierarchical with structure as the foundation, then care processes, and finally outcomes. A strong structure creates high quality care processes (Shi & Singh, 2015). Together structure and care processes impact quality outcomes. Structure has only a secondary influence on outcomes, while care processes directly impact outcomes (Donabedian, 1988; Shi & Singh, 2015). Care processes are more adaptable than structure, which makes the domain an excellent target area when aiming to improve outcomes (Leland et al., 2015). However, to understand how care processes are created and executed, knowledge is needed on the structure. Papers 1 and 2 evaluated OT care processes (i.e. OT service delivery factors and client factors) and their impact on outcomes (i.e. readmissions). Paper 3 explored the acute OT structure and care processes related to OT billing practices.

1.3.1 Paper 1

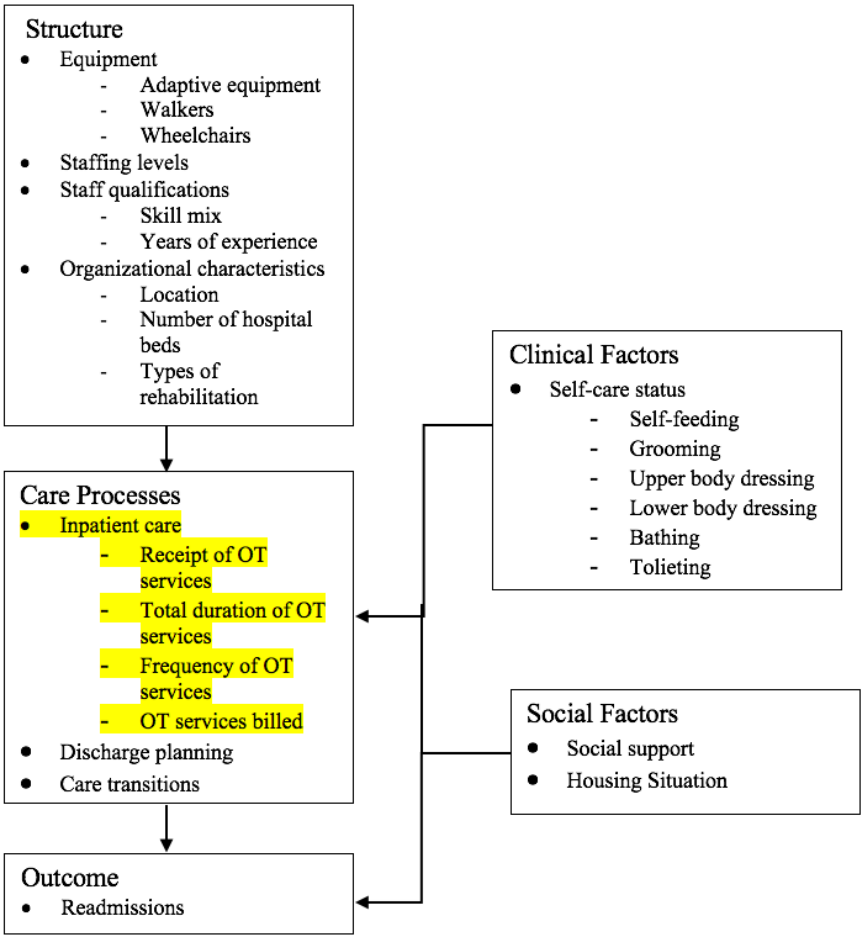
A modified version of the Donabedian model (Appendix E) provided guidance on Paper 1 (Calvillo-King et al., 2013; Rogers et al., 2017). The Donabedian model provides a theoretical framework to evaluate the quality of health care provided. Quality in health care has levels of subjectivity and is continually changing. There are several definitions of quality in health care,

however it is usually reflective of the values and goals of the medical system and the society within which it operates (Donabedian, 1966, p. 692). Quality improvement has been an elusive construct that the US health care system has been trying to quantify and base reimbursement on for many years. HRRP is a product of the US's journey towards high quality health care. However, the value-based programs like HRRP only identify positive outcomes to which hospitals should strive towards and provide no specific information on the care processes to achieve the outcomes. More evidence is needed on the care processes that can lead to the desired outcomes. To assess the dynamic concept of quality, Donabedian proposed three domains through which quality can be assessed: structure, care processes, and outcomes (Donabedian, 1966, 1988). Causal linkages between the three domains have been identified when evaluating quality-focused outcomes (Haley, Hamadi, Zhao, Xu, & Wang, 2017; Moore, Lavoie, Bourgeois, & Lapointe, 2015; Ryan & Doran, 2012). The focus of Paper 1 was on the domains of care processes and outcome. The outcome of interest was readmissions. Modifying care processes is the most direct way to modify outcomes.

The care processes domain provides specific details on the delivery of care (Figure 1). The term "care processes" is defined as the actions offered by the health care provider to the patient (Leland et al., 2015). These actions include inpatient care, discharge planning, and care transitions (Rogers et al., 2017). Applicable to this study are the care processes associated with inpatient care and treatment. The Donabedian inpatient care and treatment construct includes OT service delivery factors that were examined in Paper 1: (1) receipt of OT services, (2) total duration of OT services, (3) frequency of OT services, and (4) OT services billed. Unlike the structure domain, the care processes domain is more easily modified and transferred to different hospitals. The structure domain includes financial resources, human resources, and organizational characteristics which are difficult to modify therefore more challenging to change (Rogers, Bai, Lavin, & Anderson, 2017). Structure is the foundation of quality health care; however, it varies significantly among US hospitals and requires significant resources and effort from the entire organization to change. Focusing on care processes will allow for findings to be more easily implemented in different hospitals.

Figure 1.

Donabedian Model: Paper 1



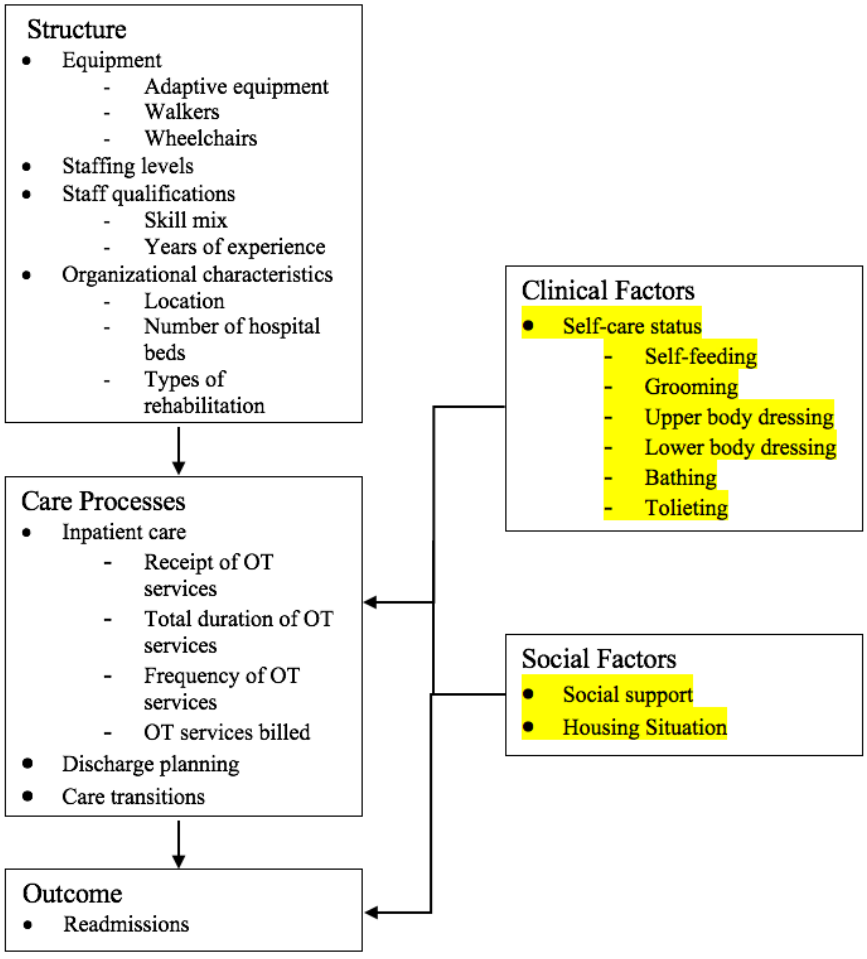
1.3.2 Paper 2

The modified Donabedian model was also used for Paper 2. Self-care status and social factors are included in the modified version of the Donabedian Model (Appendix E). Self-care status impacts the care processes delivered by occupational therapists and ultimately the outcome of readmission (Figure 2). Patients with greater levels of impairments with self-care are at higher risk for readmission (R. V. Galloway et al., 2016; Greysen, Cenzer, Auerbach, & Covinsky, 2015; Middleton, Downer, et al., 2018; Middleton, Graham, et al., 2018). Social factors are considered a non-modifiable factor and directly impacts the outcome. Lower socioeconomic status, housing instability, lack of social support,

and being unmarried are all social factors that expose patients to a higher risk for readmission (Calvillo-King et al., 2013). Details on social support and housing situation are collected by acute occupational therapists during the occupational profile created during OT evaluations and then integrated into the discharge planning process which impacts the outcome of readmission (American Occupational Therapy Association, 2017). Being able to modify self-care status via OT care processes and consider social factors such as social support and housing situation during discharge planning demonstrates how OT can directly impact the outcome of readmission.

Figure 2.

Donabedian Model: Paper 2

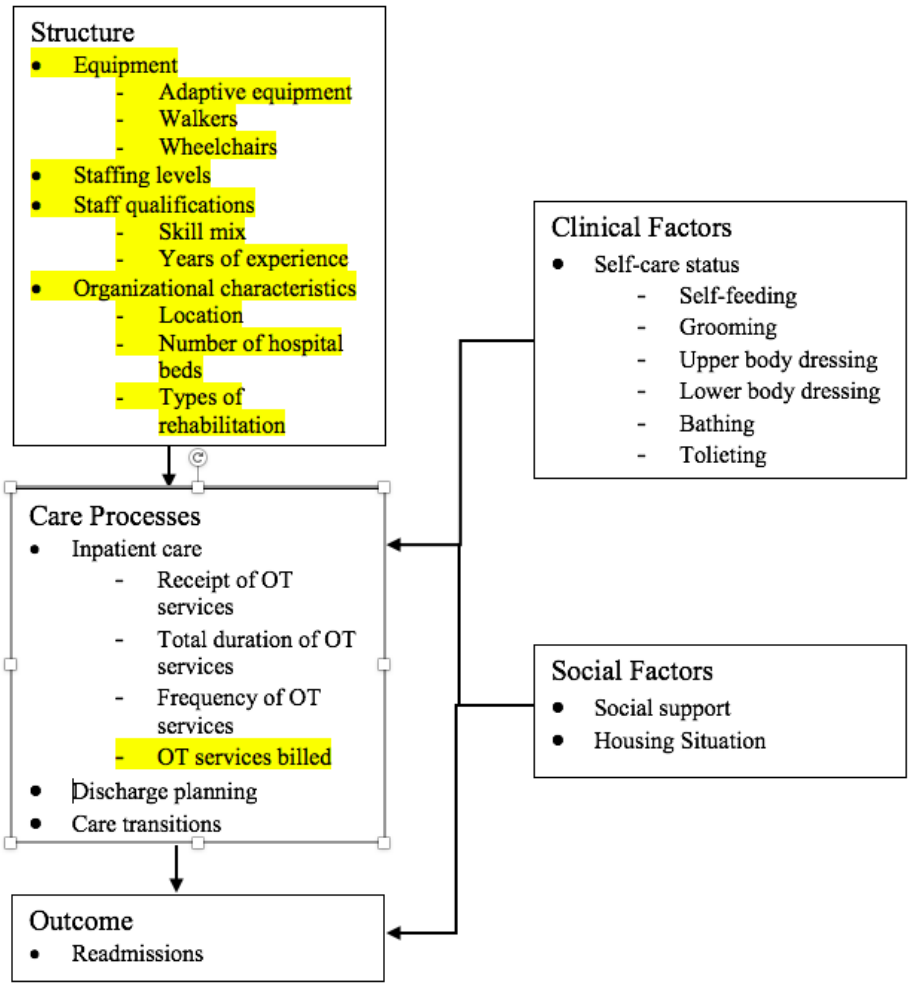


1.3.3 Paper 3

Exploration of how OT clinical practice translates into CPT billing codes was examined in Paper 3. To understand the process of acute OT billing, the structure of the OT department was simultaneously evaluated. The structure domain includes details on the organization characteristics, facilities, equipment, staffing levels, and staff qualifications (Figure 3) (Shi & Singh, 2015). The OT department structure was evaluated by collecting data on organizational characteristics such as location, number of hospital beds, the number of occupational therapists, occupational therapists' skill mix and levels of experience, departmental resources, departmental training, and influences from the hospital system and peers on the occupational therapists' practice. Evaluation of structure and its impact on care processes made the Donabedian model an ideal framework to guide Paper 3. Care processes were also examined in Paper 3 during the focus groups and interviews. Specific care processes evaluated in the focus groups were the activities and interventions provided by acute occupational therapists and how they map onto CPT billing codes. Also, the process after occupational therapists submit their billing was investigated by interviews with billing experts. Using the Donabedian model allowed for examination of how the structure of the acute OT department may impact OT billing processes and ultimately how the processes influence the outcome of readmissions.

Figure 3.

Donabedian Model: Paper 3



1.4 Study Sample

Papers 1 and 2 used the same sample of Medicare patients with HRRP-qualifying diagnoses. HRRP-qualifying diagnoses are AMI, COPD, HF, PN, CABG, and THA/TKA. Retrospective hospital data were used for the two studies. Medicare recipients account for the largest number of hospitalized patients in the US (Weiss & Elixhauser, 2014). They also have the highest readmission rate compared to any other category of insured patients (Statistical Brief #230, 2017). Approximately one-fifth of Medicare patients are readmitted to the hospital within 30 days of their index hospitalization (Jencks et al., 2009; US

Department of Health and Human Services, 2014). Inclusion criteria for the studies were (1) age 65 years or older, (2) enrolled in Medicare fee-for-service, and (3) primary admitting diagnosis to the hospital was one of the HRRP diagnoses. Data were collected from Froedtert Hospital, which is a tertiary academic medical center in Wisconsin. It is one of only two academic medical centers in Wisconsin and the only one in southeastern Wisconsin.

For Paper 3, the sample included acute care occupational therapists and two billing experts at Froedtert Hospital. The participants for the focus groups were acute occupational therapists and the participants for the interviews were billing experts. Inclusion criteria for the focus groups were (1) currently employed as an occupational therapist at Froedtert, (2) current or recent experience with providing interventions to patients with a HRRP-qualifying diagnosis, and (3) experience with applying CPT billing codes to electronic medical record (EMR) documentation. Convenience sampling was used. The inclusion criteria for the interviews with the billing experts were (1) job responsibilities managing acute occupational therapy billing and (2) identification as the primary or one of the primary individuals in the Froedtert Hospital billing department who manage acute occupational therapy billing.

1.5 Methodology

For Papers 1 and 2, a retrospective cross-sectional study design was used. The primary source for all data was Froedtert's EMR, Epic. Data from Epic is transferred to Epic Clarity to allow for complex, data-intensive reports to be run without impacting the primary user-facing environment. All deidentified study variables, described in greater detail in Chapters 2 and 3, were collected from Epic Clarity and study reports were run in Epic Clarity. The data collection period was January 2014 – February 2020. The start of the data collection timeframe was dictated by when Epic was initiated at Froedtert. Univariate and logistic regression analyses were completed for both papers.

Paper 3 used a phenomenology framework to explore occupational therapists' clinical practices related to CPT billing codes selected based on interventions and activities provided during sessions. Data collection was done via focus groups. Participant recruitment aimed for maximum variation (Atkins et al., 2017). Focus groups were conducted until data saturation was reached with a minimum of four groups

(max 6 participants per focus group) (Guest, Namey, & McKenna, 2016). All focus groups were conducted on the videoconferencing platform, Zoom, and recorded using an audio digital recorder ("Zoom Video Communications, Inc," 2020). Non-verbal communication and group dynamics were recorded by a research assistant or the lead author (J.E.). Immediately after each focus group, the initial thoughts and themes were identified. After the focus groups were complete, 1:1 interviews with two Froedtert billing experts were conducted to determine if any billing changes occur after the billing is submitted by occupational therapists. Transcription of the focus groups and interviews was done by the transcription company, REV which is located in San Francisco, California. All employees at REV sign a strict non-disclosure agreement. Documents uploaded to REV are stored on REV servers where REV transcribers are not able to download or remove files. Data analysis was done by the lead author (J.E.) using ATLAS.ti (Scientific Software Development GmbH, 2019).

1.6 Overview of Upcoming Chapters

The upcoming chapters include more details about Papers 1, 2, and 3. Chapter 2 will describe the background, research aims, objectives, hypothesis, methods, statistical analyses, results and conclusion for Paper 1. Chapter 3 will contain similar information for Paper 2. Chapter 4 will describe details on how the focus groups and interview participants were recruited, the sample characteristics, interview scripts, the composition of the focus groups, data analyses, results, and conclusion for Paper 3. Chapter 5 is the final chapter and conclusion to all three dissertation studies.

2. Research Paper 1: OT service delivery factors and readmissions

2.1 Introduction

Medicare patients in the United States (US) have the highest readmission rate when compared to other groups of insured patients. The 30-day all-cause readmission rate for patients with Medicare (17.1 per 100 index admissions in 2016) is almost double the readmission rate for patients with private insurance (8.6 per 100 index admissions in 2016) (Bailey, Weiss, & Barrett, 2019). Readmissions are costly; the estimated annual cost to Medicare due to readmissions is $26 billion (Boozary et al., 2015). Readmissions are also associated with poor patient outcomes including higher risk for mortality, nutritional concerns, and deconditioning (Fernandez et al., 2015; Krumholz, 2013; Luan et al., 2014; McIlvennan et al., 2015). In an effort to reduce readmissions, Medicare initiated the nationwide Hospital Readmission Reduction Program (HRRP). HRRP is a value-based Medicare program that reduces reimbursement by up to 3% for hospitals that have excessive readmissions for patients with one of the following diagnoses: acute myocardial infarction (AMI), chronic obstructive pulmonary disease (COPD), heart failure (HF), pneumonia (PN), coronary artery bypass graft (CABG), and elective primary total hip arthroplasty or total knee arthroplasty (THA/TKA) (“Centers for Medicare & Medicaid Services”, 2018). The effects of HRRP are far reaching since the program includes all hospitals in the Inpatient Prospective Payments system, which is three quarters of the hospitals in the US (“Inpatient PPS,” 2019). As reducing readmissions continues to be a top priority in the US health care system, health care professions need to identify their role in the quality-focused environment. Occupational therapy (OT) has yet to clearly demarcate its role in reducing hospital readmission. This study aimed to help fill this gap.

2.2 Background

Evidence thus far on the role of OT in reducing readmissions has been minimal and somewhat fragmented. In the acute care setting, higher spending and use of OT services have been found to be associated with reduced readmissions, however the evidence is lacking quantifiable definitions of *higher*

spending and *use* of OT services which makes the translation of the findings into practice difficult (Andrews et al., 2015; Burke et al., 2014; Rogers et al., 2017). In the acute care setting, duration and frequency of services can be based on patient volume, clinician judgement, and/or department guidelines which are unique to each rehabilitation department. This varied and unsystematic approach by OT to patient care results in an unknown impact on quality outcomes including readmissions.

In contrast, evidence exists demonstrating that more physical therapy (PT), defined as longer sessions (i.e., duration) and extra sessions (i.e., frequency), can reduce length of hospital stay, improve functional outcomes, and increase quality of life for patients with acute and subacute conditions (Peiris, Taylor, & Shields, 2011). Recent evidence in the acute care setting has also shown that longer durations (i.e., minutes) of PT services for hospitalized patients following an ischemic stroke leads to lower risk of readmission (Kumar et al., 2019). Lang and colleagues suggest that OT service delivery factors (i.e., duration and frequency) could account for up to one third of the variance in patient outcomes creating a high priority area for research in the profession (Lang, Lohse, & Birkenmeier, 2015).

In addition to the impact of OT service delivery factors on quality outcomes, the effect of the types of OT services delivered on quality outcomes also remains relatively unexplored. In the literature, there has been considerable debate about what goes on during rehabilitation sessions and is commonly referred to as the "black box" of rehabilitation practice (DeJong et al., 2004). Rehabilitation researchers have effectively characterized what goes into the black box (i.e., the patient) and what comes out of the black box (i.e., the patient) but there is limited evidence on what goes on inside the black box and how it relates to outcomes (DeJong et al., 2005). The current system that all acute occupational therapists use to identify, organize, and bill for the types of acute OT services delivered are current procedural terminology (CPT) codes (American Medical Association, 2019). CPT codes are a broad representation of all the tasks and services provided by occupational therapists during a session with a patient (Dotson, 2013). Examination of the differences between CPT codes billed for patients who were readmitted and not readmitted would provide a deeper understanding of the OT practice mechanisms responsible for reducing readmissions.

This study aimed to fill existing gaps in the literature with regards to the impact of OT service delivery factors on readmissions and how types of OT services delivered differ between patients readmitted and patients not readmitted. Associations were explored between 30-day all-cause readmission and the following OT service delivery factors: (1) receipt of OT services, (2) duration of OT services, and (3) frequency of OT services. CPT codes submitted for patients who were readmitted were also compared to CPT codes submitted for patients who were not readmitted. The overarching purpose of the study was to identify OT service delivery factors that are associated with reduced odds of readmission and determine if there is a difference between the OT services provided to patients who are readmitted versus patients who are not readmitted. It was hypothesized that Medicare patients with a HRRP-qualifying diagnosis who received higher duration and frequency of OT services and greater amounts of activities of daily living/self-care training, as indicated by CPT codes, would have significantly lower odds of readmission.

2.3 Methods

2.3.1 Design and Data

A cross-sectional, retrospective study of an academic medical center's data was used to examine the relationship between OT service delivery factors and readmission, as well as the differences between CPT codes for readmitted and not readmitted patients. The source of the data was the electronic medical record (EMR), Epic, at Froedtert Hospital (Froedtert) in Milwaukee, Wisconsin. Froedtert partners with the Medical College of Wisconsin (MCW) to create one of only two academic medical centers in Wisconsin. Froedtert is an adult Level 1 trauma center with 604 beds (Froedtert & Medical College of Wisconsin, 2019). It is a non-government, not-for-profit hospital, which is the largest category of hospitals in the US (American Hospital Association, 2018). At Froedtert, data is transferred from the Epic EMR into Epic Clarity. Epic Clarity is a platform that is used separately from the Epic EMR platform so that complex, data-intensive reports can be generated without

interfering with the EMR platform. The sampling timeframe for the study was from January 2014, the first year of Epic use at Froedtert, to February 2020.

2.3.2 Ethics

The study was approved by the MCW and Virginia Commonwealth University (VCU) institutional review boards. The data was collected and stored at MCW. Dual approval was required due to the study being a part of dissertation work for VCU. The study was reported according to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines for cross-sectional studies (Appendix F).

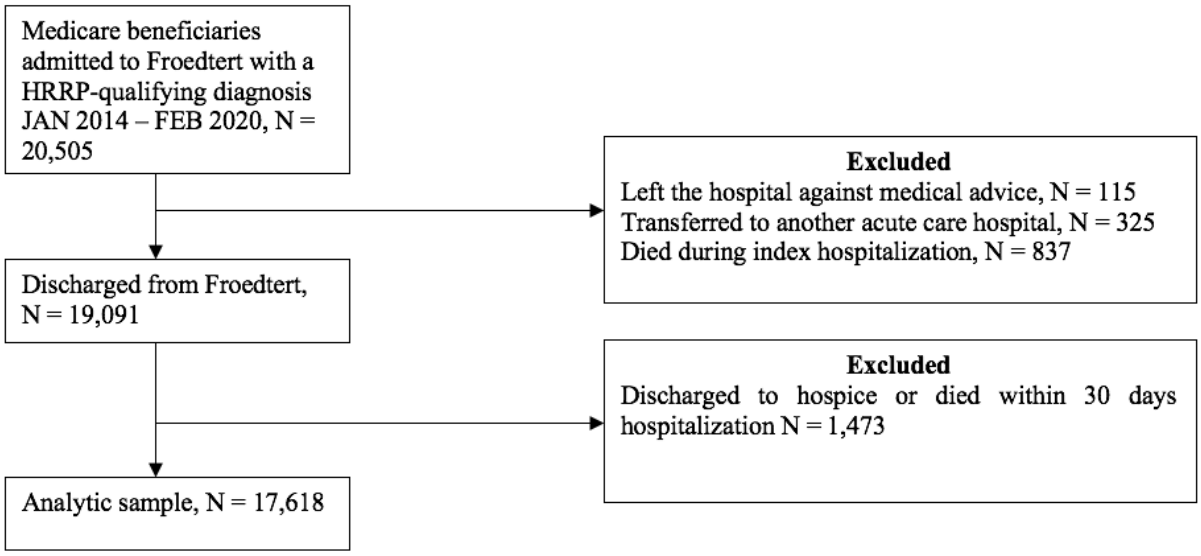
2.3.3 Participants

The study sample consisted of Medicare patients with a HRRP-qualifying diagnosis. HRRP-qualifying diagnoses include: AMI, PN, HF, COPD, CABG, and THA/TKA. HRRP diagnoses were identified in Epic using the International Classification of Diseases and Procedures, Tenth revision codes (ICD-10) (Appendix G). When HRRP was initiated in 2012, the only diagnoses included in the program were AMI, PN, and HF. In 2014, COPD and THA/TKA were added then CABG and an expanded definition of PN were added in 2016 (NEJM Catalyst, 2018). Despite all the current HRRP diagnoses being added gradually since the program's inception, occupational therapists have not changed the OT service delivery factors and types of OT services delivered as a result of HRRP diagnoses being added to the program. Therefore, all the current HRRP diagnoses were included starting at the beginning of the sampling timeframe (January 2014) even though they may not have been added officially to HRRP until a later date. Only patients over the age of 65 years who were enrolled in Medicare fee-for-service were included. Patients who left the hospital against medical advice, transferred to another acute care hospital, or died during the index hospitalization were excluded from the sample. Also, patients who were discharged to hospice or died within 30 days of discharge were excluded from the sample (Figure 4). These exclusion criteria minimize the

competing risk of readmission due to death, as this is not an indicator of quality of care (Kumar et al., 2019).

Figure 4.

Application of inclusion and exclusion criteria to the study sample



2.3.4 Key Variables

The key variables of interest were OT service delivery factors and types of OT services delivered including: 1) receipt of OT services, 2) duration of OT services, 3) frequency of OT services, and 4) CPT OT billing codes. Receipt of OT services was logged as a dichotomous (yes/no) variable and was determined by the documentation of *any* OT CPT treatment code. The documentation of the OT evaluation code was not used to indicate receipt of OT services. We determined that inclusion of only an OT evaluation code was not sufficient to be considered receipt of OT services. When an OT evaluation is conducted, the occupational therapist focuses on collecting and interpreting data and identifying barriers to occupational performance and targeted outcomes. Recommendations may be provided during the evaluation, but treatment is delivered and billed separately. Since this study was focused on the potential impact of OT services (i.e., interventions and activities) on outcomes, we felt it appropriate to include only patients who received actual treatment from the occupational therapist.

A longer length of stay is associated with higher risk for readmission for hospitalized patients so the duration and frequency variables were standardized (Kwok et al., 2019; Markham, Hall, Gay, Bettenhausen, & Berry, 2018; Sun, Leung, Dillon, & Hollenbeak, 2015). The duration variable was defined as the average minutes per day of OT services. To calculate the duration of OT services variable the total number of minutes of OT services was divided by the number of days OT services were delivered. Delivery of OT services was indicated by documentation of CPT codes (Appendix B). It was not possible to collet actual minutes so 15 minutes was assigned to each treatment CPT code. Frequency of OT services was defined as the percentage of days per stay a patient received OT services. The variable was calculated by dividing the number of days OT services were delivered by the number of days between initiation of OT services as indicated by documentation of OT CPT evaluation codes and the last day of OT services. The calculations of duration and frequency ensured that the variables were standardized for meaningful comparisons between patients who had different lengths of stay.

To evaluate the difference between types of OT services received by patients who were readmitted compared to patients who were not readmitted, CPT codes were used. CPT codes are used by all acute care rehabilitation departments that have electronic documentation due to requirements of the Administrative Simplification Section of the Health Insurance Portability and Accountability Act of 1996 (American Medical Association, 2019). CPT codes are submitted via electronic documentation every time an occupational therapist delivers an evaluation or intervention. The American Medical Association (AMA) provides the definitions of each CPT. A list of the CPT codes and definitions are provided in Appendix B. The CPT codes were consolidated into six categories using the CPT code definitions provided by the AMA (American Medical Association, 2019). The six categories were: 1) therapeutic exercise, 2) therapeutic procedures, 3) development of cognitive skills, 4) therapeutic activities, 5) activities of daily living (ADL)/self-care training, and 6) other. A list of the CPT codes under each of the six categories is provided in Appendix H. To isolate the effect of each intervention, patients that received interventions from more than one of the six categories of

CPT codes were excluded from the analyses. Therefore, if a patient had more than one CPT code billed at any time during their hospitalization they were excluded from the sample. The patient could receive multiple charges from the same CPT code, but not different CPT codes, and still be included in the sample. As a result, the sample size for the OT CPT code analysis (N=3804) was smaller than the sample size of all the patients who received OT treatment (N=6993).

2.3.5 Covariates

To control for individual patient characteristics and random effects, the following covariates were included in the adjusted analyses: age, sex, race, post-acute discharge destination, comorbidities, and intensive care unit stay (Appendix D). These variables have been established in the literature as risk factors associated with readmission (Horney, Capp, Boxer, & Burke, 2017; McIntyre, Arbabi, Robinson, & Maier, 2016; Pedersen, Meyer, & Uhrenfeldt, 2017; Silverstein et al., 2008). Age was included as a continuous variable. Sex was classified as male or female. White, Black or African-American, and Other were the categories for race/ethnicity. Post-acute discharge destination was categorized into home health care/self-care, nursing facility, or other. The Elixhauser comorbidity measure with ICD-10 codes was used to create the comorbidity variable (Quan et al., 2005). The Elixhauser comorbidity measure has demonstrated good predictive validity of in-hospital and 30 days post hospitalization mortality (Menendez, Neuhaus, Van Dijk, & Ring, 2014; Sharabiani, Aylin, & Bottle, 2012). The comorbidities variable was presented as a continuous variable. The intensive care unit (ICU) stay variable was dichotomized into yes or no and identified by a patient's location during hospitalization.

2.3.6 Outcome

The primary outcome was 30-day all-cause hospital readmission. As defined by the Centers for Medicare and Medicaid Services (CMS), any unplanned readmission that occurs for a Medicare beneficiary (65 or older) for any cause within 30 days of discharge from the hospital was included.

Confirmation that each readmission at Froedtert met CMS criteria was done by the external company Vizient Inc. The readmission variable was a dichotomous variable (yes/no) (Appendix D).

2.3.7 Statistical Analyses

Descriptive statistics were organized by readmission (readmitted or not readmitted). Continuous variables were reported with mean ± standard deviation and range. Categorical variables with counts and percentages are presented in Table 3 along with patient characteristics. Three logistic regression analyses were completed for the receipt of OT services and OT service delivery factors (i.e., duration and frequency) with the outcome of readmission or no readmission. Each of the variables had unadjusted and adjusted logistic regression models. Adjusted models controlled for age, sex, race, post-acute discharge destination, comorbidity count, and ICU stay. A chi-square test was done to compare differences between CPT codes billed for patients who were readmitted and patients who were not readmitted. A Fischer's exact test was used with groups that had small sample sizes. All statistical analyses were performed using R version 4.0.0 (R Core Team, 2020).

Table 3.

Patient characteristics and OT factors by readmission

	Readmitted (N=2335)	Not Readmitted (N=15,283)	Total (N=17,618)	*P* Value
Age				
Mean (SD)	69.809 (12.831)	71.928 (12.693)	71.647 (12.732)	<0.001***
Range	21.000-100.000	20.000-107.000	20.000-107.000	
Sex				
Female (%)	1261 (54.00%)	8234 (53.89%)	9496 (53.89%)	.908
Male (%)	1074 (46.00%)	7049 (46.12%)	8123 (46.11%)	
Race				

White or Caucasian	1538 (66.52%)	10997 (72.32%)	12535 (71.55%)	<0.001***
Black or African American	718 (31.06%)	3814 (25.08%)	4532 (25.87%)	
Other	56 (2.42%)	395 (2.60%)	451 (2.57%)	
Disposition				
Home Health/Self-care (%)	1642 (70.32%)	11406 (74.62%)	13048 (74.06%)	<0.001***
Nursing Facility (%)	575 (24.63%)	3204 (20.97%)	3779 (21.45%)	
Other (%)	118 (5.05%)	673 (4.41%)	791 (4.49%)	
Number of comorbidities				
Mean (SD)	5.864 (3.217)	4.442 (3.268)	4.630 (3.296)	<0.001***
Range	0.000 – 19.000	0.000 – 19.000	0.000 -19.000	
ICU stay	880 (37.69%)	4155 (27.19%)	5035 (28.58%)	<0.001***
OT received				
No	1367 (58.54%)	9225 (60.36%)	10592 (60.12%)	0.095
Yes	968 (41.46%)	6058 (39.64%)	7026 (39.88%)	
OT duration (minutes/day)				
Mean (SD)	27.137 (8.257)	29.592 (10.778)	29.253 (10.500)	<0.001***
Range	15.000-65.000	0.000-95.000	0.000-95.000	
OT frequency (treatment days/total days)				
Mean (SD)	0.741 (0.255)	0.821 (0.237)	0.810 (0.241)	<0.001***
Range	0.103-1.000	0.011-1.000	0.011-1.000	

**p<0.05, ***p<0.01

2.4 Results

Froedtert's readmission rate for Medicare patients with a HRRP-qualifying diagnoses was 13%. Using univariate analyses, we compared patients who were readmitted at Froedtert within 30 days of index hospitalization to non-readmitted patients. Results indicated that readmitted patients were younger (69.81 ± 12.83 years vs 71.93 ± 12.69 years, $p<0.001$), more likely to be Black or African American (31.06% vs 25.08%, $p<0.001$), more likely to discharge to a nursing facility or different location than home (24.63% vs 20.97%, $p<0.001$), had a higher comorbidity count (5.86 ± 3.22 vs 4.44 ± 3.29, $p<0.001$) and were more likely to have an ICU stay (37.69% vs 27.19%, $p<0.001$). Readmitted patients also had a lower duration of OT services (27.14 ± 8.26 minutes/day vs 29.59 ± 10.78 minutes/day, $p<0.001$) and a lower frequency of OT services (0.74 ± .26% treatment days vs .82 ± .24% treatment days, $p<0.001$).

Results from three regression models for the receipt of OT services and OT service delivery factors (i.e., OT duration and OT frequency) with the primary outcome of readmission or no readmission are presented in Table 4. Patients who received OT services, defined by receipt of OT treatment received (yes/no), did not have significantly higher or lower odds of readmission ($p>0.05$). Patients who received higher durations of OT services had significantly lower odds of readmission (OR 0.99 per additional minute of OT/day, 95% CI 0.98-0.99). Similarly, patients that received higher frequency of OT services had significantly lower odds of readmission (OR .93 per 10% increase in treatment days out of all days, 95% CI 0.90-0.95).

Table 4.

Key variables: OT received, OT duration, and OT frequency (Adjusted results)

	OT received (N=17,518)	OT duration (N=6,993)	OT frequency (N=6,993)
OT received (OR, 95% CI)			
No (ref)			
Yes	1.10(1.00-1.21)		

OT duration (min/day) (OR, 95% CI)		0.99***(0.98-0.99)	
OT frequency (treatment days/total days) (OR, (95% CI)			0.93***(0.90-0.95)
Age (OR, 95% CI)	0.99***(0.99-0.99)	0.99***(0.98-0.99)	0.99***(0.98-0.99)
Sex (OR, 95% CI)			
Female (ref)			
Male	1.01(0.92-1.10)	0.96 (0.83-1.11)	0.96 (0.84-1.11)
Race (OR, 95% CI)			
White (ref)			
Black or African American	1.09 (0.98-1.21)	1.17(0.97-1.39)	1.19(0.99-1.42)
Other	0.98 (0.73-1.30)	1.08(0.65-1.71)	1.03(0.62-1.64)
Disposition (OR, 95% CI)			
Home health care/self-care (ref)			
Nursing Facility	1.26***(1.12-1.41)	1.16 (0.99-1.34)	1.07 (0.92-1.25)
Other	1.22(0.98-1.49)	1.04 (0.77-1.38)	0.98 (0.72-1.31)
Comorbidity count (OR, 95% CI)	1.13***(1.12-1.15)	1.15***(1.13- 1.18)	1.15***(1.13-1.17)
ICU Stay (OR, 95% CI)			
No (ref)			
Yes	1.56***(1.42-1.72)	1.40***(1.21-1.63)	1.34***(1.15-1.56)

**p<0.05, ***p<0.01

Lower age, higher comorbidity count, and an ICU stay were all significantly associated with increased odds of readmission across all three models (Table 4). Post-acute discharge destination to a nursing facility was significantly associated with higher odds of readmission in only the OT received regression model (OR 1.26; 95% CI 1.12-1.41). Race and sex were not statistically significant in any of the three models.

Results of the chi-square analyses and Fischer's exact tests comparing the OT CPT codes for readmitted and not readmitted patients with HRRP-qualifying diagnoses is presented in Table 5. A higher proportion of non-readmitted patients received ADL/self-care training (80.6% vs 74.9%, p=0.005). Conversely, a higher proportion of readmitted patients, in comparison to non-readmitted patients, received therapeutic exercise (4.3% vs 1.7%, p<0.001).

Table 5.

Comparison of CPT codes billed for readmitted and not readmitted patients

	Readmitted (N=446)	Not Readmitted (N=3,358)	*P* Value
Therapeutic Exercise			
Yes (%)	19 (4.3%)	58 (1.7%)	<0.001***
No (%)	427 (95.7%)	3300 (98.3%)	
Therapeutic Procedures			
Yes (%)	3 (.7%)	21 (.6%)	.906
No (%)	443 (99.3%)	3337 (99.4%)	
Development of Cognitive Skills			
Yes (%)	0 (0%)	3 (.1%)	.528
No (%)	446 (100.0%)	3355 (99.9%)	
Therapeutic Activities			
Yes (%)	89 (19.9%)	569 (16.9%)	0.114

No (%)	357 (80.0%)	2789 (83.1%)	
Activities of daily living/self-care training			
Yes (%)	334 (74.9%)	2706 (80.6%)	0.005***
No (%)	112 (25.1%)	652 (19.4%)	
Other			
Yes	1 (.22%)	1 (.03%)	0.092
No	445 (99.8%)	3357 (99.9%)	

**p<0.05, ***p<0.01

2.5 Discussion

Reducing readmissions and the associated poor patient outcomes and high costs is a top priority in the US health care system, and this is the target of Medicare's HRRP (McIlvennan et al., 2015). Froedtert's readmission rate for Medicare patients with a HRRP-qualifying diagnoses was 13%. This rate is slightly lower than the current national rate of 16% (United Health Foundation, 2020). However, the study sample did not include all Medicare patients (i.e., only those with HRRP-qualifying diagnoses), which may have resulted in a lower readmission rate compared to the national rate. In a study of over 6,000 Medicare inpatient admissions with HRRP-qualifying diagnoses, we found that patients had reduced odds of readmission if they received higher duration and higher frequency of acute OT services while hospitalized. Also, patients who were not readmitted to the hospital received more ADL/self-care training than patients who were readmitted to the hospital. These results provide important guidance on how OT services can be leveraged to reduce readmissions.

Our finding that higher duration of acute OT services is linked to reduced readmissions is consistent with some, but not all, prior literature. Andrews et al. (2015) and Burke et al. (2014) found that higher use of acute OT services is associated with reduced likelihood of readmission; however, a clear definition of "higher use" was not provided. Kumar et al. (2019) found that only higher durations of acute PT services, not acute OT services, were associated with reduced likelihood of readmission. Kumar et al. (2019) only

included patients with ischemic stroke, while our study included all of the HRRP diagnoses (AMI, PN, HF, COPD, CABG, and TKA/THA). The differences in results between the two studies suggest that the relationship between OT service delivery factors and readmission may be specific to diagnosis.

Higher frequency of OT services was also found to be associated with reduced odds of readmission for patients with HRRP-qualifying diagnoses in our study. The association between frequency of OT services and readmission has yet to be examined in the acute care setting. Studying both duration and frequency of OT services is important so that findings can eventually be implemented in practice. Both are crucial elements that impact the daily operations of acute OT departments and effect staffing for acute occupational therapists on inpatient hospital units. Our findings indicated that for each additional minute per day of OT therapy duration, the odds of readmission for patients were 1% lower. For each 10% increase in the frequency of treatment days, the odds of readmission was 7% lower. These findings demonstrate that the more time that patients are participating in OT treatment their odds of readmission decrease. Future studies may want to explore exact dosage for duration and frequency of OT services to identify the minimum or maximum duration and frequency associated with reduced readmission risk for patients. Evidence on exact dosage would lead to best practice guidelines that optimize patient outcomes in the acute care setting.

In our study, we found that patients who were not readmitted received a significantly higher amount of ADL/self-care training by occupational therapists while hospitalized compared to readmitted patients. The OT CPT code for ADL/self-care training includes interventions focused on ADLs and also instrumental activities of daily living (IADLs) interventions and fall prevention education. IADLs are complex tasks such as financial management, health management, and community mobility that support daily life (American Occupational Therapy Association, 2017). In the post-acute setting, impairments with ADLs/self-care have been shown to be associated with increased likelihood of readmission (Depalma et al., 2013; Greysen et al., 2015; Middleton, Downer, et al., 2018; Middleton, Graham, et al., 2018). Similarly, patients who are more dependent in IADLs have also been shown to be at higher risk for readmission (Pisani et al., 2018). Furthermore, patients who experience a fall after hospitalization are

more likely to be readmitted to the hospital (Galet, Zhou, Eyck, & Romanowski, 2018). Identifying that the ADL/self-care training CPT code is billed significantly more for patients who are not readmitted demonstrates promise that CPT codes are valuable sources of information when examining OT services associated with readmission. Using CPT codes to evaluate the association between acute OT services and patient outcomes, such as readmissions, is a novel approach. We found that less patients were readmitted when they received more ADL/self-care training. These types of OT services could be responsible for reducing patients likelihood of readmission and help to open the "black box" of rehabilitation, where the OT processes are largely unknown (DeJong et al., 2005).

Examination of OT processes (i.e., services provided) is a difficult undertaking due to the variability in care provided to patients between occupational therapists. Prior studies have focused on the link between readmission and ADL impairment, but have not directly examined services that may prevent readmissions (Greysen et al., 2015; Middleton, Downer, et al., 2018; Middleton, Graham, et al., 2018; Pisani et al., 2018). This may be due to the lack of CPT codes that would identify specific therapy services in national or state databases. Our use of institutional data which included CPT codes allowed for a granular examination of the types of OT services delivered to patients who were readmitted and not readmitted. Identifying the importance of ADL and IADL interventions, not only impairments with ADLs and IADLs, in preventing readmissions is a significant finding for the OT profession because ADLs and IADLs are uniquely within the scope of OT practice. However, clarification of the OT activities and interventions provided by occupational therapists according to CPT codes is needed because the AMA definitions for CPT codes are vague allowing for wide interpretation by clinicians (American Medical Association, 2019).

2.6 Study Limitations

Our study had several limitations. First, the OT services provided variable only included patients that had one OT service provided (i.e., one type of CPT code billed) for the entirely of the patient's hospital stay. Including patients who only received one type of OT services while hospitalized may not be truly reflective of practice because multiple OT services can be provided to a single patient during their

hospital stay. Patients were included if they received multiple treatments of the same type of OT services, but not if they received a different types of OT services. However, this approach allowed us to minimize the effects of multiple services and isolate the impact of singular OT services on patients' readmission risk. Future studies should consider examining the interaction effects of the multiple services on a singular patient's readmission risk. Secondly, due to the broad nature and lack of standardized guidelines available for occupational therapists to use when submitting CPT codes, it is difficult to say with a high level of certainty that interventions focused on IADLs and fall prevention education definitively occurred when the ADL/self-care training CPT codes were submitted by the occupational therapists for the patients in the study sample. This study was part of a larger research project being conducted by the authors on the role of acute OT in preventing readmissions. One of the studies addresses the gap in the literature on what specific OT activities and interventions are delivered by acute occupational therapists according to CPT codes. The combined results from the studies will provide initial findings for the OT profession to identify the most effective treatment and processes to prevent readmissions. Another limitation associated with documentation was the inability to include actual therapy minutes in the analysis. Each treatment CPT code was assigned the value of 15 minutes for the analysis of duration of OT services. The platform where the data was collected for the study, Epic Clarity, does not have the same features included in the patient EMR. Specific CPT codes and the count of CPT codes are available in Epic Clarity, but the minutes documented by the acute occupational therapists are not available for analysis. Applying 15 minutes to each CPT code is a reasonable solution because it is the median for the minute parameters for Medicare's rules for therapy billing and other studies examining similar variables have used the same approach when evaluating revenue codes (Centers for Medicare & Medicaid Services, 2010; Kumar et al., 2019).

Other study limitations included reduced generalizability and the inclusion of all-cause readmissions. Generalizability of our study is limited by the data source and sample characteristics. The data originated from a single hospital and findings may not be generalizable to all settings where acute OT services are provided. However, the study hospital, Froedtert, can be categorized into the largest category of hospitals

in the US, which are non-government and not-for-profit hospitals (Froedtert & Medical College of Wisconsin, 2019). The sample was limited to only Medicare patients who were 65 years or older with HRRP-qualifying diagnoses. Therefore, the results of this study may not be applicable to younger patients with the same diagnoses or diagnoses not included in HRRP. Another limitation was that the readmission variable was defined by all-cause readmissions with no separation of potentially preventable and unavoidable readmissions. Nonetheless, a recent study reported that separating potentially preventable readmissions may not be beneficial when examining modifiable factors such as OT services (Malcolm, Middleton, Haas, Ottenbacher, & Graham, 2019). Finally, several covariates that could have confounded results were not included in the analyses due to data limitations, including patients' functional status and dual eligibility for Medicare and Medicaid. These may be options for future studies.

2.7 Conclusions

The findings of our study indicate that patients with HRRP-qualifying diagnoses who receive higher durations and frequency of OT services have lower odds of readmission. Also, patients who were not readmitted to the hospital within 30-days received more ADL/self-care training during OT sessions than those who were readmitted to the hospital within 30-days. These findings help to further define OT's unique role in reducing readmissions and may contribute to future work on evidence-based practice guidelines for improving patient outcomes.

3. Research Paper 2: Client factors and readmissions

3.1 Introduction

Hospital readmissions are associated with poor patient outcomes and high costs; as a result they are used as an important metric to evaluate the quality of care provided (Boozary et al., 2015; Jencks et al., 2009). The Centers for Medicaid and Medicare Services (CMS) has made reducing readmissions a top priority by creating the Hospital Readmission Reduction Program (HRRP) for Medicare patients. HRRP penalizes hospitals up to 3% of reimbursement if they have excessive readmissions for Medicare patients with one of the following diagnoses: acute myocardial infarction (AMI), heart failure (HR), pneumonia (PN), coronary artery bypass graft (CABG), chronic pulmonary obstructive disease (COPD), and total hip/knee arthroplasty (THA/TKA) (Centers for Medicare and Medicaid Services, 2018). To avoid HRRP penalties and improve patient outcomes, United States' (US) hospitals and healthcare professionals are focusing enormous efforts towards reducing readmissions. Occupational therapy (OT) is a profession with potential to substantially impact the effort to reduce hospital readmissions; however, the profession's role has yet to be clearly defined.

Two areas where OT could have an impact on outcomes is independence with self-care after hospitalization and identification and integration of social factors into discharge planning. Both independence with self-care and social factors have been linked with readmission risk following an inpatient admission (Calvillo-King et al., 2013; Greysen et al., 2015b; Middleton, Downer, et al., 2018; Middleton, Graham, et al., 2018). Importantly, determinants of self-care status and incorporation of social factors into discharge planning is within the scope of OT practice (American Occupational Therapy Association, 2017). Occupational therapists are provided with extensive training on how to collect information on social factors, specifically the social and physical environment, and integrate the information into discharge plans. OT is one of only a few professions that considers both clinical (i.e., self-care status) and social factors simultaneously when deciding on recommendations for hospitalized

patients. This holistic background positions the profession well to make a substantial impact on readmissions.

To the best of our knowledge, all the previous studies examining self-care status and readmission risk have been done in post-acute settings and have found that impaired function with self-care tasks results in higher readmission risk (R. E. Burke et al., 2016; S. R. Fisher et al., 2016; Greysen et al., 2015b; Middleton, Downer, et al., 2018; Middleton, Graham, et al., 2018). There is a gap in the literature, however, regarding how self-care status in the acute care setting impacts readmission risk; this gap may relate to the difficulty in collecting and analyzing data from the acute care setting due to the use of a narrative text entries or missing data. Regardless, there is a need for more information on the association between self-care status in the acute care setting and readmission. Approximately 40% of Medicare patients are discharged from the hospital to home with home health care. Medicare patients who discharged home with home health care had a 5.6% higher readmission rate than those who discharged to a skilled nursing facility (Werner, Coe, Qi, & Konetzka, 2019). These Medicare patients at higher risk for readmission need to be identified in the acute care setting and interventions need to be implemented accordingly to prevent readmission.

Additional gaps in the literature exist for identification and integration of social factors during discharge planning. In recent years, there has been debate about whether social risk factors should be included in risk-adjustment methodology for HRRP (Bernheim et al., 2016; Joynt Maddox et al., 2019). There are concerns that safety-net hospitals who service a higher proportion of patients with social risk factors, such as lower socioeconomic status and educational attainment, may be at higher risk for readmission resulting in unfair penalties from HRRP (Joynt & Jha, 2012). Social factors such as poverty, disability, housing instability, lack of social support, and residence in a disadvantaged neighborhood have been strongly linked to poor patient outcomes and warrant consideration when evaluating methods for reducing readmissions (Calvillo-King et al., 2013; Joynt Maddox et al., 2019; The National Academies of Sciences Engin, 2016, 2017). The link between social factors and patient outcomes is complex. It has been suggested that social factors play a major role in determining health (Braveman, Egerter, Woolf, &

Marks, 2011; Braveman, Egerter, & Williams, 2011). For example, living in a disadvantaged neighborhood may lead to higher exposure to pollution and allergens, social acceptability of violence leading to perpetuation of the violence, higher concentration of fast-food stores and fewer recreational opportunities leading to poorer nutrition and less physical activity (Braveman & Gottlieb, 2014). Further exploration of the link between social factors and readmissions is needed.

Very few studies have evaluated social factors outside of socioeconomic status, however evidence has shown that lack of social support and housing instability may result in increased risk for readmission (Calvillo-King et al., 2013). Social support is considered a patient's social environment while housing is considered their physical environment. Information on housing instability is not usually collected by occupational therapists in the acute care setting, however, a potential proxy for the variable, housing situation, is often collected. Housing situation indicates whether the patient has housing or no housing (i.e., homeless) and if the reported housing may be transitional; no housing and transitional housing both indicate housing instability. Social factors collected during the OT evaluation are analyzed by the occupational therapist and impact the interventions selected for the plan of care and eventually a patient's outcomes (American Occupational Therapy Association, 2017).

The objective of this study was to examine if acute self-care status and social factors, specifically social support and housing situation, are associated with 30-day all-cause readmission for patients included in HRRP. It was hypothesized that patients who required no physical assistance with self-care tasks and did not live alone would have lower odds of hospital readmission within 30-days.

3.2 Methods

3.2.1 Design and Data

A retrospective, cross-sectional design with data from a single large metropolitan academic hospital, Froedtert Hospital (Froedtert) in Milwaukee, WI, was used. All data were collected from the electronic medical record (EMR), Epic, at Froedtert. Froedtert is the primary affiliation to the Medical College of Wisconsin (MCW). Together the two organizations create one of only two academic

medical centers in Wisconsin. Froedtert is a level I trauma center with 604 hospital beds (Froedtert & Medical College of Wisconsin, 2019). Data were collected between January 2014, the first year of Epic use at Froedtert, to February 2020.

3.2.2 Ethics

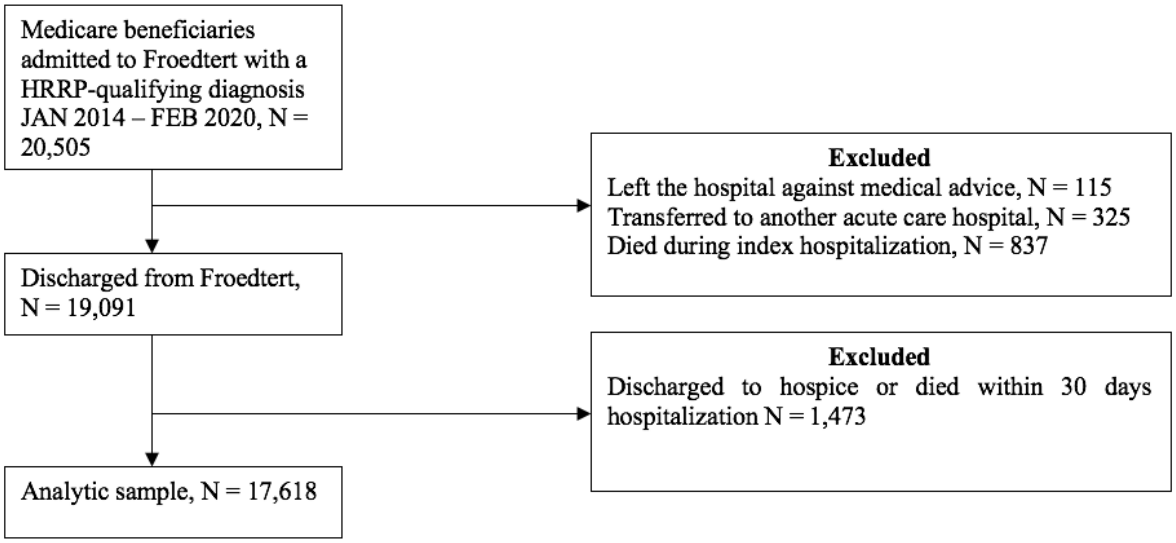
The study was approved by the institutional review board at the MCW and Virginia Commonwealth University (VCU). MCW is where the data was collected and stored. Approval was also required at VCU because the study contributed to the requirements for a dissertation at VCU. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology guidelines (Appendix F).

3.2.3 Participants

The study sample was Medicare patients admitted to Froedtert between 2014-2020 with a HRRP-qualifying diagnosis. HRRP qualifying diagnoses are: AMI, HF, PN, CABG, COPD, or THA/TKA. Participants were identified in Froedtert's EMR by International Classification of Diseases (10^{th} revision) (ICD-10) codes (Appendix G). Only patients over the age of 65 years who were enrolled in Medicare were included. Patients were excluded from the sample based on the following criteria: left the hospital against medical advice, transferred to another acute care hospital, died during the index hospitalization, discharged to hospice, or died within 30 days after discharge from the hospital. Excluding these patients from the sample helped to ensure only the standard of care was provided during hospitalization and readmissions were indicators of the quality of care provided and not due to unavoidable circumstances (Kumar et al., 2019) (Figure 5).

Figure 5.

Application of inclusion and exclusion criteria to the study sample



3.2.4 Key Variables

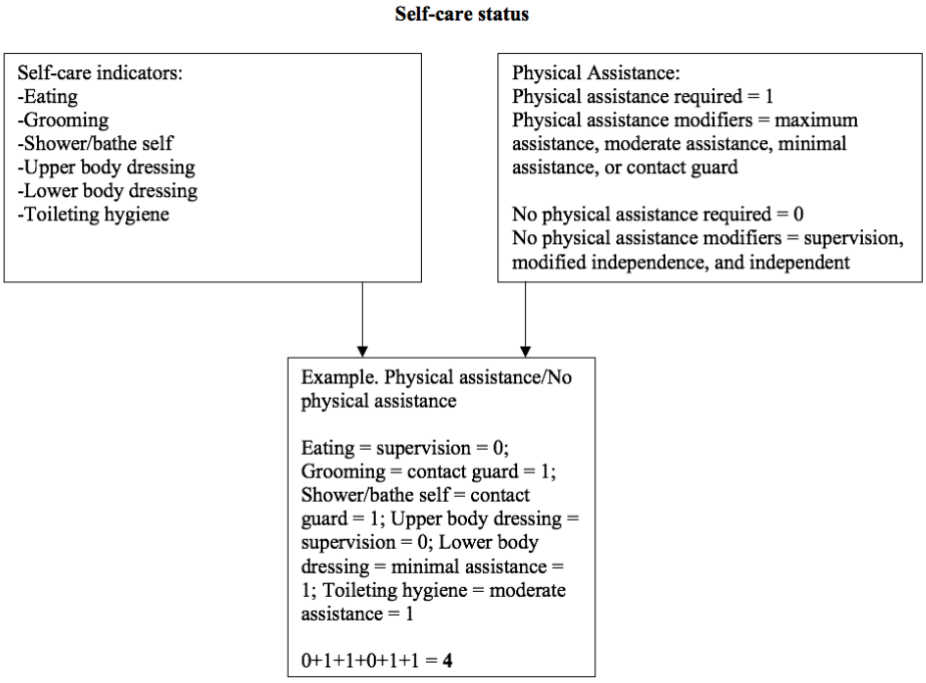
The key variables were self-care status, social support, and housing situation. There is no universal, comprehensive definition of self-care status that is used in OT practice. Self-care is usually a domain comprised of multiple indicators and can vary depending on the setting. In post-acute settings there are required patient assessment instruments to determine which self-care indicators are documented by the occupational therapists; there is no required patient assessment instrument in the acute care setting. Inpatient rehabilitation facilities (IRF) use the Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF-PAI). The IRF-PAI's self-care domain creates a composite score of independence from the following self-care indicators: eating, oral hygiene, toileting hygiene, shower/bathe self, upper body dressing, lower body dressing, putting on/taking off footwear. The IRF-PAI assigns numerical values to the levels of independence documented by occupational therapists for the different self-care indicators. The higher a patient's IRF-PAI score the higher their level of independence (RTI International, 2018). The self-care indicators used in the IRF-PAI are almost identical to the acute self-care indicators used at Froedtert, except for putting on/taking off

footwear is not included. The self-care indicators used at Froedtert are: eating, grooming (i.e., oral hygiene), shower/bathe self, upper body dressing, lower body dressing, and toileting hygiene.

For the purposes of this study, two unique scoring systems were created for the self-care variable, Scoring System 1 (SS1) and Scoring System 2 (SS2). Selection of one scoring system over the other was determined by the amount of missing data for the self-care indicators. SS1 entailed labeling each self-care indicator as: requires physical assistance versus no physical assistance required (Figure 6). Physical assistance and no physical assistance was defined by the levels of independence available in the documentation at Froedtert. Physical assistance included the following levels of independence: maximum assistance, moderate assistance, minimal assistance, and contact guard assistance. No physical assistance included the following levels of independence: supervision, conditional independence, and independent. Definitions of the levels of independence are available in Appendix I. While stand-by assistance is a common level of independence in the acute care setting, it is not a documentation option at Froedtert therefore it was not included in either category. For SS1, each self-care indicator either received 1 to indicate physical assistance was required to complete the task or 0 indicating no physical assistance was required to complete the task. Similar to the IRF-PAI, a composite score was created to reflect acute self-care status. For example, if eating = 0, grooming = 0, bathing = 1, upper body dressing = 0, lower body dressing = 1, toileting = 1 these results would create a composite score of 3. If greater than 20% of the data was missing for the self-care indicator, it was not included in the analysis. If at least four of the self-care indicators were missing greater than 20% of data then it was planned to use SS2.

Figure 6.

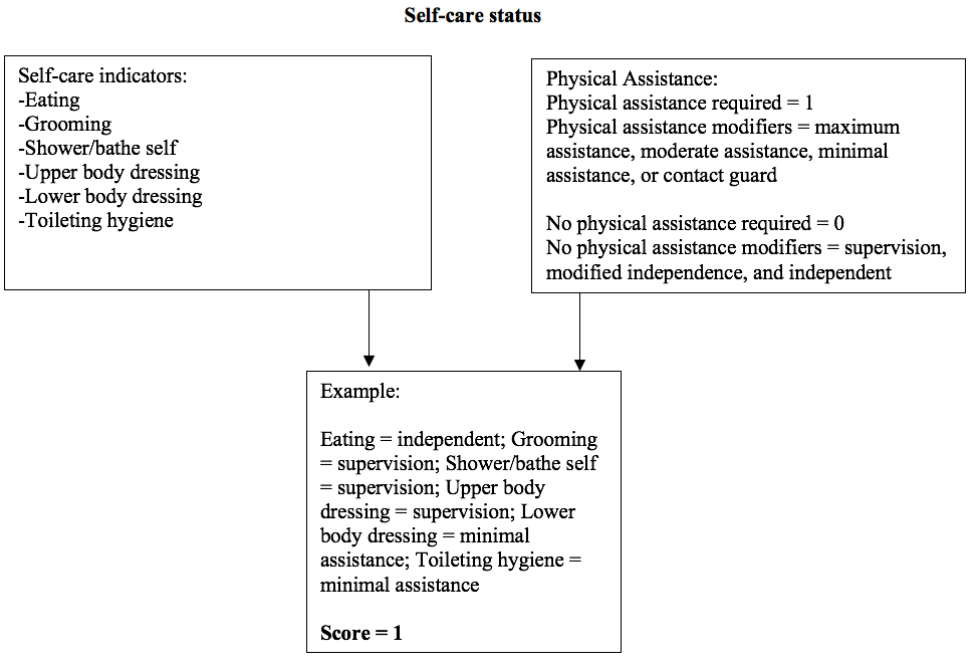
SS1: Self-care variable



In anticipation of a significant amount of missing data, the SS2 was also created for the self-care variable (Figure 7). If any of a patient's documented self-care indicators (eating, grooming, upper body dressing, lower body dressing, bathing, and toileting) required physical assistance the variable was labeled as 1; if none of the self-care indicators required physical assistance the variable was labeled as 0. Using this method, a patient's record could be included in the analysis even if they had documentation of only one self-care indicator. Physical assistance and no physical assistance was defined the same as for SS1.

Figure 7.

SS2: Self-care Variable

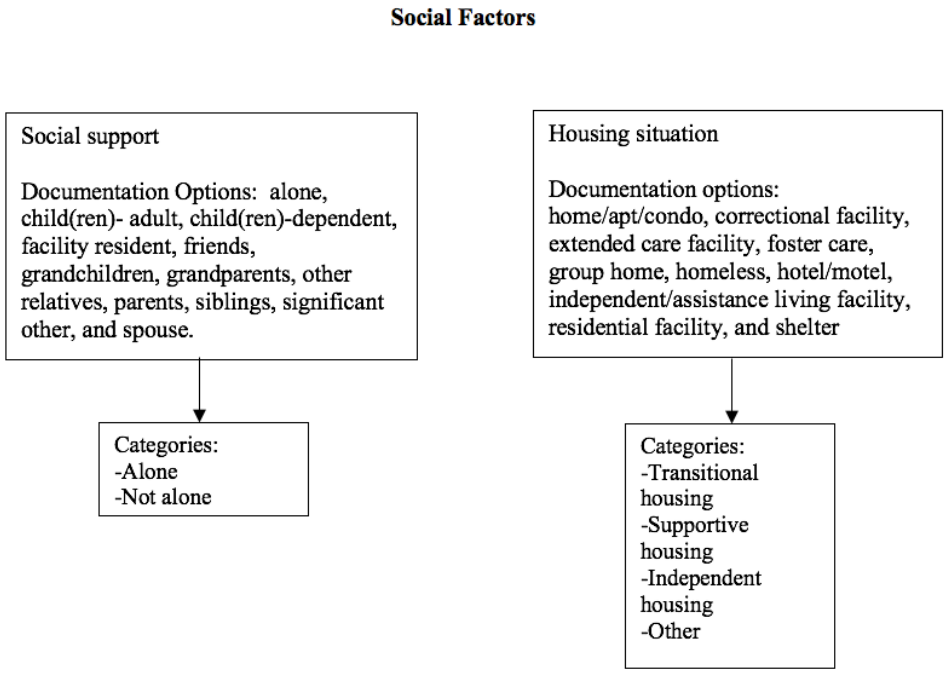


Quantification of social factors is also challenging in the acute care setting secondary to minimal documentation requirements and the frequent use of narrative text in EMR documentation. No narrative text was extracted for this study. Instead, two social variables were collected: 1) social support and 2) housing situation. The social support variable only captured who was reported to live with the patient. Documentation options for social support were: alone, child(ren)- adult, child(ren)-dependent, facility resident, friends, grandchildren, grandparents, other relatives, parents, siblings, significant other, and spouse. The options were consolidated into two categories to create a dichotomous variable for the social support variable with the options of alone or not alone (Figure 8). While housing situation is not known to be associated with readmission risk, housing instability has been (Calvillo-King et al., 2013). Housing situation served as a proxy for housing instability since it includes information as to whether the patient has no housing or lives in transitional housing which would both indicate housing instability. Housing situation documentation options included: home/apt/condo, correctional facility, extended care facility, foster care, group home, homeless,

hotel/motel, independent/assisted living facility, residential facility, and shelter. The housing situation options were consolidated into the following categories to create a categorical variable: *transitional housing* included foster care, correctional facility, homeless, hotel/motel and shelter, *supportive housing* included extended care facility and group home, *independent housing* included home/apt/condo, and *other* including residential facility and independent/assisted living facility (Figure 8).

Figure 8.

Social factors



3.2.5 Covariates

The following covariates were included in the statistical analyses: age, sex, race, post-acute discharge location, comorbidities, and intensive care unit stay. Extensive literature has established these variables as risk factors associated with readmission (Horney et al., 2017; McIntyre et al., 2016; Pedersen et al., 2017; Silverstein et al., 2008). Age was entered as a continuous variable while sex was classified and documented as male or female. White, Black or African-American, or Other were the categories used to classify race/ethnicity. Post-acute discharge location was entered as a

categorical variable with the following options: home health care/self-care, nursing facility or other. The patients' number of comorbidities was calculated by using the Elixhauser comorbidity measure using ICD-10 codes (Quan et al., 2005). The measure has demonstrated good predictive validity after translation from ICD-9 codes to ICD-10 codes for in-hospital and 30-days post hospitalization mortality (Menendez et al., 2014; Sharabiani et al., 2012). The comorbidity variable was a continuous variable. Intensive care unit stay variable was dichotomized into yes or no and identified based on patient location during hospitalization.

3.2.6 Outcome

The primary outcome measure used in this study was 30-day all-cause, hospital readmissions. Using the CMS definition of 30-day all-cause readmission, any unplanned readmission that occurs for a Medicare beneficiary (65 or older) for any cause within 30 days of discharge from the hospital was included. Verification that all the readmissions included in the study met CMS criteria was done by an external company employed by Froedtert. The readmission variable was a dichotomous variable (yes/no).

3.2.7 Statistical Analyses

Descriptive statistics were organized by readmission (readmission or no readmission). Continuous variables were reported with mean ± standard deviation. Categorical variables included counts and percentages. Univariate analyses were done to compare patient characteristics between patients who were readmitted and not readmitted. Logistic regression analyses were performed for each key variable (self-care status, social support and housing situation) resulting in three separate regression models. Each model had unadjusted and adjusted results calculated. Statistical analyses performed used R version 4.0.0 (R Core Team, 2020).

3.3 Results

The readmission rate for the study sample was 13%. Readmitted patients were younger (69.8 ± 12.8 years vs 71.9 ± 12.7 years, $p<0.001$). The readmitted group had more Black or African American patients

than the not readmitted group (31.1% vs 25.1%, p<0.001); the readmitted group had a lower proportion of White patients (66.5% vs 72.3%, p<0.0001). The majority of the patients discharged to home (74.1%). The readmitted group had a higher proportion of patients who discharged to a nursing facility (24.6% vs 21%, p<0.001). Patients in the readmitted group had a higher comorbidity count (5.86 ± 3.22 vs 4.44 ± 3.29, p<0.001). Also, a higher proportion of patients in the readmitted group had a stay in the ICU while hospitalized than the not readmitted group (37.69% vs 27.19%, p<0.001). There was no difference between the readmission rates by sex (p=.908) (Table 6).

Table 6.

Patient characteristics by readmission for patients with HRRP-qualifying diagnosis

	Readmitted (N=2335)	Not Readmitted (N=15,283)	Total (N=17,618)	*P* Value
Age				
Mean (SD)	69.809 (12.831)	71.928 (12.693)	71.647 (12.732)	<0.001***
Range	21.000-100.000	20.000-107.000	20.000-107.000	
Sex				
Female (%)	1261 (54.00%)	8234 (53.89%)	9496 (53.89%)	.908
Male (%)	1074 (46.00%)	7049 (46.12%)	8123 (46.11%)	
Race				
White or Caucasian	1538 (66.52%)	10997 (72.32%)	12535 (71.55%)	<0.001***
Black or African American	718 (31.06%)	3814 (25.08%)	4532 (25.87%)	
Other	56 (2.42%)	395 (2.60%)	451 (2.57%)	
Post-acute discharge location				
Home Health/Self-care (%)	1642 (70.32%)	11406 (74.62%)	13048 (74.06%)	<0.001***

Nursing Facility (%)	575 (24.63%)	3204 (20.97%)	3779 (21.45%)	
Other (%)	118 (5.05%)	673 (4.41%)	791 (4.49%)	
Number of comorbidities				
Mean (SD)	5.864 (3.217)	4.442 (3.268)	4.630 (3.296)	<0.001***
Range	0.000 – 19.000	0.000 – 19.000	0.000 -19.000	
ICU stay				
No	1455 (62.31%)	11128 (72.8%)	12583 (71.42%)	<0.001***
Yes	880 (37.69%)	4155 (27.19%)	5035 (28.58%)	

**p<0.05, ***p<0.01

All the self-care indicators had greater than 20% missing data (Table 7). As a result, SS2 for the self-care variable was utilized. In the adjusted analyses, there was no association between the self-care variable, the social support variable, or the housing situation variable with readmission. Therefore, the odds that patients with a HRRP-qualifying diagnosis were readmitted within 30 days to the hospital were not increased or decreased based on their level of independence with self-care tasks while hospitalized, whether they lived alone or not alone (i.e., social support), or if their housing situation was transitional, supportive, independent or other. The sample size for the self-care analysis (N=6,548) was smaller than the social support and housing situation analyses (N=17,429) because only patients who received OT services, and therefore had documentation on self-care variables, were included in the self-care analysis. There is also a discrepancy between the sample sizes for the self-care variable and the missing data for the self-care indicators. The sample size used to determine the missing data for the self-care indicators (N=7026) was determined from unadjusted data (i.e., the covariates were not applied to the data). As a result, the sample size used to identify the missing data for the self-care indicators is larger than the self-care variable (N=6,548) in the adjusted analysis where the covariates were applied. When the covariates were applied to the data, if at least one of the covariates was not found to be associated with an observation it was dropped from the analysis. Only 38% of the total sample received OT services. Results for the self-care, social support and housing situation models are presented in Table 8.

Table 7.

Missing data for self-care variable (Unadjusted sample, N=7026)

	Physical assistance (%)	No physical assistance (%)	Missing data (%)
Eating	77 (1.1%)	1852 (26.3%)	**5097 (72.5%)**
Grooming	410 (5.8%)	3625 (51.6%)	**2991 (42.6%)**
Upper body dressing	928 (13.2%)	2971 (42.3%)	**3127 (44.5%)**
Lower body dressing	2431 (34.6%)	2290 (32.6%)	**2305 (32.8%)**
Shower/bathe self	897 (12.8%)	2771 (39.4%)	**3358 (47.8%)**
Toileting	1396 (19.9%)	2533 (36.0%)	**3097 (44.1%)**

*The sample size, N=7026, is the result of using unadjusted data for the table.

Table 8.

Self-care status, social support and housing situation (Adjusted results)

	Self-care status (N=6,530)	Social support (N=17,330)	Housing situation (N=17,324)
Self-care status (OR, CI 95%)			
Physical assistance (ref)			
No physical assistance	1.01 (0.87-1.17)		
Social support (OR, 95% CI)			
Not alone (ref)			
Alone		0.92 (0.83-1.01)	
Housing situation (OR, 95% CI)			
Independent housing (ref)			
Supportive housing			1.07 (0.91-1.25)

Transitional housing			0.82 (0.43-1.42)
Other			0.91 (0.72-1.15)
Age (OR, 95% CI)	0.99***(0.98-0.99)	0.99***(0.99-0.99)	0.99***(0.99-0.99)
Sex (OR, 95% CI)			
Female (ref)			
Male	1.04 (0.90-1.20)	0.99 (0.90-1.08)	0.99 (0.91-1.09)
Race (OR, 95% CI)			
White (ref)			
Black or African American	1.21**(1.01-1.44)	1.07 (0.96-1.19)	1.06 (0.96-1.18)
Other	1.02 (0.63-1.57)	0.96 (0.71-1.27)	0.96 (0.71-1.27)
Post-acute discharge location (OR, 95% CI)			
Home health care/self-care (ref)			
Nursing Facility	1.06 (0.90-1.24)	1.29***(1.16-1.44)	1.28***(1.14-1.43)
Other	0.91 (0.66-1.23)	1.23(0.99-1.51)	1.22(0.98-1.50)
Comorbidity count (OR, 95% CI)	1.17***(1.15-1.20)	1.13***(1.12-1.15)	1.13***(1.12-1.15)
ICU Stay (OR, 95% CI)			
No (ref)			
Yes	1.58***(1.36-1.83)	1.56***(1.42-1.72)	1.57***(1.42-1.72)

**p<0.05, ***p<0.01

The following patient characteristics: (1) age, (2) comorbidity count, and (3) if the patient had an ICU stay while hospitalized, were all significantly associated with readmission risk for all three models (Table 8). Patients who were older had lower odds of readmission in the self-care model (OR 0.99 per

year increase in age; 95% CI 0.98-0.99), social support model (OR 0.99; 95% CI 0.99-0.99) and the housing situation model (OR 0.99; 95% CI 0.99-0.99). Patients with a higher comorbidity count were more likely to be readmitted in the self-care model (OR 1.17 per unit increase in comorbidity count; 95% CI 1.15-1.20), the social support model (OR 1.13; 95% CI 1.12-1.15) and the housing situation model (OR 1.13; 95% CI 1.12-1.15). If a patient had a stay in the ICU while hospitalized, they were 58% more likely to be readmitted in the self-care model (OR 1.58; 95% CI 1.36-1.83), 56% more likely to be readmitted in the social support model (OR 1.56; 95% CI 1.42-1.72) and 57% more likely to be readmitted in the housing situation model (OR 1.57; 95% CI 1.42-1.72). Race and post-acute discharge location were significantly associated with readmission, however, there was variation across the three models (Table 8). Black or African American patients had higher odds of readmission in the self-care model but not for the social support or housing situation models (OR 1.21; 95% CI 1.01-1.44). The post-acute discharge location of a nursing facility was significantly associated with higher odds of readmission in the social support (OR 1.29; 95% CI 1.16-1.44) and the housing situation models (OR 1.28; 95% CI 1.14-1.43).

3.4 Discussion

In accordance with the stated goals and policies of CMS, reduction of hospital readmissions has been identified as a quality improvement priority. The holistic practice approach of OT uniquely situates the profession to reduce readmission rates by incorporating both clinical and social factors in patient care and discharge planning. In order to leverage this opportunity, a nuanced understanding of how these clinical and social factors affect risk of readmission is needed. In a study of over 17,000 Medicare inpatients with an HRRP-qualifying diagnosis, we did not find an association between readmission and independence with self-care, social support, or housing situation.

Our findings that there is no association between independence with self-care and readmission conflicts with the current literature. Impaired functional status, specifically related to self-care tasks, has consistently been found to be associated with higher likelihood of readmission in post-acute settings (Greysen et al., 2015; Middleton, Downer, et al., 2018; Middleton, Graham, et al., 2018). Our study was

the first to be done in the acute care setting and was limited by the amount of missing data for self-care status, owing to the absence of documentation requirements for this variable. Furthermore, the lack of a standardized measure to evaluate independence with self-care in the acute care setting introduces variability related to differences in clinical judgment between occupational therapists. The self-care task that was used most frequently to determine the self-care variable was lower body dressing, which had the least amount of missing data (32.8%). Galloway and colleagues (2016), in a study done in a post-acute setting, found that improved function with lower body dressing was the only self-care task protective against readmission. This suggests that data on lower body dressing would have been the most likely to identify an association with readmission in the acute setting, if one exists. In practice, acute occupational therapists may want to focus interventions on improving independence with lower dressing and ensuring that documentation is provided on the self-care task. If lower body dressing was consistently and accurately documented on in the acute setting, then further research could be done on the predictive nature of the self-care task and readmission. However, to provide a deeper understanding of the relationship between acute self-care status and readmission a widely-used comprehensive and standardized measure of self-care status is needed in the acute setting.

We also found no association between social support and readmission. These results are specific to the definition of social support used in this study: whether the patient lives alone or not. The variable definition did not include data on the willingness or ability of any cohabitants to assist the patient in post-discharge care, or the patient's perceived level of support. Chan et al. (2019) determined that minorities who report a high level of perceived social support have reduced risk of readmission. Chan and colleagues (2019) suggest that the quality of social support, as opposed to the mere presence or absence of support, may have the greatest impact on patient outcomes. Documentation by occupational therapists in acute settings frequently includes information on the quality of social support available for the patient after discharge from the hospital, including at Froedtert. Unfortunately, data pertaining to the quality of social support is entered in the form of narrative text by occupational therapists at Froedtert. Narrative text was not used as a data source in this study. If acute occupational therapists are not addressing quality

of social support in their discharge planning, they should consider it as an important factor that may impact patients' outcomes. Future work should incorporate data on the quality of support.

Housing situation was also not found to be significantly associated with readmission. Housing situation included four categories: transitional, supportive, independent, and other, none of the categories were significantly associated with readmission. To the best of our knowledge, our study is the first to explore housing situation as a social determinant of readmission risk. This variable is similar to housing instability, which is defined as the number of address changes in the past year. Housing instability has been found to be a significant predictor of readmission (Calvillo-King et al., 2013). Housing situation was used because it is a common topic discussed between occupational therapists and patients while hospitalized and was available for analysis in the EMR. Nonetheless, data indicated that housing situation was not associated with risk for readmission in our sample.

The primary intent of this study was to examine the impact of clinical and social factors within the scope of OT practice on readmission. For years, it has been proposed that OT is a profession with the training needed to reduce hospital readmissions (Roberts & Robinson, 2014; Roberts, Robinson, Furniss, & Metzler, 2020; Rogers et al., 2017). However, in the acute care setting, there is limited direct evidence supporting the role of OT in improving patient outcomes such as readmission. None of the factors included in this study were significant predictors of readmission however this may have been due to the lack of a standardized self-care assessment in the acute setting, the complexity associated with defining and collecting information on social support and housing situation, the lack of details available in the documentation, and missing data. Also, the frequent use of narrative text in OT documentation makes using the data for research purposes challenging. While it is important for occupational therapists to use their clinical judgement during sessions with patients, it is debatable if the same lack of standardization should be applied to documentation (American Occupational Therapy Association, 2017; Zanca & Dijkers, 2014). Without clear and consistent documentation among acute occupational therapists, not only within the same facility but across all facilities nationally, researchers cannot accurately evaluate OT's impact on quality outcomes in the acute care setting. This may threaten the inclusion of OT as a needed

profession when considering how best to improve patient outcomes. Acute care OT departments should consider national implementation of a set of standardized assessments to determine patients' independence level with self-care tasks and limited use or no use of narrative text, then future studies may want to re-evaluate the impact of self-care tasks and social factors on readmission.

3.5 Study Limitations

The sample we used for our study was from a single hospital. The characteristics of Froedtert are similar to other hospitals that are large academic, non-profit institutions. However, this may have resulted in reduced generalizability of our findings. Using medical records results in limitations including potential data entry issues, missing data, and a lack of a standardized format for collecting the information. Missing data was a significant issue for the self-care variable, with missing data present in 32.8-72.5% of cases (Table 7). Due to the missing data, the self-care variable was defined mostly by only one self-care task, lower body dressing. More thorough documentation on self-care status is needed for future research. Also, there was no formal training for the occupational therapists on how to document levels of independence for self-care tasks, which may have confounded results. The levels of independence are documented subjectively by occupational therapists based on mentorship and clinical judgement. We tried to minimize the variations in the documentation on levels of independence by creating only two groups, no physical assistance versus physical assistance.

For the social support and housing situation, there were no standardized methodologies for how the data was entered into the EMR. The information could have been collected from the patient, family members, or documentation by other health care professionals on the patient's medical team while hospitalized. Therefore, there may be some inaccuracies in the data. Lastly, the description of social support was limited. More information on the quality of social support available for the patient after discharge from the hospital would be beneficial in future research. This detailed data is not available in Epic Clarity.

3.6 Conclusions

Self-care status, social support and housing situation were not significantly associated with readmission risk for Medicare inpatients with an HRRP diagnosis. The findings may reflect the inadequacies of acute OT documentation. Acute rehabilitation departments may want to consider creating guidelines on documentation of self-care tasks to ensure consistent and complete documentation. Future studies should consider using a standardized measure for self-care status that provides a comprehensive report on all self-care tasks.

4. Research Paper 3: OT activities and interventions according to CPT codes

4.1 Introduction

Occupational therapy (OT) practices vary widely between geographical locations, facilities, and clinicians. Specifically within the acute care setting, there is a paucity of data on which interventions therapists actually utilize when treating patients (Dijkers, Hart, Tsaousides, Whyte, & Zanca, 2014; Keith, 1997). This makes it difficult to establish clinical pathways and best-practice guidelines and creates challenges to defining which interventions are mostly likely to produce targeted outcomes. To ensure OT's continued advancement in the quality and outcome focused health care environment, more descriptive research is needed on the content of acute care OT sessions and their impact on quality outcomes such as hospital readmissions. Readmissions cost the United States (US) $26 billion annually (Boozary et al., 2015), and are associated with poor patient outcomes including higher risk of mortality, sleep disturbances, nutritional issues, and deconditioning as a result of bedrest or inactivity (Fernandez et al., 2015; Krumholz, 2013; Luan et al., 2014). Medicare created the Hospital Readmission Reduction Program (HRRP) in an effort to reduce readmissions. HRRP penalizes acute care hospitals by up to 3% of reimbursement if they have excessive readmissions for any of the following diagnoses: acute myocardial infarction (AMI), pneumonia (PN), heart failure (HF), chronic obstructive pulmonary disease (COPD), coronary artery bypass graft (CABG), and total hip/knee arthroplasty (THA/TKA). Occupational therapists frequently evaluate and treat patients with HRRP-qualifying diagnoses and may have a significant role to play in reducing readmission risk through discipline-specific activities and interventions.

Rehabilitation clinicians frequently cite clinical judgement and trial and error as approaches to practice, making examination of the content of OT sessions extremely difficult due to the lack of consistency and no formal taxonomy of rehabilitation treatments (Zanca & Dijkers, 2014). This conundrum of rehabilitation practice has been coined the "black box" of rehabilitation practice (DeJong et al., 2004). A few studies have begun to examine the content of OT sessions for a limited number of

diagnoses outside of the acute care setting including stroke, THA, TKA, spinal cord injury and traumatic brain injury (DeJong et al., 2009; Latham et al., 2006; Richards et al., 2005; Whiteneck, Gassaway, Dijkers, & Jha, 2009). The content of the OT sessions has been categorized as either activities or interventions. Activities are defined as whole tasks that are the focus of the therapy session. Interventions are specific treatment approaches by occupational therapists to facilitate activities (Latham et al., 2006; Smallfield & Karges, 2009). All the studies examining the content of OT sessions have been conducted in either inpatient rehabilitation facilities or skilled nursing facilities. Most of the studies limited the descriptions of the OT sessions to a list of OT activities and interventions created prior to the study and focused on percentage of time spent on the specific activities and interventions (DeJong et al., 2009; Latham et al., 2006; Richards et al., 2005). To gain a deeper and practical understanding of the content of OT sessions in the acute care setting, insight from the occupational therapists who implemented the activities and interventions is needed. Also, in order to apply findings to research and practice, a common language is needed to organize and document the findings.

Acute OT activities and interventions are currently documented in the Electronic Health Record (EHR) according to Current Procedural Terminology (CPT) codes; this is in accordance with the Administrative Simplification Section of the Health Insurance Portability and Accountability Act of 1996 to use CPT codes (American Medical Association, 2019; US Department of Health and Human Services, 2014). The American Medical Association (2019) has assigned broad definitions to each CPT code; the broad definitions give occupational therapists flexibility when selecting which CPT codes are appropriate for the OT activities and interventions delivered. However, this breadth can lead to ambiguity in how to code specific activities and interventions and can create challenges in determining which activities or interventions are the most effective in achieving desired outcomes. Since CPT codes are a national standard and embedded in all electronic documentation, collection of these codes for large scale research is feasible. If the content of OT sessions could be accurately described using CPT codes, it would provide excellent insight into the content of OT sessions on a large scale and allow for examination of how the OT session content is related to patient outcomes, such as readmissions.

The primary objective of this study was exploring the perspectives of acute care occupational therapists regarding what OT activities and interventions are implemented for patients with HRRP-qualifying diagnoses (AMI, HF, PN, COPD, CABG, and THA/TKA) as well as to gain insight on their decision-making process for selecting CPT codes. Our use of CPT codes to categorize the findings on activities and interventions was intentional, in order to provide a familiar and applicable framework for acute occupational therapists. This is an important step in a line of research that could focus on linking specific OT practices with optimal patient outcomes.

4.2 Methods

4.2.1 Design and Participants

The study used a phenomenology framework to explore what activities and interventions occupational therapists provide during acute OT sessions according to CPT codes and how they bill for CPT codes. Also, the billing process following completion by the acute occupational therapists was examined with billing experts to identify if changes occurred. The sample population was comprised of acute care occupational therapists and billing experts who work at Froedtert Hospital (Froedtert). Froedtert is a large academic medical center and level I trauma center in Milwaukee, Wisconsin with 735 inpatient beds (“Froedtert & Medical College of Wisconsin”, 2019). There are 78 occupational therapists at Froedtert; all with experience submitting CPT codes. A convenience sampling process was used for recruitment of therapists. Individuals were invited to participate via email, flyers, and communications with rehabilitation leadership. Billing experts were identified, and purposively selected, by leadership within the billing department at Froedtert.

4.2.2 Ethics

Institutional review board (IRB) approval was obtained from the Medical College of Wisconsin (MCW) and Virginia Commonwealth University (VCU). MCW’s IRB reviews all potential research at Froedtert, which was the site of the study. This study was part of a dissertation being completed at VCU and to fulfill the dissertation requirements the additional IRB review at VCU was completed.

4.2.3 Qualitative Data Collection

Data was collected from focus groups and interviews. Evidence has shown that focus groups are similar to individual interviews in terms of number and quality of ideas generated; focus groups are a widely accepted methodological approach to qualitative studies (Kidd & Parshall, 2000). Four focus groups were conducted with an average of four occupational therapists per focus group. Scheduling was structured to limit each focus group to four occupational therapists to maximize engagement from the participants (Polit & Beck, 2017). However, due to scheduling conflicts the minimum size of a focus group was three participants and the maximum size was five participants. By conducting a minimum of four focus groups, it was expected that 90% of discoverable themes would be identified (Guest et al., 2016).

Prior to the focus groups, each participant received a brief questionnaire used to obtain demographic details (Appendix J). The questionnaire contained questions about the occupational therapist's years of clinical experience, area of expertise, level of education, age, and sex. Each focus group was approximately one hour in length. While it is more typical for focus groups to be two hours, the one-hour timeframe was needed for practical purposes in the clinical setting. Some of the occupational therapists who participated in the focus groups were doing so on their lunch break during clinical practice, which is only one hour. An interview schedule of six questions with prompts was created using Krueger & Casey's (2015) good questioning route guidelines, an extensive literature review on the topic, and collaboration with occupational therapists who do not work at Froedtert (Appendix K). The interview schedule focused on CPT codes used in a previous study done by the authors of this study.

All of the focus groups were moderated by the lead author (J.E.) and completed via the video conference platform, Zoom. Zoom is a collaborative, cloud-based videoconferencing platform with features including online meetings, group messaging services, and secure recording of sessions (Zoom Video Communications Inc, 2016). Zoom was used as opposed to face-to-face interactions because the focus groups were conducted during the 2020 COVID-19 pandemic. As a result of the

precautions taken during the pandemic, any research activities that could have increased participants' risk of contracting COVID-19 compared to regular work responsibilities were not permissible, including face-to-face interactions for focus groups. Several steps were taken to ensure the confidentiality and privacy of the focus group participants. For each Zoom focus group, all participants' identification banners in Zoom were changed to random numbers. Participants were asked to not use each other's names during the recorded Zoom sessions. No participants were grouped together in-person for the Zoom sessions. They either participated from their own home or a small individual private room with no window at Froedtert. During the scheduling process, each participant was asked not to discuss their planned participation in the study to protect their privacy and the privacy of other participants.

The first five minutes of the focus group included introductions of the moderator and the research assistant and communication of the ground rules (Appendix L). A research assistant was present during all focus groups to record who was speaking, body language, and group dynamics. The interview questions were not shared with the participants prior to the focus group and the discussion flow was question, discussion, question. This flow allowed participants to focus on the individual questions rather than thinking ahead to future ones. The questions were in open-ended format with the first question being more general (Krueger & Casey, 2015). Specific time allotments for discussion of each question was assigned by the moderator to help pace the discussion. Prompt questions were asked as appropriate. While the focus group was occurring, the moderator summarized the ideas of the focus group participants who were then encouraged to agree or disagree with the summaries provided and asked to provide more details as needed. The moderator also challenged ideas if groupthink appeared to be occurring (Portney & Watkins, 2009). The focus group discussions were audio recorded and transcribed by the transcription service Rev (Rev, n.d.). A $10 gift card to a local café was provided for all participants after completion of the demographic sheets and focus groups.

After the focus groups were complete, 1:1 interviews occurred with two Froedtert billing experts. Interviews with the Froedtert billing experts were performed to determine if any changes were made

by the billing department to CPT codes submitted by the occupational therapists prior to being submitted for reimbursement. The billing experts were given the option to participate in the interview via Zoom or phone; both participants opted for a phone call. The 1:1 interviews followed a semi-structured interview script (Appendix M) and were limited to one hour. Exploratory questions were asked as appropriate. Similar to the focus groups, the interviews were audio recorded and transcribed by the transcription services, REV (Rev, n.d.)

4.2.4 Qualitative Analysis

The qualitative data analysis software, ATLAS.ti Version 7, was used for coding, text retrieval, data management, and content analysis (Scientific Software Development GmbH, 2019). The coding process entailed labeling units of data (lines, sentences, and/or paragraphs) then aggregating units into themes. To ensure the highest possible coding consistency, all coding was done by the lead author (J.E.) (Polit & Beck, 2017). Themes were guided by the study's research questions and emerged during data analysis. The themes that emerged from the data were used as categories for the data. After the themes were identified by the lead author (J.E.), they were validated by another author of the study, L.C. The validation process included L.C. reviewing the focus group transcripts and identifying themes without any prior knowledge of the themes identified by J.E. Then, J.E. and L.C. compared the independently identified themes and came to an agreement on the final themes extracted from the data.

Validation of the study's results was also done by establishing the study's trustworthiness by using Lincoln and Guba's (1985) evaluative criteria for qualitative studies (Table 9). The evaluative criteria includes examination of the study's creditability, transferability, dependability, and confirmability. The study's creditability was established by discussing emerging themes with the research assistant immediately following the focus groups. Themes were also discussed and confirmed with the study author, L.C. Lastly, member checking was performed to establish credibility. All focus group participants were invited to participate in the member checking. Member

checking allowed the focus group participants to review the identified themes and express, directly to the lead author, if the themes accurately characterized their experiences. Member checking has been used successfully in the literature and is the most practical option for acute occupational therapists (Birt, Scott, Cavers, Campbell, & Walter, 2016). Transferability was established by using direct quotes that richly describe themes in the data (i.e. thick description). Dependability was established by oversight from the dissertation committee who ensured adherence to the study's planned methodology. Also, the research assistant and audio recordings are validation methods to demonstrate the interview schedules were followed by the moderator during the focus groups and interviews. Lastly, confirmability was established by creating and maintaining all needed documentation to reproduce the study (i.e., audit trail of study protocol, IRB approval, focus group transcripts, and study results). The study results were organized by the themes identified from the data and feedback collected from member checking participants. Exact words of the focus group participants were used as able.

Table 9.

Lincoln and Guba's Evaluative Criteria

Evaluative Criterion	**Methods to establish trustworthiness**
Creditability	- Discussion of emerging themes with research assistant and author (L.C.) - Opportunity given to all focus group participants to participate in member checking
Transferability	- Identification of quotes to describe themes
Dependability	- Dissertation committee oversight - Presence of the research assistant during all focus groups to ensure the interview schedule was followed - Transcriptions of the focus groups and interviews to ensure the interview schedules were followed
Confirmability	- Creation and maintenance of all documentation needed to reproduce the

	study (Study protocol, IRB approval, focus group and interview transcripts, study results)

4.3 Results

4.3.1 Participant Characteristics

The final sample was comprised of 16 occupational therapists who participated in the focus groups, and two billing experts who were interviewed individually. The sample for the focus groups, which included only occupational therapists, only had female participants (100%) and the most common level of education for the group was a master's degree (75%) (Table 10). The two most common age groups were 20-30 (44%) and 31-40 (44%). Approximately half of the sample (56%) had 0-5 years of experience. For the remaining half of the sample, years of experience included 6-10 years (19%), 11-20 years (13%), and 21-30 years (13%). Areas of expertise noted for the occupational therapists were neurological (50%), general medicine (25%), orthopedics (13%), oncology (6%) and cardiology (6%).

Table 10.

Participant Characteristics

Participant Characteristics	N(%)
Sex	
Female	16 (100%)
Male	0 (0%)
Age	
20-30	7 (44%)
31-40	7 (44%)
41-50	2 (13%)
Years of experience	
0-5	9 (56%)
6-10	3 (19%)
11-20	2 (13%)
21-30	2 (13%)
Highest level of education	
Bachelor	3 (19%)
Masters	12 (75%)
Doctorate	1 (6%)
Practice specialty area	
General medicine	4 (25%)

Oncology	1 (6%)
Ortho	2 (13%)
Cardiac	1 (6%)
Neuro	8 (50%)

4.3.2 Focus Group Themes

THEME 1: Description of acute OT activities and interventions according to CPT codes: practice variation exists.

The three most frequently discussed CPT codes in the focus groups were: self-care/home management (occasionally referred to as ADLs by the focus group participants; CPT code: 97535), therapeutic activities (CPT code: 97530) and therapeutic exercise (CPT code: 97110). The three CPT codes were referred to by one participant as the "big three." One participant described being a new hire and how the three CPT codes were highlighted in training, "…what the floor guide had told me about is primarily using of the three of ADLs, therapeutic activity, and exercise and those were what you typically would use." The only other CPT code discussed was the development of cognitive skills CPT code (CPT code: G0515).

There was some consistency among the participants on the activities and interventions implemented, however practice variation also existed. The OT activities and interventions provided by the participants for self-care/home management training, therapeutic activities, therapeutic exercise, and development of cognitive skills CPT codes are listed in Table 11. The greatest variation centered around the use of the therapeutic activities code; as noted in Figure 9, overlap occurred between OT activities and interventions listed under the therapeutic activities code and all the other codes discussed. The therapeutic activities CPT code was frequently described as a "catch-all" code for activities and interventions: "I just throw them [OT activities and interventions] all under therapeutic activities", "it does entail(s) a lot", "I feel like I tend to use therapeutic activities more for just kind of general stuff", and "I'll do therapeutic activity as a bill to encompass a lot." One participant reported "I kind of use Ther Act (i.e., therapeutic activities) as a catch-all, often."

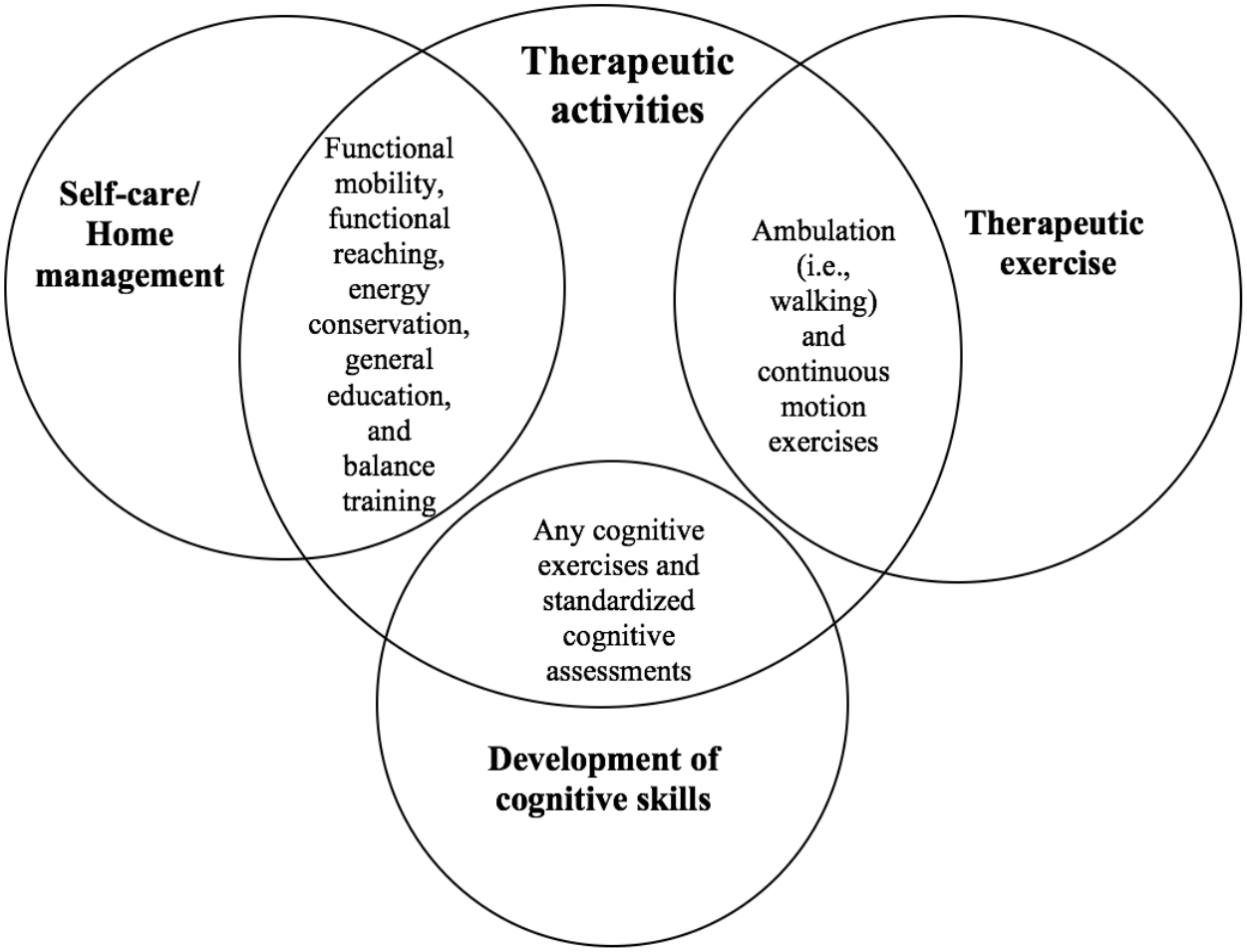
Table 11.

OT activities and interventions according to CPT codes

CPT codes	OT activities and interventions
Self-care/home management	Bathing, dressing, toileting, toilet transfer, grooming, shower transfer, tub transfer, cooking tasks, kitchen safety, kitchen mobility, medication management, money management, item retrieval, item transportation, functional mobility, functional transfers, functional reaching, education on adaptative techniques, caregiver education, laundry, instrumental activities of daily living, education on durable medical equipment, balance training, energy conservation, general education, and safety education
Therapeutic activities	Functional mobility, functional reaching, energy conservation, general education, balance training, ambulation (i.e., walking), continuous motion exercises, preparatory work, trunk co-activation, pursed lipped breathing, "normal transfers", item retrieval, dynamic standing activities, dynamic seated activities, standing at the table while working on reaching or diagonal patterns, increasing attention to affected side, shoulder arch, reaching for cones, organizing cabinets, sitting on the edge of the bed, weight shifting, sitting tolerance, co-treating with Physical Therapy, bed to chair transfers, verbal training, any activity using a prop, cones, bean bags, folding towels, hitting a balloon, any cognitive exercises, and standardized cognitive assessments
Therapeutic exercise	Ambulation (i.e., walking), continuous motion exercises, free weights, endurance training on the ergometer bike, theraband, theraputty, home exercise programs, any activity with repetition or resistance and no other functional component, active assisted range of motion, arm exercises, strengthening exercises (legs, arms, and core), Nu-step machine, and range of motion exercises (i.e., arm exercises)
Development of cognitive skills	Any cognitive exercises, standardized cognitive assessments, word searches, daily scheduling, journaling, compensatory strategies, orientation exercises, calendar activities, problem solving, planning, sequencing, and organization

Figure 9.

Overlapping OT interventions and activities



While therapeutic activities was reported as a "catch all" for some participants, it was the self-care/home management CPT code that participants identified using most frequently, with one participant sharing, "…a lot of the time I am using a task or an occupation performance in therapy, so a lot of self-care code." Rarely and never used CPT codes were identified as development of cognitive skills, neuro-muscular re-education (CPT code: 97112), and therapeutic procedures (CPT code: 97150). When one participant described their experience using the development of cognitive skills CPT code, they stated, "It's super, super rare and usually when I do, it's a one-time thing."

Previous guidance from rehabilitation leadership either at past employment or at Froedtert encouraged caution when billing the development of cognitive skills CPT code due to the risk of duplicate billing with Speech Therapy. As a result, the participants appeared to categorize cognitive activities and interventions under the therapeutic activities CPT code: “it was a while ago that we were told not to billed that kind of code anymore [development of cognitive skills] and so it changed to the therapeutic activity” “a lot of it [development of cognitive skills] is built into the therapeutic activities.”

THEME 2: Client-centered care and patient education provides guidance to acute occupational therapists when selecting OT activities and interventions; client-centered care strongly influences goals created for patients.

The decision-making process for the participants to select OT activities and interventions was complex and included multiple considerations. The participants repeatedly discussed the importance of client-centered care in practice. Client-centered care influenced what OT activities and interventions were selected for patients and the goals created for patients. The participants described client-centered care as an overarching concept that impacted all areas of practice but used goals as a way to express how their care was client-centered: “One of the only things that matters is the client's goals and getting there.” “Trying to use those activities in order to get to and resolve their goal, whatever the intervention is, or the outcome is.” To achieve the goal set for the patient, the occupational therapists would accordingly select OT activities and interventions. Other descriptors used for client-centered care by the participants included, “patient-dependent”, “patient-driven”, and “looking at them (patients) as individuals”. One participant stressed the importance of client-centered care; wanting their patients to receive care that was “meaningful….at that moment”.

Educating patients on how to perform tasks safely and efficiently to optimize the patient’s success at home was also expressed as an important aspect to practice and drove what OT activities and interventions were selected by the participants. If more education was felt to be needed, then OT

activities and interventions were adjusted accordingly. The description of the educational piece of care included, “I feel like education is a huge thing with patients” and “it's so integrated into everything that we're doing. We don't often teach a task without educating first or addressing them first.” Despite the strong presence of education in the OT activities and interventions delivered by the participants, the participants felt that the education was not well represented in the available CPT codes: “There's no discharge advice code” and “I'm always doing education, but there's not a code that says education on fall prevention or education on how important it is to take your medicine”. Less consistent considerations expressed by the occupational therapists when considering what OT activities and interventions to implement were patients’ expected length of stay, social support, functional capability, discharge location, and diagnosis.

THEME 3: Context was a major consideration for acute occupational therapists when selecting CPT codes.

The participants consistently expressed context as a major consideration when selecting CPT codes to reflect the activities and interventions delivered during the OT session. Depending on the context of the session, the selected CPT code could change. One participant shared, “If I would transfer them to the toilet or into the shower that would be ADL [CPT code], but to me, I'm practicing that transfer, but not in the ADL context, so that would be a therapeutic activity [CPT code].” For this example, the intervention is the same, mobility training, however, the context in which the intervention occurred is different and changed the CPT code selected by the participant. Other participants reported how context influenced the selection of CPT codes, “If we're standing…for balance, then I'll do it as therapeutic activity [CPT code]. But if we're standing and doing it so they can actually then progress to unloading the dishwasher or hanging their clothes up, then I'd probably do it as self-care [CPT code].” and “If I was specifically just focusing on balance and not incorporating home management into it, then I would maybe not do self-care [CPT code], but if it was something like while they were doing a cooking task or doing something in their room like folding laundry or something while incorporating balance, then I feel like I would do self-care [CPT code].”

THEME 4: Several types of training informed acute occupational therapists' decision-making process for selecting CPT codes.

In addition to directly examining the decision-making for selecting OT activities and interventions according to CPT codes, the focus group also included discussions on the training that has guided the participants' decision-making process for selecting CPT codes. The participants unanimously identified that they received training on submitting CPT codes, however the types of training varied and included both formal and informal methods. The types of training identified by the participants were (1) mentorship received during clinical rotations as a student or during orientation as a new occupational therapist, (2) education provided while in OT school, and (3) peer-influence once working as an independent occupational therapist. The most common type of training discussed was informal training from mentors while they were students or new occupational therapists. For example, one participant stated, "I feel like I just kind of picked [it] up during fieldwork, both my fieldworks [were] acute care and so just a lot of what my CI (clinical instructor) said." The second type of CPT code training identified by the participants was provided during OT school: "Just what we were taught in school." and "I think it still goes back to school for me." Most participants did not elaborate on what the training during school entailed but the training seemed to be more formal and part of the academic curriculum. One participant expressed that only general training was received in school on CPT codes: "In school it was more of a broad overview and like some of the other participants were saying, some of those billing codes or CPT codes might not be as applicable depending on what practice you're in." The third type of CPT code training discussed among the occupational therapists was peer-influence. Peer-influence included reading other occupational therapists' documentation and face-to-face discussions. One participant reported, "Reading other people's documentation and seeing what they do" to better understand how to select CPT codes. Another participant compared learning about CPT codes in school to discussions with peers, "I'd say probably discussion with peers is more applicable." All education on CPT codes was done proactively at the beginning of the occupational therapists' career or self-initiated through discussions with peers;

none of the participants reported receiving follow-up guidance on CPT codes: “I've never gotten really any pushback from anything I've ever billed”, “No one's ever challenged the code I've chosen, or questioned it”, and “I don't think I've ever gotten any feedback on billing”.

4.3.3 Results from interviews with billing experts

Acute occupational therapy billing is not directly submitted by the occupational therapists for reimbursement from insurers. At Froedtert, the billing is reviewed by experts prior to submitting it for reimbursement. To identify if frequent changes were applied to the OT billing, interviews with Froedtert billing experts were conducted. Interviews with the billing experts at Froedtert reported that the only potential changes that may occur to the acute occupational therapists billing after it is submitted is from chart audits done by leadership or peers. The interviewees reported the chart audits are, “on a very low volume, but a random basis too”. When asked how frequently occupational therapists are changing their CPT codes as a result of the chart audits, the interviewee stated, “Rarely…. I don't think we often see it. I think sometimes there's an opportunity where it falls between two codes. It could be charged by either one. But I don't think anybody ever charged ... I think rarely we have the wrong code.” One interviewee reported modifiers, such as the KX and 59 modifiers, are occasionally applied to acute OT billing but changes to the billing do not occur as a result of the modifiers being applied.

4.3.4 Results from member checking

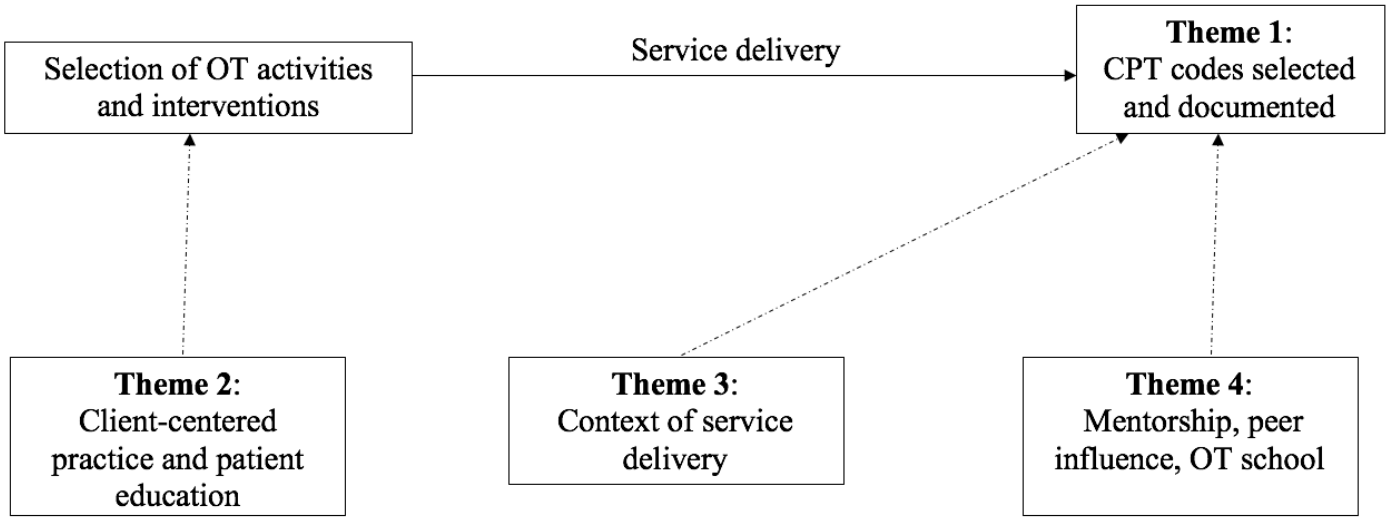
All of the focus group participants were invited to participate in the member checking process. The four themes were sent to the participants for review. Feedback and validation from the participants on the themes were requested. Sixty-three percent of the participants responded to the member checking request and 100% confirmed the themes were valid. No further feedback was provided by the participants on the themes.

4.4 Discussion

The primary objectives of the focus groups were to gain a deeper understanding of what OT activities and interventions acute occupational therapists provide to patients while hospitalized in acute care settings and to gain insight into acute occupational therapists' decision-making process for selecting CPT codes. To the best of our knowledge, our study is the first to examine the content of acute care occupational therapy sessions using insight from occupational therapists. Data from the focus groups resulted in four themes: (1) description of acute OT activities and interventions according to CPT codes: practice variation exists, (2) client-centered care and patient education provides guidance to occupational therapists when selecting OT activities and interventions; client-centered care strongly influences goals created for patients, (3) context was a major considerations for acute occupational therapists when selecting CPT codes, and (4) several types of training contribute to acute occupational therapists' decision-making process for CPT codes. Figure 10 depicts how the themes integrate to inform OT practice.

Figure 10.

Model of how themes integrate to inform OT process in acute care



Our study took a novel approach to examining the content of acute OT sessions by gaining insight directly from occupational therapists and organizing findings by CPT codes. Previous studies that have examined the content of OT sessions have used a list of OT activities and interventions created prior to the study and did not organize the activities and interventions by CPT codes (DeJong et al., 2009; Latham et al., 2006; Richards et al., 2005). Organizing our findings by CPT codes may allow future studies to evaluate associations between CPT codes and outcomes with a better understanding of the activities and interventions that occur for each code. However, according to our findings, there are discrepant interpretations regarding which OT activities and interventions align with unique CPT codes. Specifically, each CPT code discussed had activities and interventions that overlapped with the code for therapeutic activities. The American Medical Association (AMA) (2019) defines the therapeutic activities CPT code as "direct (one-on-one) patient contact (use of dynamic activities to improve functional performance)". It is a vague definition that understandably leads to ambiguity in the code's usage. All the other CPT code definitions are similarly vague, making it difficult to cross reference the formal definition of the CPT code with the reports of the occupational therapists. The only specific discrepancy noted between the formal AMA definitions and the practice definitions was for the skill of money management. Money management was categorized by our participants under the self-care/home management CPT code; however, the AMA categorizes money management under the community/work reintegration training CPT code, which was not brought up by any of our participants in any of the focus groups.

The inconsistencies found between the OT activities and interventions used and the CPT codes billed may have also resulted from the diverse training on CPT codes that the acute occupational therapists received. The types of training included (1) mentorship received during clinical rotations as a student or orientation as a new occupational therapist, (2) education provided while in OT school, and (3) peer-influence once working as an independent occupational therapist. Two of the types of training, mentorship and peer-influence, were described as informal. The training received in school was more formal but was described as broad and not always applicable to the environment where the OT student was eventually employed. The Accreditation Council for Occupational Therapy Education (ACOTE)

(2018) provides limited details on what is required of OT students to become proficient in CPT codes. The most recent ACOTE standards state that OT students must, “demonstrate knowledge of…..coding and documentation requirements that affect consumers and the practice of occupational therapy” (Accreditation Council for Occupational Therapy Education, 2018, p. 34) No specifics are offered on how OT students should demonstrate their knowledge of CPT codes. The education received in school by occupational therapists appears to create pliability to education received in the practice environment. It is debatable if this pliability is a benefit to the OT profession. It seemed to contribute to variability within the one facility examined in this study, suggesting that there is even greater potential for significant inconsistencies between facilities spread across the US. CPT are used as the national standard for acute OT billing and are intended to be uniform across facilities (US Department of Health and Human Services, 2014). If any future research were to use CPT codes to identify the impact of OT activities and interventions on patient outcomes using data from multiple facilities, it would be very difficult to determine with a high level of certainty the content of OT sessions based on CPT codes alone.

Client-centered care was described as an important focus in practice and helped to guide selection of the OT activities, interventions, and goals created for patients. Patient education was also reported to guide the selection of OT activities and interventions. Our findings indicate that client-centered care appeared to be operationalized in practice through goal setting for patients. Client-centered care is a strong principle of the OT profession and has been present in the values of the profession since its inception (Bing, 1981). The theme is also consistent with the current Occupational Therapy Practice Framework which describes the OT process of care as the delivery of client-centered services and outcomes (American Occupational Therapy Association, 2017). Client-centered care has been compared to patient-centered care, which is a crucial component of the Affordable Care Act and has influenced the development of the Triple Aims, with several similarities noted (Berwick, Nolan, & Whittington, 2008; Leland et al., 2015; Mroz, Pitonyak, Fogelberg, & Leland, 2015). Patient-centered care is an important area of research with little understood on how it translates into patient outcomes. Due to the similarities between client-centered care and patient-centered care, OT is well positioned to evaluate the association

between client-centered care and outcomes. Discrepancies between occupational therapists on CPT code usage may be reduced if client-centered goals were organized by CPT codes. Patient education appeared to also drive selection of OT interventions and activities. It was highlighted as an important area of practice by the participants. Patient education was expressed as a fluid concept that was not limited to one specific CPT code, but also not well-represented by any of the CPT codes. Future research may want to examine the CPT code frequently used by occupational therapists to represent education provided and its impact on patients outcomes.

The selection of CPT codes appeared to be dependent on the context in which the care was delivered by the occupational therapists. Context is one of the domains of OT practice and believed to significantly impact a patient's occupational performance; when the context changes, a patient's performance can change (American Occupational Therapy Association, 2017). Interestingly, the context of the OT session appeared to impact not the OT activities and interventions, but the CPT codes selected. This may have been influenced by the acute care setting. In the acute care setting, most of the OT sessions are done within the confines of a hospital room resulting in limited options for OT activities and interventions. However, the context in which the activities and interventions are performed can be changed. For example, an occupational therapist may work with a patient on functional transfers. If the functional transfers are being done on the toilet versus the chair the context of the intervention changes and thus the CPT code would change, but the intervention remains the same.

A topic that was not included in the focus group interview schedule but came up spontaneously multiple times during the focus group discussions was insight from the occupational therapists on why they think OT may be responsible for reducing readmission. Feedback from the occupational therapists consistently focused on practical education on function and safety as reasons for how OT may reduce readmissions. When function is described by occupational therapists it usually entails ADLs, functional transfers, functional mobility, IADLs, and home safety. Focusing on these areas of practice is consistent with previous literature demonstrating that patients have a higher likelihood of readmission if they experience impairments with ADLs, IADLs, and mobility (Greysen et al., 2015; Middleton, Downer, et

al., 2018; Pisani et al., 2018). However, the focus on safety education as a mechanism for reducing readmissions is new to the discussion on the role of OT in reducing readmissions. Future studies may want to explore the educational aspect occupational therapists provide on function and safety as methods OT may use to reduce readmissions.

4.5 Study Limitations

The circumstances of this study were unique because the focus groups were done during the 2020 COVID-19 pandemic. Due to the limitations on face-to-face research during the pandemic, it was not possible to conduct the focus groups in-person, so they were done via the video conference platform, Zoom. Limitations associated with conducting the focus groups via Zoom were less interaction between the participants because it was difficult to read body language and non-verbal cues and there were more distractions (e.g., family members, children, bad connection) if the participant was connecting from home. However, conducting the focus groups over Zoom may have led to an increased number of overall participants because the scheduling of the focus groups was flexible. Three out of the four focus groups were done during the evening hours while the participants were at home.

The focus group and interview participants were only recruited from one location, Froedtert. Participant recruitment from only one location may limit the generalizability of the results of the study. However, Froedtert belongs to the largest category of hospitals in the US, which is non-government, not-for-profit hospitals, so it is reasonable to assume that the characteristics of the occupational therapy staff at Froedtert is similar to numerous other US hospitals (Froedtert & Medical College of Wisconsin, 2019).

4.6 Conclusions

The findings of our study provide a deeper understanding of the OT activities and interventions implemented according to CPT codes in the acute setting and acute occupational therapists' decision-making process for selecting CPT codes. By better understanding the content of the acute OT sessions it may be possible to identify specific OT activities and interventions that are responsible for specific patient outcomes, such as reduced readmissions. Also, elucidating occupational therapists' decision-

making process for selecting CPT codes provides a foundation for where the OT profession can apply improved instruction for OT students and clinicians to ensure there is consistency among the profession on how and when CPT codes are used. Future studies should explore the input from occupational therapists at multiple facilities across different geographical regions to gain more insight into the OT process of selecting of OT activities and interventions according to CPT codes.

5. Conclusion

The papers presented in this dissertation were conducted in an effort to determine if acute care occupational therapy (OT) service delivery factors and client factors, including patient level of independence with self-care tasks and social factors, were associated with reduced risk of readmission for Medicare patients with a Hospital Readmission Reduction Program (HRRP)-qualifying diagnosis. Furthermore, acute OT billing practices were explored, with a focus on understanding how current procedural terminology (CPT) codes were used to bill for OT activities and interventions the acute care setting. All three studies were based upon conceptual proposals suggesting that OT activities and interventions have the potential to be a significant contributor in the effort to reduce readmissions, as well as prior research findings that OT services are associated with reduced readmissions without exploration of the mechanism (Andrews et al., 2015; J. F. Burke, Skolarus, Adelman, Reeves, & Brown, 2014; Roberts & Robinson, 2014; Roberts et al., 2020; Rogers et al., 2017a). To remain current and relevant in the quality-focused United States (US) health care system, it is imperative for the OT profession to identify how it can contribute to quality metrics such as reducing readmissions. The aforementioned dissertation studies successfully addressed gaps in research identified throughout the papers and contributed to the evidence on the role of OT in reducing readmission in a meaningful and impactful way.

5.1 Results from Paper 1, 2, and 3

The findings for all three studies provided valuable insight into the role of OT in reducing readmissions while also providing a foundation for future research. Paper 1 focused on OT service delivery factors and compared CPT codes for patients who were readmitted versus not readmitted. The study included over 6,000 Medicare inpatients with HRRP-qualifying diagnoses. The results demonstrated that patients who received a higher duration and frequency of OT services, normalized to their length of stay, were less likely to be readmitted to the hospital. Receipt of any OT services, defined by initiation of OT treatment, however, was not found to be associated with reduced readmission

compared to no initiation of OT treatment. These results were consistent with previous research on the use of acute OT services and its impact on readmissions, however most previous studies did not specify the duration and frequency of OT services and only reported higher use of OT services as associated with reduced readmissions (Andrews et al., 2015; J. F. Burke et al., 2014). Our study provided more granular details needed for eventual implementation into practice. Interestingly, our results differed from Kumar and colleagues (2019), who determined that only higher duration of PT services (not frequency) was associated with reduced likelihood of readmissions. One possibility for this discrepancy is that Kumar et al. (2019) included only ischemic stroke patients in their study, while our study included all of the HRRP diagnoses. It is also possible that there is something unique about OT services that makes frequency a more salient factor for reducing readmissions compared to PT services; this may warrant further exploration. The results of Paper 1 also indicated that patients who were not readmitted to the hospital after an acute care stay received higher amounts of self-care/home management training (as indicated by CPT codes) compared to patients who were readmitted to the hospital. Our findings on the self-care/home management CPT codes were novel. Previous research on the content of OT sessions has focused on characterization of the OT sessions rather than linking the content of OT sessions to outcomes, such as readmission (DeJong et al., 2009; Latham et al., 2006; Richards et al., 2005). Our study supports the provision of higher durations and frequency of OT services focused on improving patients' skills to perform daily self-care tasks and overall safety to return home after hospitalization.

Paper 2 of this dissertation examined the association between patient independence level with self-care tasks, social factors (social support and housing situation), and readmission. The study used the same Medicare inpatients with HRRP-qualifying diagnoses included in Paper 1. There was no association found between self-care tasks or social factors and readmission. The self-care tasks evaluated were limited due to missing data. Missing data on self-care tasks ranged between 33%-73% depending on the specific self-care task. To maximize the study sample, a patient only needed one self-care task documented by an occupational therapist to be included in the study. The self-care task that had the least amount of missing data (33%), and therefore represented the majority of the sample, was lower body

dressing. This approach did not provide a comprehensive representation of patients' level of independence with self-care tasks but was the most practical option. The social factors included in the study were social support and housing situation. Both were evaluated separately and found to not be associated with readmission.

Lastly, Paper 3 focused on what OT activities and interventions acute care occupational therapists implemented according to CPT codes billed for patients with HRRP-qualifying diagnoses. Insight was also gained regarding the acute care occupational therapists decision-making process for selecting CPT codes. Four focus groups were conducted via Zoom with a total of 16 participants. The focus groups ranged in size between 3-5 participants. Two supplemental interviews were also completed with billing specialists to determine if any changes were made to the CPT codes after being submitted by the occupational therapists. Four primary themes emerged from the focus groups: (1) description of acute OT activities and interventions according to CPT codes: practice variation exists, (2) client-centered care and patients education provides guidance to acute occupational therapists when selecting OT activities and interventions; client-centered care strongly influences goals created for patients, (3) context was a major consideration for acute occupational therapists when selecting CPT codes and (4) several types of training informed acute occupational therapists' decision-making process for selecting CPT codes. Results from the interviews indicated that the only changes made to CPT codes after being submitted by the occupational therapists were from quality audits done by peers or leadership. However, the billing specialists reported that changes to the CPT codes very rarely occur.

5.2 Implications of research findings

The findings for Paper 1 were consistent with most of the limited evidence on the impact of duration of OT services on readmissions (Andrews et al., 2015; J. F. Burke et al., 2014b). However, our study provided a novel contribution to the literature because the results included frequency of OT services and the current HRRP-qualifying diagnoses. Both duration and frequency of OT services are crucial components to be included in the analysis to enable the results to be applicable to practice. Duration and frequency are used in the daily operations of acute OT departments and determine OT staffing. By

identifying that both duration and frequency are linked with improved outcomes for patients, OT staffing could eventually be adjusted based on evidence to optimize outcomes. The evidence could also be used to create best practice guidelines that include the duration and frequency patients should be seen by OT while hospitalized for specific diagnoses.

In Paper 1, we also identified that patients who were not readmitted had a significantly higher amount of self-care/home management training by occupational therapists while hospitalized. Our study is the first to evaluate the content of OT sessions using CPT codes and readmissions. While it is difficult to determine the exact OT activities and interventions provided based on CPT codes alone, the results provide important data on what may be the "active ingredients" provided by occupational therapists that reduce readmissions. When occupational therapists bill the self-care/home management CPT code, their interventions and activities may include activities of daily living, compensatory training, meal preparation, safety procedures, and instructions in the use of assistive technology/adaptive equipment (American Medical Association, 2019). Identifying which OT activities and interventions that are associated with reduced readmissions could also lead to best practice guidelines on areas of practice to focus on for patients while hospitalized to reduce their chances of readmission.

No association between readmission and patient independence levels with self-care tasks or social factors were found for Paper 2. However, our study was the first to examine patient independence levels with self-care tasks and OT-related social factors in the acute care setting. The findings on self-care independence were inconsistent with the current evidence. Impaired functional status, specifically with self-care tasks, has been consistently found to be associated with increased likelihood of readmission in post-acute settings (Greysen et al., 2015; Middleton, Downer, et al., 2018; Middleton, Graham, et al., 2018). However, in post-acute settings, comprehensive standardized measures such as the such as the Inpatient Rehabilitation Facility – Patient Assessment Instrument and Minimum Dataset are used to evaluate independence level with self-care tasks and their completion is required by occupational therapists. There are standardized measures available to use in the acute care setting, but none are required; furthermore, there are no basic documentation requirements for occupational therapists in the

acute care setting, excluding facility dependent ones. As mentioned previously, there was a significant amount of missing data with lower body dressing being the most frequently documented self-care task. A higher level of independence with lower body dressing has been found to be protective against readmission at 90 days after discharge from inpatient rehabilitation (Galloway et al., 2016). Our study did not confirm these results but indicated that lower body dressing training is feasible with the majority of hospitalized patients and warrants further investigation as a protective measure against readmission for acute care patients. Without standardized documentation requirements, future research on self-care independence in the acute care setting will be exceedingly difficult. Future research on acute care practices would benefit from acute OT departments collectively deciding on standardized patient measures that would be practical to implement in the acute care setting and accurately measure patient progress while hospitalized.

Similarly, within Paper 2, social support and housing situation (social factors), were both found have no association with readmission. A prior study by Chan and colleagues (2019) showed that a high-level of perceived of social support, not simply the mere presence of another individual, is associated with reduced likelihood of readmission (Chan et al., 2019). The quality of social support was documented by acute occupational therapists at Froedtert during our study in a narrative format in the electronic medical record (EMR); this data is not readily adapted into research and requires labor intensive chart reviews to collect the data. Our study was the first to assess housing situation, which was also not found to be associated with readmission. Housing situation included the following categories: independent housing, supportive housing, transitional housing, and other. Transitional housing may indicate housing instability for some patients. Previous studies have examined housing instability and found it be associated with readmission (Calvillo-King et al., 2013). Our findings demonstrated that housing situation may not be a significant predictor of readmission. When occupational therapists perform the occupational profile during the OT evaluation, meaningful information about the home environment is collected such as bathroom setup, number of stairs to enter the home and inside the home, and available durable medical equipment. However, the information is not easily accessible for research purposes because it is in

narrative format in the EMR. The difficulties associated with performing research on these variables indicate a need for acute OT departments to identify areas where templated documentation could be used to augment, or to replace, narrative documentation to ensure access for research purposes. If acute OT practices and outcomes are not able to be evaluated by rigorous evidence-based methods, the profession is at risk of being left behind other professions that have already started to implement measurable quality metrics in their daily practices (Hodgin, 2019).

Paper 3 provided novel findings based on the insight from acute occupational therapists on what acute OT activities and interventions are provided according to CPT codes and the decision-making process for CPT code selection. Four themes were identified from focus groups conducted with acute occupational therapists. Inconsistencies were identified among the occupational therapists on CPT code usage according to OT activities and interventions. All the CPT codes discussed had OT activities and interventions that overlapped with the therapeutic activities CPT code. Also, the training that resulted in the occupational therapists' decision-making process for selecting CPT codes varied and mostly resulted from informal methods such as mentorship and peer-influence. While OT school was reported as an educational resource on CPT codes, the occupational therapists placed greater value on the training they received from mentors and peers. This disconnect between the formal training received in OT school and the informal training received by mentors and peers appears to have resulted in discrepancies between the occupational therapists on how OT activities and interventions are organized according to CPT codes. CPT codes are a national standard with universal definitions, but this was not reflected in the findings of Paper 3 (American Medical Association, 2019; US Department of Health and Human Services, 2014). Without a common training method, the implications for practice are negative because the CPT codes submitted by acute occupational therapist may not accurately reflect the OT activities and interventions provided. Future studies may want to evaluate CPT code training methods done in the practice setting due to the high value occupational therapists place on guidance provided by work-place mentors and peers. An interesting finding from Paper 3 is preliminary results on how client-centered care is operationalized in the acute care setting through patient goals. Patient-centered care and client-centered care have been

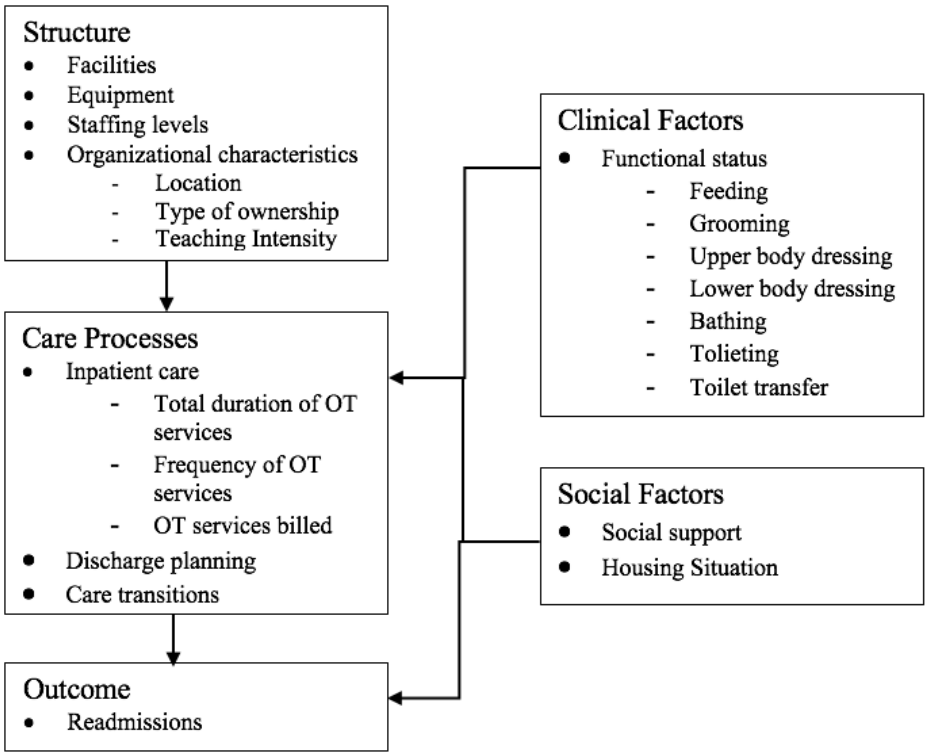
proposed to have similarities (Mroz et al., 2015). Patient-centered care is an important element of the Affordable Care Act and included in the Triple Aim, which is the framework created by the Institute of Healthcare to optimize health system performance (Berwick et al., 2008). Future studies that evaluate how client-centered care is operationalized and integrated into practice could guide a clearer understanding of the role of OT in the quality-focused US health care system.

5.3 Connection between Papers 1, 2, and 3

All three dissertation papers focused on the central theme of the role of OT in reducing readmissions. The modified Donabedian model presented in Chapter 1 provides a clear framework on how all three papers are connected and may impact the outcomes of readmissions (Figure 11). The Donabedian model is a theoretical framework used to evaluate health care quality and its impact on targeted outcomes like readmission (Donabedian, 1966). Each paper of this dissertation examined an element of the Donabedian Model. Paper 1 examined the link between care processes (i.e., OT service delivery factors and differences between CPT codes submitted for readmitted and not readmitted patients) and readmission. Paper 2 evaluated the association between clinical (i.e., self-care tasks) and social factors (i.e., social support and housing situation) and readmission. Lastly, Paper 3 provided insight into the structure (i.e., characteristics of the occupational therapists and hospital) and care processes (i.e., OT activities and interventions provided according to CPT codes). Evidence has shown that the Donabedian Model is an effective method to evaluate the quality of care provided to patients and its impact on specific patient outcomes, like readmissions (Moore et al., 2015). By using the framework provided by the Donabedian model, a better understanding on the role of OT in reducing readmission was achieved through the three dissertation studies because targeted areas of practice were identified to be associated with reduced likelihood of readmission. The three studies also identified future areas of research that need further investigation.

Figure 11.

Modified Donabedian Model



The three papers were also connected based on how the results from one paper either helped to provide a complete picture of the material or informed the results of another paper. While the areas of research for Papers 1 and 2 were different both were needed to inform practice for acute occupational therapists. Paper 1 provided results on operations while Paper 2 provided results on patient care processes. To create best practice guidelines, occupational therapists not only need to know how to schedule patients to be seen but also what type of care they should be providing when the patient is being seen by occupational therapists while hospitalized. Lastly, Paper 3 informed the results from Paper 1. In Paper 1, we determined that when comparing patients who were not readmitted to patients who were readmitted, patients who were not readmitted received higher amounts of self-care/home management training from occupational therapists while hospitalized. These findings were reported by CPT code. The findings from Paper 3 provided insight into what types of OT activities and interventions are provided by occupational therapists according to the self-care/home management training CPT code. These results

provide the preliminary results on what may be the "active ingredients" of OT sessions that lead to patients not being readmitted to the hospital.

5.4 Future Research

Several areas of future research were identified from the findings of Papers 1, 2, and 3. These areas include the inclusion of more acute care OT departments in future studies so the results can be generalized to larger populations, examination of the HRRP-diagnoses individually, determination of thresholds for OT duration and frequency associated with reduced likelihood of readmission, further exploration of the source of the discrepancies between occupational therapists on OT activities and interventions implemented and subsequently selected CPT codes, and more insight on how client-centered care is operationalized in the acute care setting. To improve the external validity of future studies more acute OT departments should be included in the dataset. Our studies only had data provided from one acute care OT department. The Froedtert acute OT department may be representative of a significant amount of US hospitals, because Froedtert belongs to the largest category of hospitals in the US: non-government and not-for-profit hospitals (Froedtert & Medical College of Wisconsin, 2019); however generalizability of the studies were limited to the one data source. Including multiple acute OT departments in future studies is feasible. The data collected for these studies was from Epic, which is a common electronic medical record used in hospitals across the US (Roth, 2019). Also, CPT codes are the national standard for hospitals that use electronic documentation, therefore acute OT departments will have current and retrospective data to contribute to the research.

In the future it is recommended that OT service delivery factors be evaluated individually for each HRRP diagnosis and that evidence-based duration and frequency thresholds be identified to reduce the likelihood of readmission. The differences between our results and the results of Kumar and colleagues (2019) indicate that the relationship between OT services and readmissions may be dependent on diagnosis. Kumar and colleagues (2019) included only ischemic stroke patients in their sample and found no association between higher durations of acute OT services and readmission. Conversely, our sample included all the HRRP-diagnoses and determined that patients with HRRP-qualifying diagnoses who

received higher durations and frequency of OT services were less likely to be readmitted. To better understand the relationship between diagnosis, OT services, and readmission, future studies should examine the HRRP-diagnoses individually. Individual examination of diagnoses would allow for clinicians to create best practice guidelines specific to the diagnosis. To create best practice guidelines, specific thresholds for the duration and frequency of OT services and the association with readmission need to be explored. Our studies provide the research community the rationale to further explore associations between duration and frequency of OT services and quality outcomes, but more evidence is needed on specific thresholds to translate the findings into practice. If specific thresholds were identified, scheduling of patients and acute OT staffing could be adjusted based on patient outcomes rather than solely on the arbitrary metric of patient volume.

Preliminary findings on the OT activities and interventions provided according to specific CPT codes provide valuable insight into the "active ingredients" that may be responsible for reducing readmissions. The content of OT sessions is a relatively unexplored area of OT practice. OT processes have been coined the "black box" of rehabilitation practice (DeJong et al., 2005). The findings from our study have demonstrated that there are practice discrepancies between acute occupational therapists. The source of the discrepancies needs to be examined more closely. Potential sources of the discrepancies could be area of practice within the acute care setting (e.g., orthopedics, oncology, neurology, etc.), education received in OT school, and training received by mentors and peers. Once the source of the discrepancies is identified, then targeted training could be created to establish consistency among occupational therapists on what OT activities and interventions are applied to specific CPT codes. An unexpected area of future research that was identified is how client-centered care is operationalized in practice. Due to OT's focus on client-centered care and its alignment with the quality-focused US health care environment, it is an important area to explore in future research to provide a well-rounded and detailed description of OT's role in improving patient outcomes.

5.5 Final Comments

There is still work that needs to be done on establishing the role of OT in reducing readmissions and its overall impact on patient outcomes. However, the results from the three dissertation studies have shown that higher duration and frequency of OT services are associated with reduced likelihood of readmission, patients who are not readmitted to the hospital receive higher amounts of self-care/home management training, patients' self-care status in the acute care setting was found to have significant amounts of missing data, social support and housing situation may not be significant predictors of readmission, and, finally, discrepancies exist between acute occupational therapist and how they select CPT codes based on the OT activities and interventions provided during OT sessions.

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Appendix A. Frequently used acronyms

AMI	Acute myocardial infarction
ADL	Activities of daily living
CABG	Coronary artery bypass graft
CPT	current procedural terminology
COPD	Chronic obstructive pulmonary disease
DM	Donabedian Model
EMR	Electronic Medical Record
Froedtert	Froedtert Hospital
FY	Fiscal Year
HF	Heart failure
HHS	Department of Health and Human Services
HRRP	Hospital Readmission Reduction Program
IRF	Inpatient rehabilitation facility
IRF-PAI	Inpatient Rehabilitation-Patient Assessment Instrument
MCW	Medical College of Wisconsin
MDS	Minimum Data Set
OT	occupational therapy
PN	Pneumonia
PT	Physical therapy
Readmissions	hospital readmissions
RTT	Rehabilitation treatment taxonomy
SNF	Skilled nursing facility
THA	Elective primary total hip arthroplasty
TKA	Elective primary total knee arthroplasty
US	United States

Appendix B. Occupational Therapy Current Procedural Terminology codes

CPT code	CPT code description
97165	Occupational therapy evaluation, low complexity
97166	Occupational therapy evaluation, moderate complexity
97167	Occupational therapy evaluation, high complexity
97168	Occupational therapy re-evaluation
G0515	Development of skills to improve attention, memory, problem solving (includes compensatory training), direct (one-one-one) patient contact, each 15 minutes
97127	Therapeutic interventions that focus on cognitive function (e.g., attention, memory, reasoning, executive function, problem solving, and/or pragmatic functioning) and compensatory strategies to manage the performance of an activity (e.g., managing time or schedules, initiating, organizing, and sequencing tasks), direct (one-on-one) patient contact *(97127 is untimed and should only be used once per day.)* *(97127 is not covered under Medicare. Practitioners should use G0515 under Medicare—see below.)*
97140	Manual therapy techniques (e.g., mobilization/manipulation, manual lymphatic drainage, manual traction), 1 or more regions, each 15 minutes
97112	Neuromuscular reeducation of movement, balance, coordination, kinesthetic sense, posture, and/or proprioception for sitting and/or standing activities
97530	Therapeutic activities, direct (one-on-one) patient contact (use of dynamic activities to improve functional performance), each 15 minutes
97110	Therapeutic Exercise to develop strength and endurance, range of motion and flexibility
97545	Work hardening/conditioning; initial 2 hours
97535	Self-care/home management training (e.g. activities of daily living and compensatory training, meal preparation, safety procedures, and instructions in use of assistive technology devices/adaptive equipment), direct one-on-one contact
97032	Application of a modality to one or more areas; electrical stimulation (manual), each 15 minutes
97014	Electrical stimulation (unattended)

G0283	Electrical stimulation (unattended), to one or more areas for indication(s) other than wound care as part of a therapy plan of care *(97014 is not covered under Medicare. Practitioners should use G0283 under Medicare—see below.)*
97035	Ultrasound, each 15 minutes
X	OT EMG Biofeedback
97016	Vasopneumatic devices
97018	paraffin bath
	Fludiotherapy
97113	aquatic therapy with therapeutic exercises
95992	Canalith repositioning procedure(s) (e.g., Epley maneuver, Semont maneuver), per day
97542	Wheelchair management (e.g., assessment, fitting, training), each 15 minutes
X	OT functional home
97750	Physical performance test or measurement (e.g., musculoskeletal, functional capacity), with written report, each 15 minutes
97124	Massage, including effleurage, petrissage and/or tapotement
97139	Unlisted therapeutic procedure
97150	Therapeutic procedure(s), group (2 or more individuals)
97150	Therapeutic procedure(s), group (2 or more) *(Report for each member of the group)* *(Group therapy procedures involve constant attendance by the physician* ***or other qualified health care professional*** *[i.e., therapist], but by definition do not require one-on-one patient contact by the same physician or other health care professional.)*
X	OT service <8 minutes w/patient
97533	Sensory integrative technique to enhance sensory processing and promote adaptive responses to

	environmental demands, direct (one-on-one) patient contact, each 15 minutes
X	OT rehab staff for research
97537	Community/work reintegration training (e.g., shopping, transportation, money management, avocational activities and/or work environment/modification analysis, work task analysis, use of assistive technology device/adaptive equipment), direct one-on-one contact, each 15 minutes
X	OT L code shoulder
X	OT L code Elbow
X	OT L code wrist
X	OT L code hand/finger
X	OT L code knee
X	OT L code ankle/foot
X	OT L code repair/replace
X	OT casting
97760	Orthotic management and training (including assessment and fitting when not otherwise reported), upper extremity(ies), lower extremity(ies), and/or trunk, initial orthotic encounter, each 15 minutes
97761	Prosthetic(s) training, upper and/or lower extremity(ies), initial prosthetic(s) encounter
97763	Orthotic(s)/prosthetic(s) management and/or training, upper extremity(ies), lower extremity(ies), and/or trunk, subsequent orthotic(s)/prosthetic(s) encounter
97597	Debridement (e.g., high pressure water jet with/without suction, sharp selective debridement with scissors, scalpel, and forceps), open wound (e.g., fibrin, devitalized epidermis and/or dermis, exudate, debris, biofilm) including topical application(s), wound assessment, use of a whirlpool, when performed and instruction(s) for ongoing care, per session, total wound(s) surface area: first 20 sq. cm. or less
+97598	Each additional 20 sq. cm., or part thereof (list separately in addition to code for primary procedure)
97602	Removal of devitalized tissue from wound(s), non-selective debridement, without anesthesia (e.g., wet-to-moist dressings, enzymatic, abrasion, larval therapy), including topical application(s), wound assessment, and instructions(s) for ongoing care, per session

Appendix C. Crosswalk of Study Goals, Objectives, Research Questions, and Hypotheses

Table C-1. Paper 1 Goals, Objectives, Associated Propositions, Research Question, and Hypotheses

Goal: **Identify acute OT service delivery factors are significant predictors of readmission.**
Objective: **Examine if receipt of OT services, OT duration, and OT frequency are predictors of readmission for patients with a HRRP-qualifying diagnosis. Identify if there is a significant difference between OT services provided to patients who were readmitted compared to patients who were not readmitted with a HRRP-qualifying diagnosis.**
Research Question**:** **For patients with a HRRP-qualifying diagnosis, are receipt of OT services, duration of OT services, and frequency of OT services predictors of readmission risk? Is there a significant difference between OT services provided for patients who were readmitted compared to patients who were not readmitted with a HRRP-qualifying diagnosis?**
Hypotheses:
1-1. Patients who receive OT services will have reduced readmission risk compared to those who did not receive OT services.
1-2. Patients with higher durations of OT services will have lower readmission risk.
1-3. Patients who participate in higher frequencies of OT services will have lower readmission risk.
1-4. Patients who are not readmitted will receive more ADL/self-care training than those who are readmitted to the hospital.

Table C-2. Paper 2 Goals, Objectives, Associated Propositions, Research Question, and Hypotheses

Goal: **Identify OT client factors that are significant predictors of readmission in the acute care setting.**
Objective: **Evaluate if discharge self-care status (feeding, grooming, bathing, upper body dressing, lower body dressing and toileting), social support, and housing situation are significant predictors of readmission.**
Research Question**:** **For patients with a HRRP-qualifying diagnosis, does discharge self-care status, social support, and housing situation predict readmission risk?**
Hypotheses:
2-1. Patients with lower levels of independence with self-care will be at increased risk for readmission.
2-2. Patients who live alone will have higher odds of readmission.
2-3. Patients who live in transitional housing will have higher odds of readmission.

Table C-3. Paper 3 Goals, Objectives, Associated Propositions, Research Question, and Hypotheses

Goal: **Understand and categorize acute OT activities and interventions provided to patients with HRRP-qualifying diagnoses and subsequent CPT codes selected for billing. Identify if any changes are made to acute OT billing after submitted by acute occupational therapists.**
Objective:

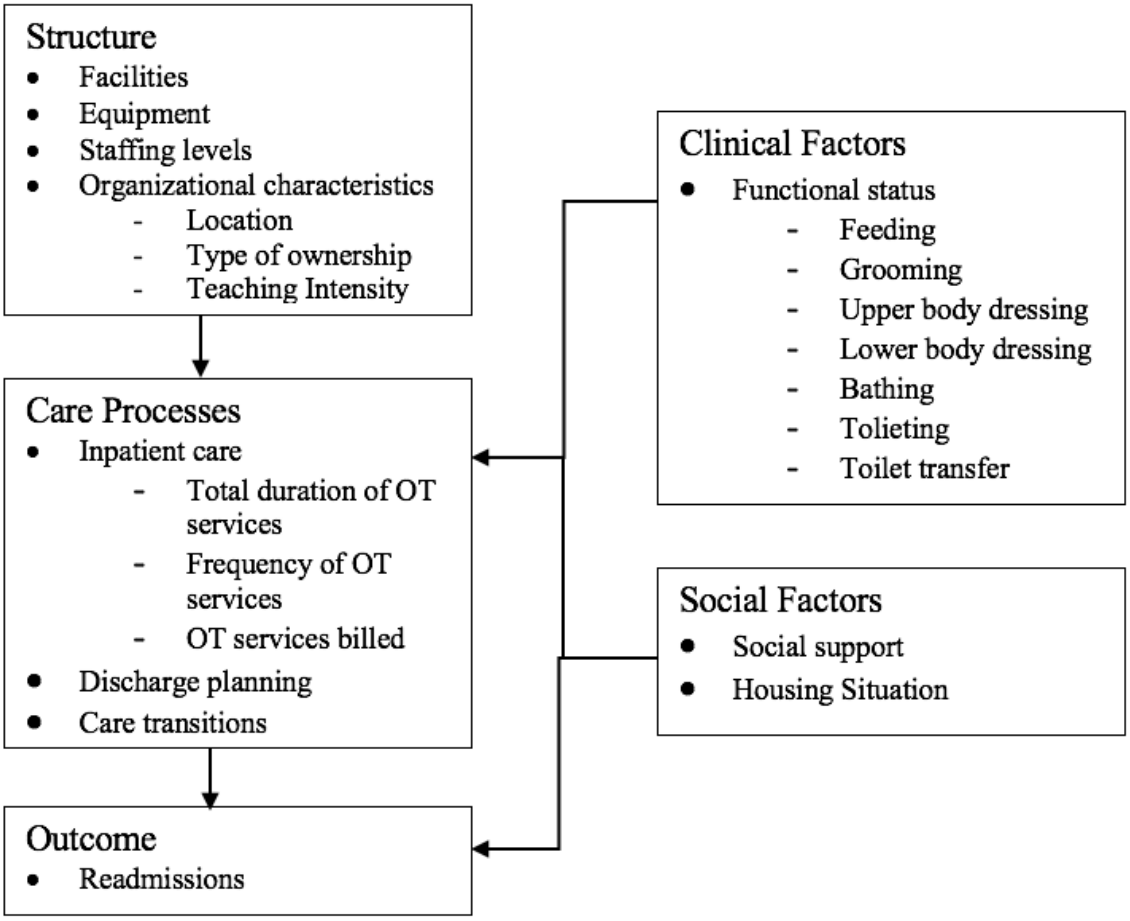
Conduct focus groups of acute occupational therapists to discuss the activities and interventions provided during acute OT sessions according to CPT billing codes. Complete interviews with at least two billing experts to identify any changes to acute OT billing after submitted by the occupational therapists.
Research Question**:** **What OT activities and interventions do occupational therapists provide to patients with a HRRP-qualifying diagnosis according to CPT billing codes?**
Hypotheses:
3-1. Interventions provided when self-care is billed will include compensatory strategies, adaptative equipment training, ADL process and repetition, and safety education.
3-2. Interventions provided when therapeutic activities is billed will include activity tolerance, balance training, safety education, assistive device education, functional mobility process and repetition, functional transfers process and repetition, cooking tasks, cleaning tasks.
3-3. Interventions provided when therapeutic exercises is billed will include active range of motion exercises, passive range of motion exercises, active assist range of motion exercises, creation and delivery of home exercise program, practicing a home exercise program, free weights, arm bike.
3-4. Interventions provided when cognitive skills is billed will include standardized cognitive assessments, functional cognitive exercises (money management, home safety), navigation through the environment, interactive games.
3-5. Interventions provided when neuromuscular re-education is billed will include activities focused on movement, balance, posture, coordination, and proprioception.
3-6. Minimal changes will occur to acute OT billing after submitted by the occupational therapists.

Appendix D. Key Study Variables

Key Variables	**Definition**	**Variable Type**
CPT codes	Only CPT code billed for the patient encounter	Categorical
Duration of OT services	Total number of minutes of OT divided by the number of days OT services were delivered indicated by documentation of CPT billing codes.	Continuous
Frequency of OT services	Number of days OT services were delivered divided by the number of days between initiation of OT as indicated by documentation of OT CPT evaluation codes and discharge from the hospital or OT services, whichever comes first.	Continuous
Self-care status	Indicators: eating, grooming, bathing, upper body dressing, lower body dressing, toileting, and toilet transfer Levels of independence: Dependent, maximum assistance, moderate assistance, minimal assistance, contact guard assistance, supervision, modified independence, and independent. If the level of independence is missing for a functional indicator, the blank value will be coded as 99. No physical assistance = 0 Physical assistance = 1	SS1 = Continuous SS2 = Dichotomous
Social Support	Who the patient lives with: Categories: -Alone -Not alone	Dichotomous
Housing situation	Categories: -Transitional housing -Supportive housing -Independent housing -Other	Categorical
Readmissions	Yes/No	Dichotomous
Receipt of OT services	Yes/No defined by receipt of any OT treatment CPT code	Dichotomous
Covariates	**Definition**	**Variable Type**
Age	Any age	Continuous

Comorbidities	Elixhauser comorbidity measure with ICD-9 and ICD-10 codes	Continuous
Intensive Care Unit Stay	Yes/No	Dichotomous
Post-acute discharge destination	Home Health Care/Self-care, nursing facility, and other	Categorical
Race	White, African-American, Hispanic, Asian and Other	Categorical
Sex	Male or female	Dichotomous

Appendix E. Modified Donabedian Model



Appendix F. Strengthening the Reporting of Observational Studies in Epidemiology Guidelines: Cross-sectional studies

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analyzed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures

Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarize key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalizability	21	Discuss the generalizability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Appendix G. Hospital Readmission Reduction Program ICD-10 codes

HRRP ICD-10-CM codes and ICD-10-PCS codes

Heart Failure	
ICD-10-CM Code	**Description**
I11.0	Hypertensive heart disease with heart failure
I13.0	Hypertensive heart and chronic kidney disease with heart failure and stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease
I13.2	Hypertensive heart and chronic kidney disease with heart failure and with stage 5 chronic kidney disease, or end stage renal disease
I50.1	Left ventricular failure, unspecified
I50.20	Unspecified systolic (congestive) heart failure
I50.21	Acute systolic (congestive) heart failure
I50.22	Chronic systolic (congestive) heart failure
I50.23	Acute on chronic systolic (congestive) heart failure
I50.30	Unspecified diastolic (congestive) heart failure
I50.31	Acute diastolic (congestive) heart failure
I50.32	Chronic diastolic (congestive) heart failure
I50.33	Acute on chronic diastolic (congestive) heart failure
I50.40	Unspecified combined systolic (congestive) and diastolic (congestive) heart failure
I50.41	Acute combined systolic (congestive) and diastolic (congestive) heart failure
I50.42	Chronic combined systolic (congestive) and diastolic (congestive) heart failure
I50.43	Acute on chronic combined systolic (congestive) and diastolic (congestive) heart failure
I50.810	Right heart failure, unspecified
I50.811	Acute right heart failure
I50.812	Chronic right heart failure
I50.813	Acute on chronic right heart failure
I50.814	Right heart failure due to left heart failure
I50.82	Biventricular heart failure
I50.83	High output heart failure
I50.84	End stage heart failure
I50.89	Other heart failure
I50.9	Heart failure, unspecified
Chronic Obstructive Pulmonary Disease	
ICD-10-CM Code	**Description**
J41.0	Simple chronic bronchitis

J41.1	Mucopurulent chronic bronchitis
J41.8	Mixed simple and mucopurulent chronic bronchitis
J42	Unspecified chronic bronchitis
J43.0	Unilateral pulmonary emphysema [MacLeod's syndrome]
J43.1	Panlobular emphysema
J43.2	Centrilobular emphysema
J43.8	Other emphysema
J43.9	Emphysema, unspecified
J44.0	Chronic obstructive pulmonary disease with acute lower respiratory infection
J44.1	Chronic obstructive pulmonary disease with (acute) exacerbation
J44.9	Chronic obstructive pulmonary disease, unspecified
J96.00	Acute respiratory failure, unspecified whether with hypoxia or hypercapnia
J96.01	Acute respiratory failure with hypoxia
J96.02	Acute respiratory failure with hypercapnia
J96.20	Acute and chronic respiratory failure, unspecified whether with hypoxia or hypercapnia
J96.21	Acute and chronic respiratory failure with hypoxia
J96.22	Acute and chronic respiratory failure with hypercapnia
J96.90	Respiratory failure, unspecified, unspecified whether with hypoxia or hypercapnia
J96.91	Respiratory failure, unspecified with hypoxia
J96.92	Respiratory failure, unspecified with hypercapnia
R06.03	Acute respiratory distress
R09.2	Respiratory arrest
Acute Myocardial Infarction	
ICD-10-CM Code	**Description**
I21.01	ST elevation (STEMI) myocardial infarction involving left main coronary artery
I21.02	ST elevation (STEMI) myocardial infarction involving left anterior descending coronary artery
I21.09	ST elevation (STEMI) myocardial infarction involving other coronary artery of anterior wall
I21.11	ST elevation (STEMI) myocardial infarction involving right coronary artery
I21.19	ST elevation (STEMI) myocardial infarction involving other coronary artery of inferior wall
I21.21	ST elevation (STEMI) myocardial infarction involving left circumflex coronary artery
I21.29	ST elevation (STEMI) myocardial infarction involving other sites
I21.3	ST elevation (STEMI) myocardial infarction of unspecified site
I21.4	Non-ST elevation (NSTEMI) myocardial infarction
I21.9	Acute myocardial infarction, unspecified
Pneumonia	
ICD-10-CM Code	**Description**
A48.1	Legionnaires' disease

J09.X1	Influenza due to identified novel influenza A virus with pneumonia
J10.00	Influenza due to other identified influenza virus with unspecified type of pneumonia
J10.01	Influenza due to other identified influenza virus with the same other identified influenza virus pneumonia
J10.08	Influenza due to other identified influenza virus with other specified pneumonia
J11.00	Influenza due to unidentified influenza virus with unspecified type of pneumonia
J11.08	Influenza due to unidentified influenza virus with specified pneumonia
J12.0	Adenoviral pneumonia
J12.1	Respiratory syncytial virus pneumonia
J12.2	Parainfluenza virus pneumonia
J12.3	Human metapneumovirus pneumonia
J12.81	Pneumonia due to SARS-associated coronavirus
J12.89	Other viral pneumonia
J12.9	Viral pneumonia, unspecified
J13	Pneumonia due to Streptococcus pneumoniae
J14	Pneumonia due to Hemophilus influenzae
J15.0	Pneumonia due to Klebsiella pneumoniae
J15.1	Pneumonia due to Pseudomonas
J15.20	Pneumonia due to staphylococcus, unspecified
J15.211	Pneumonia due to Methicillin susceptible Staphylococcus aureus
J15.212	Pneumonia due to Methicillin resistant Staphylococcus aureus
J15.29	Pneumonia due to other staphylococcus
J15.3	Pneumonia due to streptococcus, group B
J15.4	Pneumonia due to other streptococci
J15.5	Pneumonia due to Escherichia coli
J15.6	Pneumonia due to other Gram-negative bacteria
J15.7	Pneumonia due to Mycoplasma pneumoniae
J15.8	Pneumonia due to other specified bacteria
J15.9	Unspecified bacterial pneumonia
J16.0	Chlamydial pneumonia
J16.8	Pneumonia due to other specified infectious organisms
J18.0	Bronchopneumonia, unspecified organism
J18.1	Lobar pneumonia, unspecified organism
J18.8	Other pneumonia, unspecified organism
J18.9	Pneumonia, unspecified organism
J69.0	Pneumonitis due to inhalation of food and vomit
A02.1	Salmonella sepsis
A22.7	Anthrax sepsis
A26.7	Erysipelothrix sepsis
A32.7	Listerial sepsis

A40.0	Sepsis due to streptococcus, group A
A40.1	Sepsis due to streptococcus, group B
A40.3	Sepsis due to Streptococcus pneumoniae
A40.8	Other streptococcal sepsis
A40.9	Streptococcal sepsis, unspecified
A41.01	Sepsis due to Methicillin susceptible Staphylococcus aureus
A41.02	Sepsis due to Methicillin resistant Staphylococcus aureus
A41.1	Sepsis due to other specified staphylococcus
A41.2	Sepsis due to unspecified staphylococcus
A41.3	Sepsis due to Hemophilus influenzae
A41.4	Sepsis due to anaerobes
A41.50	Gram-negative sepsis, unspecified
A41.51	Sepsis due to Escherichia coli [E. coli]
A41.52	Sepsis due to Pseudomonas
A41.53	Sepsis due to Serratia
A41.59	Other Gram-negative sepsis
A41.81	Sepsis due to Enterococcus
A41.89	Other specified sepsis
A41.9	Sepsis, unspecified organism
A42.7	Actinomycotic sepsis
A54.86	Gonococcal sepsis
B37.7	Candidal sepsis

Coronary Artery Bypass Graft	
ICD-10-PCS Code	**Description**
0210083	Bypass Coronary Artery, One Artery from Coronary Artery with Zooplastic Tissue, Open Approach
0210088	Bypass Coronary Artery, One Artery from Right Internal Mammary with Zooplastic Tissue, Open Approach
0210089	Bypass Coronary Artery, One Artery from Left Internal Mammary with Zooplastic Tissue, Open Approach
0210093	Bypass Coronary Artery, One Artery from Coronary Artery with Autologous Venous Tissue, Open Approach
0210098	Bypass Coronary Artery, One Artery from Right Internal Mammary with Autologous Venous Tissue, Open Approach
0210099	Bypass Coronary Artery, One Artery from Left Internal Mammary with Autologous Venous Tissue, Open Approach
0210483	Bypass Coronary Artery, One Artery from Coronary Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach
0210488	Bypass Coronary Artery, One Artery from Right Internal Mammary with Zooplastic Tissue, Percutaneous Endoscopic Approach
0210489	Bypass Coronary Artery, One Artery from Left Internal Mammary with Zooplastic Tissue, Percutaneous Endoscopic Approach
0210493	Bypass Coronary Artery, One Artery from Coronary Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
0210498	Bypass Coronary Artery, One Artery from Right Internal Mammary with Autologous Venous Tissue, Percutaneous Endoscopic Approach

0210499	Bypass Coronary Artery, One Artery from Left Internal Mammary with Autologous Venous Tissue, Percutaneous Endoscopic Approach
0211083	Bypass Coronary Artery, Two Arteries from Coronary Artery with Zooplastic Tissue, Open Approach
0211088	Bypass Coronary Artery, Two Arteries from Right Internal Mammary with Zooplastic Tissue, Open Approach
0211089	Bypass Coronary Artery, Two Arteries from Left Internal Mammary with Zooplastic Tissue, Open Approach
0211093	Bypass Coronary Artery, Two Arteries from Coronary Artery with Autologous Venous Tissue, Open Approach
0211098	Bypass Coronary Artery, Two Arteries from Right Internal Mammary with Autologous Venous Tissue, Open Approach
0211099	Bypass Coronary Artery, Two Arteries from Left Internal Mammary with Autologous Venous Tissue, Open Approach
0211483	Bypass Coronary Artery, Two Arteries from Coronary Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach
0211488	Bypass Coronary Artery, Two Arteries from Right Internal Mammary with Zooplastic Tissue, Percutaneous Endoscopic Approach
0211489	Bypass Coronary Artery, Two Arteries from Left Internal Mammary with Zooplastic Tissue, Percutaneous Endoscopic Approach
0211493	Bypass Coronary Artery, Two Arteries from Coronary Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
0211498	Bypass Coronary Artery, Two Arteries from Right Internal Mammary with Autologous Venous Tissue, Percutaneous Endoscopic Approach
0211499	Bypass Coronary Artery, Two Arteries from Left Internal Mammary with Autologous Venous Tissue, Percutaneous Endoscopic Approach
0212083	Bypass Coronary Artery, Three Arteries from Coronary Artery with Zooplastic Tissue, Open Approach
0212088	Bypass Coronary Artery, Three Arteries from Right Internal Mammary with Zooplastic Tissue, Open Approach
0212089	Bypass Coronary Artery, Three Arteries from Left Internal Mammary with Zooplastic Tissue, Open Approach
0212093	Bypass Coronary Artery, Three Arteries from Coronary Artery with Autologous Venous Tissue, Open Approach
0212098	Bypass Coronary Artery, Three Arteries from Right Internal Mammary with Autologous Venous Tissue, Open Approach
0212099	Bypass Coronary Artery, Three Arteries from Left Internal Mammary with Autologous Venous Tissue, Open Approach
0212483	Bypass Coronary Artery, Three Arteries from Coronary Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach
0212488	Bypass Coronary Artery, Three Arteries from Right Internal Mammary with Zooplastic Tissue, Percutaneous Endoscopic Approach
0212489	Bypass Coronary Artery, Three Arteries from Left Internal Mammary with Zooplastic Tissue, Percutaneous Endoscopic Approach
0212493	Bypass Coronary Artery, Three Arteries from Coronary Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
0212498	Bypass Coronary Artery, Three Arteries from Right Internal Mammary with Autologous Venous Tissue, Percutaneous Endoscopic Approach
0212499	Bypass Coronary Artery, Three Arteries from Left Internal Mammary with Autologous Venous Tissue, Percutaneous Endoscopic Approach
0213083	Bypass Coronary Artery, Four or More Arteries from Coronary Artery with Zooplastic Tissue, Open Approach
0213088	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary with Zooplastic Tissue, Open Approach
0213089	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary with Zooplastic Tissue, Open Approach
0213093	Bypass Coronary Artery, Four or More Arteries from Coronary Artery with Autologous Venous Tissue, Open Approach
0213098	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary with Autologous Venous Tissue, Open Approach
0213099	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary with Autologous Venous Tissue, Open Approach
0213483	Bypass Coronary Artery, Four or More Arteries from Coronary Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach

0213488	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary with Zooplastic Tissue, Percutaneous Endoscopic Approach
0213489	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary with Zooplastic Tissue, Percutaneous Endoscopic Approach
0213493	Bypass Coronary Artery, Four or More Arteries from Coronary Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
0213498	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary with Autologous Venous Tissue, Percutaneous Endoscopic Approach
0213499	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary with Autologous Venous Tissue, Percutaneous Endoscopic Approach
021008C	Bypass Coronary Artery, One Artery from Thoracic Artery with Zooplastic Tissue, Open Approach
021008F	Bypass Coronary Artery, One Artery from Abdominal Artery with Zooplastic Tissue, Open Approach
021008W	Bypass Coronary Artery, One Artery from Aorta with Zooplastic Tissue, Open Approach
021009C	Bypass Coronary Artery, One Artery from Thoracic Artery with Autologous Venous Tissue, Open Approach
021009F	Bypass Coronary Artery, One Artery from Abdominal Artery with Autologous Venous Tissue, Open Approach
021009W	Bypass Coronary Artery, One Artery from Aorta with Autologous Venous Tissue, Open Approach
02100A3	Bypass Coronary Artery, One Artery from Coronary Artery with Autologous Arterial Tissue, Open Approach
02100A8	Bypass Coronary Artery, One Artery from Right Internal Mammary with Autologous Arterial Tissue, Open Approach
02100A9	Bypass Coronary Artery, One Artery from Left Internal Mammary with Autologous Arterial Tissue, Open Approach
02100AC	Bypass Coronary Artery, One Artery from Thoracic Artery with Autologous Arterial Tissue, Open Approach
02100AF	Bypass Coronary Artery, One Artery from Abdominal Artery with Autologous Arterial Tissue, Open Approach
02100AW	Bypass Coronary Artery, One Artery from Aorta with Autologous Arterial Tissue, Open Approach
02100J3	Bypass Coronary Artery, One Artery from Coronary Artery with Synthetic Substitute, Open Approach
02100J8	Bypass Coronary Artery, One Artery from Right Internal Mammary with Synthetic Substitute, Open Approach
02100J9	Bypass Coronary Artery, One Artery from Left Internal Mammary with Synthetic Substitute, Open Approach
02100JC	Bypass Coronary Artery, One Artery from Thoracic Artery with Synthetic Substitute, Open Approach
02100JF	Bypass Coronary Artery, One Artery from Abdominal Artery with Synthetic Substitute, Open Approach
02100JW	Bypass Coronary Artery, One Artery from Aorta with Synthetic Substitute, Open Approach
02100K3	Bypass Coronary Artery, One Artery from Coronary Artery with Nonautologous Tissue Substitute, Open Approach
02100K8	Bypass Coronary Artery, One Artery from Right Internal Mammary with Nonautologous Tissue Substitute, Open Approach
02100K9	Bypass Coronary Artery, One Artery from Left Internal Mammary with Nonautologous Tissue Substitute, Open Approach
02100KC	Bypass Coronary Artery, One Artery from Thoracic Artery with Nonautologous Tissue Substitute, Open Approach
02100KF	Bypass Coronary Artery, One Artery from Abdominal Artery with Nonautologous Tissue Substitute, Open Approach
02100KW	Bypass Coronary Artery, One Artery from Aorta with Nonautologous Tissue Substitute, Open Approach
02100Z3	Bypass Coronary Artery, One Artery from Coronary Artery, Open Approach
02100Z8	Bypass Coronary Artery, One Artery from Right Internal Mammary, Open Approach
02100Z9	Bypass Coronary Artery, One Artery from Left Internal Mammary, Open Approach
02100ZC	Bypass Coronary Artery, One Artery from Thoracic Artery, Open Approach
02100ZF	Bypass Coronary Artery, One Artery from Abdominal Artery, Open Approach
021048C	Bypass Coronary Artery, One Artery from Thoracic Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach

021048F	Bypass Coronary Artery, One Artery from Abdominal Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach
021048W	Bypass Coronary Artery, One Artery from Aorta with Zooplastic Tissue, Percutaneous Endoscopic Approach
021049C	Bypass Coronary Artery, One Artery from Thoracic Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
021049F	Bypass Coronary Artery, One Artery from Abdominal Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
021049W	Bypass Coronary Artery, One Artery from Aorta with Autologous Venous Tissue, Percutaneous Endoscopic Approach
02104A3	Bypass Coronary Artery, One Artery from Coronary Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02104A8	Bypass Coronary Artery, One Artery from Right Internal Mammary with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02104A9	Bypass Coronary Artery, One Artery from Left Internal Mammary with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02104AC	Bypass Coronary Artery, One Artery from Thoracic Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02104AF	Bypass Coronary Artery, One Artery from Abdominal Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02104AW	Bypass Coronary Artery, One Artery from Aorta with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02104J3	Bypass Coronary Artery, One Artery from Coronary Artery with Synthetic Substitute, Percutaneous Endoscopic Approach
02104J8	Bypass Coronary Artery, One Artery from Right Internal Mammary with Synthetic Substitute, Percutaneous Endoscopic Approach
02104J9	Bypass Coronary Artery, One Artery from Left Internal Mammary with Synthetic Substitute, Percutaneous Endoscopic Approach
02104JC	Bypass Coronary Artery, One Artery from Thoracic Artery with Synthetic Substitute, Percutaneous Endoscopic Approach
02104JF	Bypass Coronary Artery, One Artery from Abdominal Artery with Synthetic Substitute, Percutaneous Endoscopic Approach
02104JW	Bypass Coronary Artery, One Artery from Aorta with Synthetic Substitute, Percutaneous Endoscopic Approach
02104K3	Bypass Coronary Artery, One Artery from Coronary Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02104K8	Bypass Coronary Artery, One Artery from Right Internal Mammary with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02104K9	Bypass Coronary Artery, One Artery from Left Internal Mammary with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02104KC	Bypass Coronary Artery, One Artery from Thoracic Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02104KF	Bypass Coronary Artery, One Artery from Abdominal Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02104KW	Bypass Coronary Artery, One Artery from Aorta with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02104Z3	Bypass Coronary Artery, One Artery from Coronary Artery, Percutaneous Endoscopic Approach
02104Z8	Bypass Coronary Artery, One Artery from Right Internal Mammary, Percutaneous Endoscopic Approach
02104Z9	Bypass Coronary Artery, One Artery from Left Internal Mammary, Percutaneous Endoscopic Approach
02104ZC	Bypass Coronary Artery, One Artery from Thoracic Artery, Percutaneous Endoscopic Approach
02104ZF	Bypass Coronary Artery, One Artery from Abdominal Artery, Percutaneous Endoscopic Approach
021108C	Bypass Coronary Artery, Two Arteries from Thoracic Artery with Zooplastic Tissue, Open Approach
021108F	Bypass Coronary Artery, Two Arteries from Abdominal Artery with Zooplastic Tissue, Open Approach
021108W	Bypass Coronary Artery, Two Arteries from Aorta with Zooplastic Tissue, Open Approach

021109C	Bypass Coronary Artery, Two Arteries from Thoracic Artery with Autologous Venous Tissue, Open Approach
021109F	Bypass Coronary Artery, Two Arteries from Abdominal Artery with Autologous Venous Tissue, Open Approach
021109W	Bypass Coronary Artery, Two Arteries from Aorta with Autologous Venous Tissue, Open Approach
02110A3	Bypass Coronary Artery, Two Arteries from Coronary Artery with Autologous Arterial Tissue, Open Approach
02110A8	Bypass Coronary Artery, Two Arteries from Right Internal Mammary with Autologous Arterial Tissue, Open Approach
02110A9	Bypass Coronary Artery, Two Arteries from Left Internal Mammary with Autologous Arterial Tissue, Open Approach
02110AC	Bypass Coronary Artery, Two Arteries from Thoracic Artery with Autologous Arterial Tissue, Open Approach
02110AF	Bypass Coronary Artery, Two Arteries from Abdominal Artery with Autologous Arterial Tissue, Open Approach
02110AW	Bypass Coronary Artery, Two Arteries from Aorta with Autologous Arterial Tissue, Open Approach
02110J3	Bypass Coronary Artery, Two Arteries from Coronary Artery with Synthetic Substitute, Open Approach
02110J8	Bypass Coronary Artery, Two Arteries from Right Internal Mammary with Synthetic Substitute, Open Approach
02110J9	Bypass Coronary Artery, Two Arteries from Left Internal Mammary with Synthetic Substitute, Open Approach
02110JC	Bypass Coronary Artery, Two Arteries from Thoracic Artery with Synthetic Substitute, Open Approach
02110JF	Bypass Coronary Artery, Two Arteries from Abdominal Artery with Synthetic Substitute, Open Approach
02110JW	Bypass Coronary Artery, Two Arteries from Aorta with Synthetic Substitute, Open Approach
02110K3	Bypass Coronary Artery, Two Arteries from Coronary Artery with Nonautologous Tissue Substitute, Open Approach
02110K8	Bypass Coronary Artery, Two Arteries from Right Internal Mammary with Nonautologous Tissue Substitute, Open Approach
02110K9	Bypass Coronary Artery, Two Arteries from Left Internal Mammary with Nonautologous Tissue Substitute, Open Approach
02110KC	Bypass Coronary Artery, Two Arteries from Thoracic Artery with Nonautologous Tissue Substitute, Open Approach
02110KF	Bypass Coronary Artery, Two Arteries from Abdominal Artery with Nonautologous Tissue Substitute, Open Approach
02110KW	Bypass Coronary Artery, Two Arteries from Aorta with Nonautologous Tissue Substitute, Open Approach
02110Z3	Bypass Coronary Artery, Two Arteries from Coronary Artery, Open Approach
02110Z8	Bypass Coronary Artery, Two Arteries from Right Internal Mammary, Open Approach
02110Z9	Bypass Coronary Artery, Two Arteries from Left Internal Mammary, Open Approach
02110ZC	Bypass Coronary Artery, Two Arteries from Thoracic Artery, Open Approach
02110ZF	Bypass Coronary Artery, Two Arteries from Abdominal Artery, Open Approach
021148C	Bypass Coronary Artery, Two Arteries from Thoracic Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach
021148F	Bypass Coronary Artery, Two Arteries from Abdominal Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach
021148W	Bypass Coronary Artery, Two Arteries from Aorta with Zooplastic Tissue, Percutaneous Endoscopic Approach
021149C	Bypass Coronary Artery, Two Arteries from Thoracic Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
021149F	Bypass Coronary Artery, Two Arteries from Abdominal Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
021149W	Bypass Coronary Artery, Two Arteries from Aorta with Autologous Venous Tissue, Percutaneous Endoscopic Approach
02114A3	Bypass Coronary Artery, Two Arteries from Coronary Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02114A8	Bypass Coronary Artery, Two Arteries from Right Internal Mammary with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02114A9	Bypass Coronary Artery, Two Arteries from Left Internal Mammary with Autologous Arterial Tissue, Percutaneous Endoscopic Approach

02114AC	Bypass Coronary Artery, Two Arteries from Thoracic Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02114AF	Bypass Coronary Artery, Two Arteries from Abdominal Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02114AW	Bypass Coronary Artery, Two Arteries from Aorta with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02114J3	Bypass Coronary Artery, Two Arteries from Coronary Artery with Synthetic Substitute, Percutaneous Endoscopic Approach
02114J8	Bypass Coronary Artery, Two Arteries from Right Internal Mammary with Synthetic Substitute, Percutaneous Endoscopic Approach
02114J9	Bypass Coronary Artery, Two Arteries from Left Internal Mammary with Synthetic Substitute, Percutaneous Endoscopic Approach
02114JC	Bypass Coronary Artery, Two Arteries from Thoracic Artery with Synthetic Substitute, Percutaneous Endoscopic Approach
02114JF	Bypass Coronary Artery, Two Arteries from Abdominal Artery with Synthetic Substitute, Percutaneous Endoscopic Approach
02114JW	Bypass Coronary Artery, Two Arteries from Aorta with Synthetic Substitute, Percutaneous Endoscopic Approach
02114K3	Bypass Coronary Artery, Two Arteries from Coronary Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02114K8	Bypass Coronary Artery, Two Arteries from Right Internal Mammary with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02114K9	Bypass Coronary Artery, Two Arteries from Left Internal Mammary with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02114KC	Bypass Coronary Artery, Two Arteries from Thoracic Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02114KF	Bypass Coronary Artery, Two Arteries from Abdominal Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02114KW	Bypass Coronary Artery, Two Arteries from Aorta with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02114Z3	Bypass Coronary Artery, Two Arteries from Coronary Artery, Percutaneous Endoscopic Approach
02114Z8	Bypass Coronary Artery, Two Arteries from Right Internal Mammary, Percutaneous Endoscopic Approach
02114Z9	Bypass Coronary Artery, Two Arteries from Left Internal Mammary, Percutaneous Endoscopic Approach
02114ZC	Bypass Coronary Artery, Two Arteries from Thoracic Artery, Percutaneous Endoscopic Approach
02114ZF	Bypass Coronary Artery, Two Arteries from Abdominal Artery, Percutaneous Endoscopic Approach
021208C	Bypass Coronary Artery, Three Arteries from Thoracic Artery with Zooplastic Tissue, Open Approach
021208F	Bypass Coronary Artery, Three Arteries from Abdominal Artery with Zooplastic Tissue, Open Approach
021208W	Bypass Coronary Artery, Three Arteries from Aorta with Zooplastic Tissue, Open Approach
021209C	Bypass Coronary Artery, Three Arteries from Thoracic Artery with Autologous Venous Tissue, Open Approach
021209F	Bypass Coronary Artery, Three Arteries from Abdominal Artery with Autologous Venous Tissue, Open Approach
021209W	Bypass Coronary Artery, Three Arteries from Aorta with Autologous Venous Tissue, Open Approach
02120A3	Bypass Coronary Artery, Three Arteries from Coronary Artery with Autologous Arterial Tissue, Open Approach
02120A8	Bypass Coronary Artery, Three Arteries from Right Internal Mammary with Autologous Arterial Tissue, Open Approach
02120A9	Bypass Coronary Artery, Three Arteries from Left Internal Mammary with Autologous Arterial Tissue, Open Approach
02120AC	Bypass Coronary Artery, Three Arteries from Thoracic Artery with Autologous Arterial Tissue, Open Approach
02120AF	Bypass Coronary Artery, Three Arteries from Abdominal Artery with Autologous Arterial Tissue, Open Approach
02120AW	Bypass Coronary Artery, Three Arteries from Aorta with Autologous Arterial Tissue, Open Approach
02120J3	Bypass Coronary Artery, Three Arteries from Coronary Artery with Synthetic Substitute, Open Approach

02120J8	Bypass Coronary Artery, Three Arteries from Right Internal Mammary with Synthetic Substitute, Open Approach
02120J9	Bypass Coronary Artery, Three Arteries from Left Internal Mammary with Synthetic Substitute, Open Approach
02120JC	Bypass Coronary Artery, Three Arteries from Thoracic Artery with Synthetic Substitute, Open Approach
02120JF	Bypass Coronary Artery, Three Arteries from Abdominal Artery with Synthetic Substitute, Open Approach
02120JW	Bypass Coronary Artery, Three Arteries from Aorta with Synthetic Substitute, Open Approach
02120K3	Bypass Coronary Artery, Three Arteries from Coronary Artery with Nonautologous Tissue Substitute, Open Approach
02120K8	Bypass Coronary Artery, Three Arteries from Right Internal Mammary with Nonautologous Tissue Substitute, Open Approach
02120K9	Bypass Coronary Artery, Three Arteries from Left Internal Mammary with Nonautologous Tissue Substitute, Open Approach
02120KC	Bypass Coronary Artery, Three Arteries from Thoracic Artery with Nonautologous Tissue Substitute, Open Approach
02120KF	Bypass Coronary Artery, Three Arteries from Abdominal Artery with Nonautologous Tissue Substitute, Open Approach
02120KW	Bypass Coronary Artery, Three Arteries from Aorta with Nonautologous Tissue Substitute, Open Approach
02120Z3	Bypass Coronary Artery, Three Arteries from Coronary Artery, Open Approach
02120Z8	Bypass Coronary Artery, Three Arteries from Right Internal Mammary, Open Approach
02120Z9	Bypass Coronary Artery, Three Arteries from Left Internal Mammary, Open Approach
02120ZC	Bypass Coronary Artery, Three Arteries from Thoracic Artery, Open Approach
02120ZF	Bypass Coronary Artery, Three Arteries from Abdominal Artery, Open Approach
021248C	Bypass Coronary Artery, Three Arteries from Thoracic Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach
021248F	Bypass Coronary Artery, Three Arteries from Abdominal Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach
021248W	Bypass Coronary Artery, Three Arteries from Aorta with Zooplastic Tissue, Percutaneous Endoscopic Approach
021249C	Bypass Coronary Artery, Three Arteries from Thoracic Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
021249F	Bypass Coronary Artery, Three Arteries from Abdominal Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
021249W	Bypass Coronary Artery, Three Arteries from Aorta with Autologous Venous Tissue, Percutaneous Endoscopic Approach
02124A3	Bypass Coronary Artery, Three Arteries from Coronary Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02124A8	Bypass Coronary Artery, Three Arteries from Right Internal Mammary with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02124A9	Bypass Coronary Artery, Three Arteries from Left Internal Mammary with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02124AC	Bypass Coronary Artery, Three Arteries from Thoracic Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02124AF	Bypass Coronary Artery, Three Arteries from Abdominal Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02124AW	Bypass Coronary Artery, Three Arteries from Aorta with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02124J3	Bypass Coronary Artery, Three Arteries from Coronary Artery with Synthetic Substitute, Percutaneous Endoscopic Approach
02124J8	Bypass Coronary Artery, Three Arteries from Right Internal Mammary with Synthetic Substitute, Percutaneous Endoscopic Approach
02124J9	Bypass Coronary Artery, Three Arteries from Left Internal Mammary with Synthetic Substitute, Percutaneous Endoscopic Approach
02124JC	Bypass Coronary Artery, Three Arteries from Thoracic Artery with Synthetic Substitute, Percutaneous Endoscopic Approach
02124JF	Bypass Coronary Artery, Three Arteries from Abdominal Artery with Synthetic Substitute, Percutaneous Endoscopic Approach

02124JW	Bypass Coronary Artery, Three Arteries from Aorta with Synthetic Substitute, Percutaneous Endoscopic Approach
02124K3	Bypass Coronary Artery, Three Arteries from Coronary Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02124K8	Bypass Coronary Artery, Three Arteries from Right Internal Mammary with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02124K9	Bypass Coronary Artery, Three Arteries from Left Internal Mammary with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02124KC	Bypass Coronary Artery, Three Arteries from Thoracic Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02124KF	Bypass Coronary Artery, Three Arteries from Abdominal Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02124KW	Bypass Coronary Artery, Three Arteries from Aorta with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02124Z3	Bypass Coronary Artery, Three Arteries from Coronary Artery, Percutaneous Endoscopic Approach
02124Z8	Bypass Coronary Artery, Three Arteries from Right Internal Mammary, Percutaneous Endoscopic Approach
02124Z9	Bypass Coronary Artery, Three Arteries from Left Internal Mammary, Percutaneous Endoscopic Approach
02124ZC	Bypass Coronary Artery, Three Arteries from Thoracic Artery, Percutaneous Endoscopic Approach
02124ZF	Bypass Coronary Artery, Three Arteries from Abdominal Artery, Percutaneous Endoscopic Approach
021308C	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery with Zooplastic Tissue, Open Approach
021308F	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery with Zooplastic Tissue, Open Approach
021308W	Bypass Coronary Artery, Four or More Arteries from Aorta with Zooplastic Tissue, Open Approach
021309C	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery with Autologous Venous Tissue, Open Approach
021309F	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery with Autologous Venous Tissue, Open Approach
021309W	Bypass Coronary Artery, Four or More Arteries from Aorta with Autologous Venous Tissue, Open Approach
02130A3	Bypass Coronary Artery, Four or More Arteries from Coronary Artery with Autologous Arterial Tissue, Open Approach
02130A8	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary with Autologous Arterial Tissue, Open Approach
02130A9	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary with Autologous Arterial Tissue, Open Approach
02130AC	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery with Autologous Arterial Tissue, Open Approach
02130AF	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery with Autologous Arterial Tissue, Open Approach
02130AW	Bypass Coronary Artery, Four or More Arteries from Aorta with Autologous Arterial Tissue, Open Approach
02130J3	Bypass Coronary Artery, Four or More Arteries from Coronary Artery with Synthetic Substitute, Open Approach
02130J8	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary with Synthetic Substitute, Open Approach
02130J9	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary with Synthetic Substitute, Open Approach
02130JC	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery with Synthetic Substitute, Open Approach
02130JF	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery with Synthetic Substitute, Open Approach
02130JW	Bypass Coronary Artery, Four or More Arteries from Aorta with Synthetic Substitute, Open Approach
02130K3	Bypass Coronary Artery, Four or More Arteries from Coronary Artery with Nonautologous Tissue Substitute, Open Approach
02130K8	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary with Nonautologous Tissue Substitute, Open Approach
02130K9	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary with Nonautologous Tissue Substitute, Open Approach

02130KC	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery with Nonautologous Tissue Substitute, Open Approach
02130KF	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery with Nonautologous Tissue Substitute, Open Approach
02130KW	Bypass Coronary Artery, Four or More Arteries from Aorta with Nonautologous Tissue Substitute, Open Approach
02130Z3	Bypass Coronary Artery, Four or More Arteries from Coronary Artery, Open Approach
02130Z8	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary, Open Approach
02130Z9	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary, Open Approach
02130ZC	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery, Open Approach
02130ZF	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery, Open Approach
021348C	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach
021348F	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery with Zooplastic Tissue, Percutaneous Endoscopic Approach
021348W	Bypass Coronary Artery, Four or More Arteries from Aorta with Zooplastic Tissue, Percutaneous Endoscopic Approach
021349C	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
021349F	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery with Autologous Venous Tissue, Percutaneous Endoscopic Approach
021349W	Bypass Coronary Artery, Four or More Arteries from Aorta with Autologous Venous Tissue, Percutaneous Endoscopic Approach
02134A3	Bypass Coronary Artery, Four or More Arteries from Coronary Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02134A8	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02134A9	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02134AC	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02134AF	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02134AW	Bypass Coronary Artery, Four or More Arteries from Aorta with Autologous Arterial Tissue, Percutaneous Endoscopic Approach
02134J3	Bypass Coronary Artery, Four or More Arteries from Coronary Artery with Synthetic Substitute, Percutaneous Endoscopic Approach
02134J8	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary with Synthetic Substitute, Percutaneous Endoscopic Approach
02134J9	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary with Synthetic Substitute, Percutaneous Endoscopic Approach
02134JC	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery with Synthetic Substitute, Percutaneous Endoscopic Approach
02134JF	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery with Synthetic Substitute, Percutaneous Endoscopic Approach
02134JW	Bypass Coronary Artery, Four or More Arteries from Aorta with Synthetic Substitute, Percutaneous Endoscopic Approach
02134K3	Bypass Coronary Artery, Four or More Arteries from Coronary Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach

02134K8	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02134K9	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02134KC	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02134KF	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02134KW	Bypass Coronary Artery, Four or More Arteries from Aorta with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
02134Z3	Bypass Coronary Artery, Four or More Arteries from Coronary Artery, Percutaneous Endoscopic Approach
02134Z8	Bypass Coronary Artery, Four or More Arteries from Right Internal Mammary, Percutaneous Endoscopic Approach
02134Z9	Bypass Coronary Artery, Four or More Arteries from Left Internal Mammary, Percutaneous Endoscopic Approach
02134ZC	Bypass Coronary Artery, Four or More Arteries from Thoracic Artery, Percutaneous Endoscopic Approach
02134ZF	Bypass Coronary Artery, Four or More Arteries from Abdominal Artery, Percutaneous Endoscopic Approach
Total Hip Arthroplasty/Total Knee Arthroplasty	
ICD-10-PCS Code	**Description**
0SR9019	Replacement of Right Hip Joint with Metal Synthetic Substitute, Cemented, Open Approach
0SR901A	Replacement of Right Hip Joint with Metal Synthetic Substitute, Uncemented, Open Approach
0SR901Z	Replacement of Right Hip Joint with Metal Synthetic Substitute, Open Approach
0SR9029	Replacement of Right Hip Joint with Metal on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SR902A	Replacement of Right Hip Joint with Metal on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SR902Z	Replacement of Right Hip Joint with Metal on Polyethylene Synthetic Substitute, Open Approach
0SR9039	Replacement of Right Hip Joint with Ceramic Synthetic Substitute, Cemented, Open Approach
0SR903A	Replacement of Right Hip Joint with Ceramic Synthetic Substitute, Uncemented, Open Approach
0SR903Z	Replacement of Right Hip Joint with Ceramic Synthetic Substitute, Open Approach
0SR9049	Replacement of Right Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SR904A	Replacement of Right Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SR904Z	Replacement of Right Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Open Approach
0SR9069	Replacement of Right Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SR906A	Replacement of Right Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SR906Z	Replacement of Right Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Open Approach
0SR90J9	Replacement of Right Hip Joint with Synthetic Substitute, Cemented, Open Approach
0SR90JA	Replacement of Right Hip Joint with Synthetic Substitute, Uncemented, Open Approach
0SR90JZ	Replacement of Right Hip Joint with Synthetic Substitute, Open Approach
0SRB019	Replacement of Left Hip Joint with Metal Synthetic Substitute, Cemented, Open Approach
0SRB01A	Replacement of Left Hip Joint with Metal Synthetic Substitute, Uncemented, Open Approach
0SRB01Z	Replacement of Left Hip Joint with Metal Synthetic Substitute, Open Approach

0SRB029	Replacement of Left Hip Joint with Metal on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SRB02A	Replacement of Left Hip Joint with Metal on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SRB02Z	Replacement of Left Hip Joint with Metal on Polyethylene Synthetic Substitute, Open Approach
0SRB039	Replacement of Left Hip Joint with Ceramic Synthetic Substitute, Cemented, Open Approach
0SRB03A	Replacement of Left Hip Joint with Ceramic Synthetic Substitute, Uncemented, Open Approach
0SRB03Z	Replacement of Left Hip Joint with Ceramic Synthetic Substitute, Open Approach
0SRB049	Replacement of Left Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SRB04A	Replacement of Left Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SRB04Z	Replacement of Left Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Open Approach
0SRB069	Replacement of Left Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SRB06A	Replacement of Left Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SRB06Z	Replacement of Left Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Open Approach
0SRB0J9	Replacement of Left Hip Joint with Synthetic Substitute, Cemented, Open Approach
0SRB0JA	Replacement of Left Hip Joint with Synthetic Substitute, Uncemented, Open Approach
0SRB0JZ	Replacement of Left Hip Joint with Synthetic Substitute, Open Approach
0SRC069	Replacement of Right Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SRC06A	Replacement of Right Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SRC06Z	Replacement of Right Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Open Approach
0SRC0J9	Replacement of Right Knee Joint with Synthetic Substitute, Cemented, Open Approach
0SRC0JA	Replacement of Right Knee Joint with Synthetic Substitute, Uncemented, Open Approach
0SRC0JZ	Replacement of Right Knee Joint with Synthetic Substitute, Open Approach
0SRD069	Replacement of Left Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SRD06A	Replacement of Left Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SRD06Z	Replacement of Left Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Open Approach
0SRD0J9	Replacement of Left Knee Joint with Synthetic Substitute, Cemented, Open Approach
0SRD0JA	Replacement of Left Knee Joint with Synthetic Substitute, Uncemented, Open Approach
0SRD0JZ	Replacement of Left Knee Joint with Synthetic Substitute, Open Approach

Appendix H. Categories of Current Procedural Terminology codes for chi-square analysis

Therapeutic Exercise	
97110	THERAPEUTIC EXERCISE, EACH 15 MIN, OT
97110	OT BIODEX TREATMENT
97110	THERAPEUTIC PROCEDURE EA 15 MINUTES
97110	WH OT THER EXERCISE EACH 15 MIN
97110	THERAPEUTIC EXERCISE, EACH 15 MIN
Therapeutic Procedure(s), group (2 or more)	
97533	SENSORY INTEGRATIVE TECH, EACH 15 MIN
97150	THER PROC 2 OR MORE PEOPLE
97150	THER PROC 2 OR MORE PEOPLE, 15 MIN
97150	THER PROC 2 OR MORE PEOPLE, 45 MIN
97150	WH OT GROUP TRAINING 60 MIN
97150	WH VOC TRAINING/ORIENTATION 45 MIN
97150	THER PROC 2 OR MORE PEOPLE, 60 MIN
97150	WH OT GROUP TRAINING 15 MIN
97150	THER PROC 2 OR MORE PEOPLE, 15 MIN, OT
97150	THER PROC 2 OR MORE PEOPLE, 60 MIN, OT
97150	WH VOC TRAINING/ORIENTATION 15 MIN
97150	WH OT GROUP TRAINING 30 MIN
97150	THER PROC 2 OR MORE PEOPLE, 30 MIN
97150	THER PROC 2 OR MORE PEOPLE, 30 MIN, OT
97150	THER PROC 2 OR MORE PEOPLE, 45 MIN, OT
97150	WH VOC TRAINING/ORIENTATION 30 MIN
97150	WH VOC TRAINING/ORIENTATION 75 MIN
97140	OT LYMPHEDEMA NEW, ARM
97140	MANUAL THERAPY, EACH 15 MIN ST
97140	WH OT MANUAL THERAPY EA 15 MIN
97140	OT MOBILITIES
97140	MANUAL THERAPY, EACH 15 MIN
97140	MANUAL THERAPY, EACH 15 MIN, OT
97140	OT LYMPHEDEMA NEW, LEG
97140	OT LYMPHEDEMA F/UP, ARM
97140	OT LYMPHEDEMA F/UP, LEG
97113	AQUATIC THERAPY W/ EXERCISE, EACH 15 MIN
97537	COMMUNITY/WORK REINTEGRATION, EA 15 MIN
97542	WHEELCHAIR MANAGEMENT, EACH 15 MIN

97545	WORK HARDENING INITIAL 2 HOURS OT
97545	WH WORK CONDITIONING INIT 2 HR
97545	WORK HARDENING INITIAL 2 HOURS
97545	WH VOC EVALUATION INITIAL 2 HOURS
97750	PHYSICAL PERFORMANCE TEST EA 15MIN OT
97750	FUNCTIONAL CAPACITY EXAM FCE PER 15 MIN
97750	PHYSICAL PERFORMANCE TEST EA 15 MIN
97750	WH OT FUNCTIONAL CAP EVAL 15 MIN
97112	NEUROMUSCULAR RE-ED, EACH 15 MIN
97112	WH OT NEUROMUSCULAR RE ED 15MN
97112	NEUROMUSCULAR RE-ED, EACH 15 MIN, OT
97124	MASSAGE, EACH 15 MIN
Therapeutic Activities	
97530	WH OT THERAPEUTIC ACTIVITIES EA 15 MIN
97530	THERAPEUTIC ACTIVITY EA 15 MIN, OT
97530	THERAPEUTIC ACTIVITY EA 15 MIN
97530	THERAPEUTIC ACTIVITY EA 15 MIN OT
97530	THERAPEUTIC ACTIVITY, EACH 15 MIN
Activities of Daily Living/Self-care training	
97535	ADL/SELF CARE TRAIN, EACH 15 MIN, OT
97535	HOME MGMT TRAINING, EACH 15 MIN, OT
97535	WH OT ADL TRAINING EA 15 MIN
97535	SELF CARE/HOME MGMT TRAIN, EACH 15 MIN
Development of Cognitive Skills	
G0515	DEVELOPMENT OF COGNITIVE SKILLS, EA 15 MINUTES
97127	THERAPEUTIC INTERVENTION W/FOCUS ON COGNITIVE FUNCTION
OTHER	
95992	CANALITH PROCEDURES, PER DAY
97014	APPLY ELECTRICAL STIM UNATTENDED
97014	ELECTRICAL STIMULATION THERAPY
97032	APPLY ELECTRICAL STIM ATTENDED EA 15 MIN
97032	APPLY ELECTRICAL STIM EA 15 MIN, OT
97032	OT E-STIM ATTENDED PER 15 MIN
97016	APPLY VASOPNEUMATIC DEVICE 30MIN
97016	VASOPNEUMATIC DEVICE THERAPY
97016	APPLY VASOPNEUMATIC DEVICE 15MIN
97018	APPLY PARAFFIN BATH OT
97032	APPL MODALITY W-STIM EA 15 MIN, OT
97035	ULTRASOUND, EACH 15 MIN

97035	OT ULTRASOUND PER 15 MIN
97035	ULTRASOUND, EACH 15 MIN, OT
97035	WH OT ULTRASOUND EA 15 MIN
G0283	ELECTRICAL STIM UNATTENDED, 15 MIN
G0283	ELECTRICAL STIM UNATTENDED, 45 MIN
G0283	ELECTRICAL STIM UNATTENDED, 15 MIN, OT
G0283	OT E-STIM UNATTENDED 15 MIN
G0283	ELECTRICAL STIM UNATTENDED, 45 MIN, OT
G0283	ELECTRICAL STIM UNATTENDED, 30 MIN
G0283	E-STIM UNATTENDED NONWOUND
G0283	ELECTRICAL STIM UNATTENDED, 30 MIN, OT
97597	DEBRIDEMENT WOUND CARE MINOR <=20CM
97597	DEBRIDEMENT WOUND CARE ADVAN <=20CM
97597	DEBRIDEMENT WOUND CARE MINOR <=20CM, OT
97597	DEBRIDEMENT WOUND CARE MOD <=20CM, OT
97597	OT DEBRIDEMENT WOUND CARE MOD <=20SQCM
97597	DEBRIDEMENT WOUND CARE ADVAN <=20CM OT
97597	DEBRIDEMENT WOUND CARE MAJOR <=20CM
97597	OT DEBRIDEMENT WOUND CARE ADVAN <=20SQCM
97597	SELECTIVE WOUND DEBRIDEMENT <=20SQCM
97597	DEBRIDEMENT WOUND CARE MOD <=20CM
97597	DEBRIDE WOUND EPIDERMIS OR DERMIS <=20SQCM
97597	WH OT DEBRD/WND CARE MNR<=20CM
97597	MINI WOUND CARE
97598	DEBRIDEMENT WOUND CARE ADVAN >20CM OT
97598	DEBRIDEMENT WOUND CARE ADVAN EA ADDL 20SQCM OT
97598	WOUND DEBRIDEMENT, EA ADDL 20SQCM
97598	DEBRIDEMENT WOUND CARE MINOR > 20CM
97598	DEBRIDEMENT WOUND CARE MOD > 20CM
97598	DEBRIDEMENT WOUND CARE MAJOR > 20CM
97598	DEBRIDEMENT WOUND CARE ADVAN > 20CM
97598	DEBRIDE WOUND EPIDERMIS OR DERMIS EA ADDL 20SQCM
97602	NONSEL DEBRIDEMENT WOUND CARE MINOR
97602	NONSEL DEBRIDEMENT WOUND CARE ADVAN
97602	NONSEL DEBRIDEMENT WOUND CARE MINOR, OT
97602	NONSEL DEBRIDEMENT WOUND CARE MOD, OT
97602	RN NONSEL DEBRIDEMENT WOUND CARE MOD
97602	RN NONSEL DEBRIDEMENT WOUND CARE MAJOR
97602	WOUND CARE, NON-SELECTIVE DEBRIDEMENT

97602	NONSEL DEBRIDEMENT WOUND CARE MOD
97602	NONSEL DEBRIDEMENT WOUND CARE MAJOR
97760	ORTHOTICS FIT TRAIN, INITIAL ENCOUNTER, EACH 15 MIN OT
97760	ORTHOTICS FIT TRAIN EACH 15 MIN
97760	ORTHOTICS FIT TRAIN, INITIAL ENCOUNTER, EACH 15 MIN
97760	ORTHOTICS FITTING TRAINING, EACH 15 MIN
97760	ORTHOTICS FIT TRAIN EACH 15 MIN OT
97761	PROSTHETIC TRAINING, INITIAL ENCOUNTER, EACH 15 MIN
97761	PROSTHETIC TRAINING EACH 15 MIN OT
97761	PROSTHETIC TRAINING EACH 15 MIN
97761	PROSTHETIC TRAINING, EACH 15 MIN
97763	ORTHOTICS/PROSTHETIC MGMT &/OR TRAINING SBSQ ENCTR 15 MIN

Appendix I. Levels of Independence

Levels of Assistance	**Froedtert Definition**
Independent	
Conditional Independence	
Set up	
Supervision	
Contact Guard Assist	
Minimum Assistance	75% patient effort
Moderate Assistance	50% patient effort
Maximum Assistance	25% patient effort
Dependent	Less than 25% patient effort

Appendix J. Demographics Questionnaire for Focus Groups

1. What is your gender?
    a. Female
    b. Male
2. Age
    a. 20-30
    b. 31-40
    c. 41-50
    d. 51-60
    e. 61-70
    f. 71-80
3. How long have you been an OT?
    a. 0-5 years
    b. 6-10 years
    c. 11-20 years
    d. 21-30 years
    e. 31- 40 years
4. What is your highest level of education?
    a. Bachelor's Degree
    b. Master's Degree
    c. Doctorate degree
    d. PhD
5. What is your practice specialty area?
    a. General Medicine
    b. Oncology
    c. Ortho
    d. Cardiac
    e. Neuro

Appendix K. Interview Schedule: Focus Groups

Interview Schedule: Focus Groups

Thank you for participating in this focus group. Today we will be exploring your decision-making process on which CPT codes are billed based on interventions and activities provided during OT sessions. When we are discussing these topics, I would like you to focus your responses on the following diagnoses: acute myocardial infarction, heart disease, pneumonia, chronic obstructive pulmonary disease, coronary artery bypass graft, and total hip and knee arthroplasty. I realize these are very different diagnoses however they are grouped together for the Medicare program, the Hospital Readmission Reduction Program, so our discussion will focus on the diagnoses as one group. I would also like to discuss how you learned to bill for the interventions and activities provided during OT sessions for patients, like hospital policies, departmental training. Before getting started today, there are a few simple ground rules I would like to review with the group.

1. The session will be audio recorded and anonymity is a top priority so please do not use other people's names during the session.
2. Turn off cell phones and limit distractions
3. Try to use "I statements" like "I disagree" rather than "You're wrong"
4. Try to stick to the topic of the question
5. This is a safe place for people to share their honest thoughts
6. There are no right or wrong answers – only different points of view
7. Listen respectfully, even if you disagree.

What questions do you have about the ground rules before we move onto the focus group questions?

Thank you for your questions. Now we will move onto the questions for the focus group.

1. Before we talk about billing, I would like to know more about how you define activities and interventions. Please share how you define or describe each of these.
    a. **Prompt:** In the literature, activities are defined as "*whole tasks that are the focus of the therapy session".* Examples include exercise and functional mobility. Do you agree with this definition? If not, how would you change it?
    b. **Prompt:** The literature defines interventions as *"specific treatment approaches by occupational therapists to facilitate activities"*. Examples include conditioning exercises and activity tolerance. Do you agree with this definition? If not, how would you change it?

2. What do you take into consideration when deciding which activities and interventions to use and when to use them?
    a. **Prompt:** For example, how would you decide to focus on dressing during one session then exercise the next session?

3. Now that we've talked a little bit about activities and interventions and when we use them, I would like to find out more about how you bill for them. How do you decide which CPT code to bill for after a session is complete?
    a. **Prompt:** How does the department, hospital and/or your peers influence your decision on which CPT code to bill?
    b. **Prompt:** How does available resources in the department impact your decision on which CPT code to bill?
    c. **Prompt:** If you think multiple CPT codes can be appropriately billed for one session, how do you allocate the minutes, activities, and interventions to the multiple CPT codes?

4. What training did you receive on how to bill for CPT codes?
    a. **Prompt:** How does the department determine you are proficient in billing CPT codes?
    b. **Prompt:** If you received training, how well did you feel the training prepared you for practice?

5. Data analysis completed before this focus groups showed that X1 and X2 CPT codes are associated with reduced likelihood for readmission. What are your thoughts?
    a. **Prompt:** When you think of X1 CPT code, what activities and interventions do you think of?
    b. **Prompt:** When you think of X2 CPT code, what activities and interventions do you think of?
    c. **Prompt:** Which of those activities and interventions do you think may be the active ingredient in reducing readmissions?

6. The data analysis also showed that Y1 and Y2 CPT codes are NOT associated with reduced readmission, what are your thoughts about these CPT codes not being associated with reduced readmission?
    a. **Prompt:** When you think of Y1 CPT code, what activities and interventions do you think of?
    b. **Prompt:** When you think of Y2 CPT code, what activities and interventions do you think of?

Thank you for sharing your thoughts on CPT codes with me today. The goal is getting a better understanding of how, as OTs, we determine activities and interventions and billing codes among these populations. It will also help us begin to explore OTs role in reducing readmission rates. Before we end our focus group, what other thoughts or questions do you have?

Appendix L. Focus Group Ground Rules

1. The session will be audio recorded and anonymity is a top priority so please do not use other people's names during the session.
2. Turn off cell phones and limit distractions
3. Try to use "I statements" like "I disagree" rather than "You're wrong"
4. Try to stick to the topic of the question
5. This is a safe place for people to share their honest thoughts
6. There are no right or wrong answers – only different points of view
7. Listen respectfully, even if you disagree.

Appendix M. Interview Schedule: 1:1 interview with Froedtert billing expert

Interview Schedule: 1:1 Interview with Billing Expert

Thank you for participating in this interview with me. Today during the interview, we will be exploring what happens to **occupational therapy** billing once it is received by your department and before it is sent for reimbursement. I also hope to discuss any associated issues with occupational therapy billing after reimbursement is requested.

1. To begin, please tell me a little more about your role in the billing department specifically with occupational therapy billing.
    a. **Prompt:** What is the approximate percentage of your work that you deal with occupational therapy billing?

2. What training specifically around occupational therapy billing have you received?
    a. **Prompt:** Did you receive any specific training with general therapy billing (i.e. PT, OT, and SLP)?
    b. **Prompt:** For any of the training you received, was the training unique to Froedtert? Or is the training determined by national guidelines?

3. What are the guidelines for managing occupational therapy building in Froedtert billing department?
    a. **Prompt:** Are the department guidelines specific to Froedtert? National guidelines?

4. In what ways do you feel that billing decisions made here are different and similar from other hospitals either on the state-level or national level?
    a. **Prompt:** How do billing decisions made at Froedtert differ from other hospitals in the state?
    b. **Prompt:** How do billing decisions made at Froedtert differ from other hospitals in the country?

5. Now that we have talked about OT billing in general, I would like to discuss changing billing policies. What would be examples of changes you would make to occupational therapy billing after it is submitted by the occupational therapist but before it is submitted for reimbursement?
    a. **Prompt:** Could you describe your process for reviewing occupational therapy billing?
    b. **Prompt:** If you make any changes, are any of the changes based on Froedtert requirements or are the changes national requirements?

6. What are examples of reimbursement requests for occupational therapy CPT codes that have been denied reimbursement?
    a. **Prompt:** What do you do if occupational therapy CPT codes are denied reimbursement? Do you make corrections and resubmit?
    b. **Prompt:** Why are those CPT codes denied reimbursement?

7. What suggestions do you for OTs to help make the billing more consistent with policies and regulations?

Thank you for sharing your thoughts on CPT codes and billing with me today. The goal is getting a better understanding of how, as OTs, we determine activities and interventions and billing codes among this population. It will also help us begin to explore OTs role in reducing readmission rates and how we can more effectively and efficiently code for our services. Before we end our interview, what other thoughts or questions do you have?