CLINICAL UTILITY OF THE CARE ITEM SET

by

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I have two of the most amazing young men I'm proud to call my sons. They've supported me, encouraged me, and helped make it possible for me to focus on this process. Thank you Knox and Will – I am blessed to have you in my life! I dedicate this study to you.

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ABSTRACT

The Continuity Assessment Record Evaluation (CARE) Item Set provides a reliable, valid measure of mobility and self-care outcomes in post-acute settings. If the CARE Item Set can provide direction for the therapy plan of care, its value is multiplied. The assessment and treatment planning process would be streamlined if rehabilitation therapists can use the CARE Item Set to identify risk factors for adverse events, focus interventions on the most critical tasks for community discharge, and quantify function for rehabilitation goals.

Post-acute patients participating in occupational (OT) and/or physical therapy (PT) programs in skilled nursing facilities (SNF) were the focus of this study. Data were extracted from the PT and OT documentation and the Minimum Data Set including CARE Item Set scores at admission and discharge, age, diagnoses, discharge placement, therapy program duration, and prior level of function.

The primary aims of the first study (Chapter Two) were to determine the extent to which scores on the CARE Item Set mobility scale and subsets of the scale (bed mobility, transfers, and combined basic mobility items) of the scale were responsive to change in function and associated with community discharge. Findings indicated that the mobility scale items and the bed mobility, transfer, and combined basic mobility items were responsive to change over the course of the PT program and were associated with differences in the meaningful outcome of community discharge. The total CARE mobility scale and basic mobility subscales provided an effective way to describe

baseline status, establish goals and demonstrate progress for post-acute care patients in the SNF setting.

The primary aim of the second study (Chapter Three) was to use demographic and clinical information and CARE Item Set scores at time of therapy evaluation to identify patients at risk for interruption of the rehabilitation program with a hospital readmission. While mobility and self-care scores were significantly different between groups ($p <$ .001), only decline in self-care abilities during the hospital stay contributed to readmission risk in the decision tree and logistic regression prediction models. Length of stay in the SNF was the strongest predictor of hospital readmission in the decision tree model. Patients were more likely to be readmitted to the hospital during the first eight days of the SNF stay. Patients with medical conditions including pneumonia, COPD, heart failure and operative hip fracture were at increased risk of readmission.

The primary aim of the third study (Chapter Four) was to identify the functional tasks most strongly associated with discharge to the community. Results can inform care planning and prioritization of treatment goals and interventions. Toileting was the most critical functional task for community discharge in this group of inpatients. Focusing therapy plans of care on toileting and transfer tasks may be the most efficacious approach for patients whose goal is to return to the community from the SNF.

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CHAPTER I: INTRODUCTION

The escalating cost of health care and increasing numbers of older adults make it necessary to focus on effectiveness and efficiency of care. Alternate reimbursement plans are emerging that share responsibility between patients, providers, and payors for personal health and for quality, effective health care. The Affordable Care Act (ACA) became law in 2010 and provides a framework for health care reform (U.S.D.H.H.S., 2015b). One of the primary aims of the law is to "improve health-care value, quality, and efficiency while reducing wasteful spending and making the health-care system more accountable to a diverse patient population" (Rosenbaum, 2011, p 130). The ACA lays the foundation for fundamental changes in health care quality and practice. Health care providers receiving government reimbursement for services are strongly incentivized to collaborate to maximize meaningful outcomes for patients and measure/report on specific quality indicators such as hospital readmissions and discharges to the community rather than institutional settings.

A review of the history of health care in the United States provides a backdrop to the need for and nature of reform in our current system. Americans have debated options for providing access to and funding for health care since the early 1900's (Hoffman, 2009). Opinion polls indicated support for guaranteed access to care, health insurance for all, and government financial support for health care as early as the 1930's. Through the 1960's the focus was primarily on expanding access to care. Medicare and Medicaid programs emerged in 1965 extending health care coverage to a large segment of the population. The federal agencies now in place to evaluate and estimate the potential

financial implications of legislation were not in place at that time and President Johnson chose to make the coverage available and "worry about how to afford it later" (Blumenthal & Morone, 2008, paragraph 34).

Government health care expenses grew quickly from 4% of the U.S. national budget in 1965 to 11% in 1973 as a result of the Medicare and Medicaid programs (Hoffman, 2009). Health care reform began to include the concept of cost control in addition to access to care. A managed competition approach to health care management began to emerge in the 1990's with a focus on reducing cost. Health care expenses continued to increase and, with the expectation of baby boomers entering retirement years, more dramatic reforms were necessary. A system that paid for the quantity of care without consideration for the quality of care was not sustainable (Gawande, 2010).

The changing health care system presents unique challenges for medical rehabilitation professionals. In his address to the American Physical Therapy Association in 2012, Alan Jette identified three critical system skills for physical therapists (PTs) navigating the new health care environment. He challenged PTs to develop an interest in data, the ability to use data and experience to devise solutions to problems identified, and the ability to collaborate effectively across the continuum of care for optimal patient outcomes. Therapists must routinely collect and appropriately analyze outcomes data and disseminate findings to allow determination of the most effective treatment strategies for optimizing health of individuals and the population.

Evidence-Based Practice in Rehabilitation

The term "evidence-based medicine" first emerged in the 1990's referring to the concept of basing clinical practice on the integration of knowledge resulting from the synthesis of research evidence, clinical expertise, and individual patient's values and preferences (Dickersin, Straus, & Bero, 2007). It was a milestone in health care allowing for the discovery and development of treatment approaches that have extended life spans and, in many cases, enhanced quality of life. Haynes (2002) gave guidance for grading the quality of research studies and resulting evidence including:

1. Reasonable precautions to minimize bias – including use of reliable and valid outcome measurement instruments
2. Using patient populations as much as possible like those in typical clinical practice
3. Outcomes measured are important to patients

Reliable and valid measurement of outcomes are critical to evidence based practice in research and in clinical settings. In clinical practice, reliable and valid outcome measurement instruments are those that:

1. Impose no more than minimal burden on clinicians
2. Are relevant and useful in different conditions – clinical severity, different literacy levels
3. Have standardized procedures for administration to maximize likelihood of consistent application and interpretation

4. Are helpful for diagnosing/classifying patients, setting goals, determining prognosis, and/or quantifying treatment effectiveness
5. Reflect life/health issues that are addressed by therapy
6. Provide a quantitative measurement
7. Have normative data that allow comparisons between patients and patient groups
8. Have strong psychometric properties (MacDermid, Law, & Michlovitz, 2014).

Clinical measurement of outcomes is important for evaluating change over time, discriminating different types of patients and patient needs, and for outcome prediction to inform goal setting and treatment planning (MacDermid, 2014). The increasing focus on outcome measurement in rehabilitation therapy is evident by a JEWL search of literature using the search terms "outcome measurement or outcomes, and physical therapy or rehabilitation". For the 20-year time period of January 1980 through December 1999 the search yielded 26,990 responses. For the 16 year period of January 2000 through December 2015 (16 years) the search yielded 350,154 responses, a 1297% increase. Rehabilitation Measures Database, a web-based resource for rehabilitation professionals, contains information such as administration guidelines and psychometric testing for 357 different measurement instruments for a wide range of domains including body structure and function, activity/participation, balance, and quality of life (Rehabilitation Measures Database, 2010). Sometimes health care providers can become so overwhelmed with the number of things to measure they can lose focus on the actual needs of the patient (McEvoy, 2014).

The challenge of balancing the need for meaningful measurement with the overwhelming number of available, required, and/or recommended measurement instruments is not unique to health care providers. Business consultants have identified metrics overload as a possible distraction from focusing on the vital metrics that drive actual success of corporations (Cassimatis & Lynch, 2014). They encourage businesses to select areas and instruments for measurement based first on what is essential to company success. Secondly, companies should select the fewest number of outcome measures needed to determine if the company performance is progressing toward the desired goals. Measurement instruments should use simple and consistent language and methodology so that everyone with access to the results can interpret them effectively in order to make good decisions for the company. Lastly, metrics should be directly related to performance.

Health care providers can apply these principles to measurement. With many measurement instruments available, it is important to choose ones that are most relevant to the desired outcome(s) for individual patients. Clinicians should select the fewest instruments necessary to identify strengths and weaknesses and determine if the patient is indeed progressing toward the desired goal(s). Measurement tools should use simple and consistent language and terminology and should directly relate to the performance of the patient.

Responsiveness

The most common clinical use of outcome measurement instruments is to evaluate changes in response to treatment (MacDermid et al., 2014). Responsiveness –

the ability of an instrument to detect important change in performance over time- is a form of validity with two distinct aspects: internal and external (Husted, Cook, Farewell & Gladman, 2000). Internal responsiveness refers to the ability of a measure to change over a specific time frame and can be assessed by examining changes in scores from a pre-treatment time (e.g., PT evaluation) to a post-treatment time (e.g., PT discharge). External responsiveness describes the extent to which changes in scores are associated with an outcome of interest. An improvement in function that is associated with a desired outcome represents a meaningful and important change in a patient's status. Instruments demonstrating discriminative (known groups) validity allow for classification of patients into groups that have different treatment or discharge needs. When an instrument demonstrates predictive validity, results can predict the outcome so that treatment planning is directed toward the most likely outcome in the most effective and efficient way.

Post-acute Care

An analysis of health care spending reveals disparities in spending for specific conditions. For hip replacement, total cost per episode varied between $17,784 for the bottom quintile and $24,693 for the top quintile based on Medicare claims data between January 2005 and November 2007 (Miller et al., 2011). Post-acute care was responsible for $5,885 of the $6,909 difference in spending. For back surgery, post-acute care made up $3,156 of the $7,759 difference in spending between the top and bottom quintiles. With post-acute care services accounting for a large proportion of the spending variance

and 1/3 or more of hospitalized Medicare beneficiaries discharged to post-acute settings, health care reform is reasonably focused on these levels of care (Gage et al., 2012a).

Post-acute health care providers provide skilled nursing and/or rehabilitative therapies in home care, inpatient rehabilitation hospitals, skilled nursing facilities, and long term care hospitals. Approximately 20% of Medicare beneficiaries have a hospital admission each year, with almost 40% of them then transferred to a post-acute setting for skilled nursing and/or therapy services following hospitalization (Gage et al., 2012a). Theoretically, the four separate post-acute provider settings meet different patient needs and provide a continuum of care for patients, but in reality, all four provide skilled nursing and rehabilitation services and all three inpatient settings provide 24-hour per day nursing care. The decision to refer a patient to one setting over another may depend on availability, geographical preference, or other criteria. While there are similarities between settings in the types of services provided, the intensity and the focus of treatment can differ. With limited health care dollars, the focus must be on optimizing clinical outcomes and minimizing cost by providing patients with the right care at the right time in the right place (Nowak, Rimmasch, Kirby, & Kellogg, 2012).

Each post-acute setting uses a different tool to assess the acuity level of their patients and measure outcomes. Acute hospitals and long term care hospitals do not have a mandated tool. Skilled nursing facilities (SNF) use the federally mandated Minimum Data Set (MDS), home health care agencies use the Outcome and Assessment Information Set (OASIS) and inpatient rehabilitation hospitals use the Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF-PAI). These instruments

facilitate development of an individualized plan of care for patients as well as provide data to measure and evaluate outcomes and establish payment to the provider for each patient.

While the assessment tools being used by post-acute providers measure many of the same constructs, the specific items and data collection formats differ making it difficult to compare utilization and outcomes between settings, a necessary criterion for determining the most effective and efficient setting for specific types of patients. The IRF-PAI has 18 functional items, uses seven scale levels and describes performance over the prior three days. The MDS has twelve items, eight rating scale levels, and describes function of a 5-7 day period. The OASIS has 8 items, varying number of rating scale levels, and describes function on the assessment day. The differences in tools makes it difficult to compare individual patient responses to treatment when they utilize more than one post-acute setting and to determine the most effective rehabilitation placement. The Medicare Payment Advisory Commission report to the U.S. Congress (Medicare Payment Advisory Commission, 2013) included the observation that Medicare payments varied significantly for different post-acute settings caring for similar patients. Evidence to support the benefit of one setting over another for any particular type of patient is lacking due to differences in outcome measurement across settings.

The Policy Council (2006) document outlining the Post-Acute Care Reform Plan (2006) addresses priorities for post-acute care reform including:

- Providing high-quality post-acute care (PAC) services in the most appropriate setting based upon patient needs – which requires getting patients into the right PAC setting at the right time, as well as measuring patients' progress and the quality of care provided in PAC settings.
- Developing effective measures (including process measures) in order to drive the PAC system toward the delivery of high-quality care in the most effective manner and, thus, improve payment efficiency
- Providing a seamless continuum of care for beneficiaries through improved coordination of acute care, post-acute care and long-term care services, including better management of transitions between care settings.

A critical element of the plan for reform is to develop and implement a standardized assessment instrument that would effectively measure functional status of patients in all post-acute settings. Standardizing outcome measurement across settings should facilitate seamless transitions between settings and evaluation of quality across settings to inform payment reform (Gage, 2013). The final tool should provide data that is reliable, valid, communicates the same information across settings, and is reusable and informative. The Continuity Assessment Record and Evaluation (CARE) Item Set is the result of this initiative.

Care Item Set

Purpose and Development of the CARE Item Set

The CARE Item Set was developed as a component of the Post-Acute Payment Reform Demonstration mandated by Congress as part of the Deficit Reduction Act of 2005 (Gage et al., 2012a). The goal was to standardize measures of patient severity and functional impairment levels so that patient acuity, outcomes and costs could be compared across settings while minimizing administrative burden on providers.

CARE item selection

A panel of experts from relevant disciplines, post-acute provider settings, and the measurement field was responsible for item development and selection for the CARE Item Set. Items should measure abilities across the continuum of care so that the tool would be sensitive to changes in patient ability at both high and low ends of severity represented in the population treated in post-acute care. The tool should allow for comparison across settings, demonstrate unidimensionality and pose only minimal burden on providers (Gage, 2013).

Existing items included in Medicare required assessment tools provided a starting point to compile a battery of items describing functional levels with self-care and mobility. While many CARE items were taken from existing assessment tools and were reliable and valid for specific provider settings, they had not been used and tested in multiple post-acute care settings (Gage et al., 2012a). Workgroups evaluated items from the IRF-PAI, MDS, and OASIS that related to patient severity, payment, or quality of care to identify the best items for capturing functional domains across the continuum of

post-acute care. The initial set of items was published in the Federal Register and public review and comments were solicited. After consideration of feedback and pilot testing the workgroups submitted the final list of items as part of the Post-Acute Care Payment Reform Demonstration (PAC PRD).

The tool contains two subscales (mobility and self-care) rather than one single measure of motor function in order to maximize discrimination of patient ability. Different conditions effect patients in different practical ways so differentiating between mobility and self-care can allow for more accurate description of functional status. For example, since self-care generally requires more upper extremity function than does mobility, conditions effecting upper extremities will result in more self-care dysfunction than do conditions effecting primarily the lower extremities. An aggregated disability score may be useful for measuring overall disability but separate scores for mobility and self-care may allow for better discrimination of disability by patient and/or diagnostic group (Gage et al., 2012c).

The CARE Item Set is made up of eight self-care items (eating, oral hygiene, toilet hygiene, upper body dressing, lower body dressing, washing upper body, shower/bathing, and putting on/off footwear) and fourteen mobility items (lying to sitting, sitting to lying, rolling right/left, sit to stand, bed/chair transfers, toilet transfers, walking assistance, picking up objects, car transfers, walking 50 feet with 2 turns, walking 10 feet on uneven surfaces, stepping up 1 step, stepping up 4 steps, and stepping up 12 steps. Many of these items are also included on the OASIS, MDS 3.0, and/or the

IRF-PAI. (Gage et al, 2012c). Descriptions of self-care items are provided in Appendix A and mobility items in Appendix B.

Functional status with each task is evaluated on the CARE Item Set using an ordinal scale from 1 (dependent) to six (independent). Interim levels of performance are assigned to indicate substantial/maximal assistance (2), partial/moderate assistance (3), supervision or touching assistance (4), or set-up or clean-up assistance (5). Definitions of each level are provided and included in Appendix C (CARE Item Coding). Therapists are instructed to code the patient's most usual performance considering both safety and quality of the performance. If a patient is unable to attempt the task due to medical restrictions a code of "dependent" is appropriate. If a patient is unable to complete a task other tasks requiring the same or a greater level of ability can be coded as "dependent" without direct observation of an attempt of the task. For example, if a patient is unable to step up one step it is reasonable to designate a code of one (dependent) for four and twelve steps. Assistive devices may be used as needed.

A training manual for therapists is available that describes each task and examples of each level of performance of that task (American Health Care Association, National Association in Support of Long Term Care, 2014). Vignettes are included in the manual describing appropriate coding for commonly encountered situations. Therapists can view training videos and complete post-tests online to confirm competency in administration of the CARE item set. Only therapists with evidence of successful completion of the online testing are allowed to contribute CARE item set data into national databases.

Psychometric Testing of the CARE Item Set

Providers representing all post-acute settings and varying types of patients and markets (rural and urban, high and low provider availability in the community, etc.) participated in CARE Item Set testing from April 2008 through December 2010 (Deutsch et al., 2012). Each of the 206 selected providers collected data on 200-250 Medicare beneficiaries over a 6-9 month period for psychometric testing.

CARE reliability

Reliability of item scoring was critical to the project since the assessment would be used in a variety of settings and potentially with different clinical disciplines in each setting. A subset (27) of the 34 providers participating in the PAC PRD project participated in reliability testing. All participants in the reliability testing completed training in administration of the CARE Item Set. Interrater reliability was assessed between providers in each post-acute setting and between providers in different settings. Clinicians from each setting completed duplicate assessments on a patient at the same time (or within 48 hours) upon admission. Providers in different settings scored selected CARE items after viewing video-taped patient scenarios. Participants included a designated number of Medicare patients representing a range of functional abilities and acuity levels yielding a total of 455 pairs of matched patient assessments.

Kappa statistics indicated the level of agreement in scoring CARE items between providers. Researchers expected at least moderate agreement ($\geq$.41) as evidence of adequate reliability. Inter-rater reliability testing indicated that there was at least a moderate level of agreement in scoring the ADL and mobility items between providers

within each setting and between settings. Agreement between providers in skilled nursing facilities (SNF) was generally higher than agreement in other post-acute settings. The only exceptions were eating, toilet hygiene, upper/lower body dressing, lying to sitting at admission and/or discharge assessment. Agreement was at least moderate (minimum of .574) for each of these items in the SNF setting. When compared to reliability tests of the currently used instruments, the CARE items were as reliable, or in some cases more reliable (Gage, et al, 2012c). Internal consistency of the CARE items was evaluated using Cronbach's alpha. A Cronbach alpha of 0.80 was required to support the use of the items in each of the two scales (mobility and self-care) to adequately represent the constructs suggested. Cronbach's alpha for mobility, self-care, and combined motor scales was .95 to .98 for admission and discharge assessments indicating good internal consistency of the items.

Exploratory factor analysis clarified the number of constructs explaining the variation in item scores. Results suggested that either two or three constructs could explain the variation in the data: self-care and mobility as two distinct constructs, or two core motor (mobility and self-care) constructs in contrast with instrumental activities of daily living (IADL). Model fit estimates indicated that either approach to explaining the variation in data is acceptable. IADL items were not included in the final core set of items.

Rasch analysis was used to examine the fit of the items in a mobility and self-care scale. The scope of item difficulty was of interest since a wide range of impairments are represented in patients across the post-acute continuum (Gage et al., 2012c). Eating was the easiest item in the scale and ascending/descending twelve steps was the most difficult.

Several sets of items were similar in level of difficulty, but were not excluded from the item set because the individual items measure dimensions of function that are clinically relevant to the rehabilitation process and discharge goals. One example is four items (upper body dressing, lying to sitting, sitting to lying, and washing upper body) that represent a comparable level of difficulty, but are each critical skills for patients to master, so each were included.

Floor and ceiling effects were minimal (733 patients achieved the maximum score and 754 patients achieved the minimum score out of 36,176 assessments) indicating that the difficulty of the items was appropriate for quantifying function for patients across the post-acute continuum. The six point rating scale was effective for capturing performance levels for mobility and self-care items.

Skilled Nursing Facilities

In 2011, 1.7 million Medicare fee-for-service beneficiaries received skilled nursing and/or rehabilitative care in skilled nursing facilities, accounting for 2.4 million admissions (Medicare Payment Advisory Commission, 2013). Skilled nursing facilities (SNFs) provide skilled care through Medicare Part A for patients unable to return to their prior living situation after a hospitalization. Medicare reimburses up to 100 days of care in a SNF after a hospital stay of at least 3 days when skilled rehabilitation and/or skilled nursing services are required on a daily basis (at least five days per week for therapy) in an inpatient setting. The most common reasons for hospitalization for Medicare beneficiaries admitted to SNFs include joint replacement, septicemia, kidney and urinary tract infections, hip fracture, and heart failure (Medicare Payment Advisory Commission, 2013). The primary goal of skilled post-acute services in SNF is to improve function –

optimally to the level of independence experienced prior to the hospitalization – to allow discharge to home or the less restrictive environment (Pruitt, 2013).

Patients admitted to SNFs are more likely female, older, and are four times more likely to have limitations in multiple activities of daily living than other Medicare beneficiaries. According to data obtained during January through March of 2016 from the Minimum Data Set (MDS), the Center for Medicare and Medicaid Services (CMS) required assessment tool for use in SNFs, 59.71% of SNF patients required extensive assistance with bed mobility and 51.27% required extensive assistance with transfers (Centers for Medicare and Medicaid Services, 2016). Almost 65% of the patients were women and over half had moderate to severe cognitive impairment. Only 4.8% of Medicare patients admitted to skilled nursing facilities in 2012 were independent in bed mobility and 2.5% were independent in transfers. The trend over time shows increasing dependency in ADLs among SNF short-stay patients (Pruitt, 2013).

The prevalence of chronic conditions such as hypertension, heart disease, and diabetes and of combinations of chronic conditions in the same person ("multiple chronic conditions") increases with age and increases the risk for functional limitations and high health care resource utilization. In 2012, two thirds of Medicare beneficiaries had multiple chronic conditions (CMS, 2012a). The number of SNFs admitting complex medical patients increased from approximately 900 in 2007 to over 1,200 in 2011 (Medicare Payment Advisory Commission, 2013). The typical person receiving care in a skilled nursing facility "is more medically complex as patients are discharged 'sicker and quicker' from the hospital ..." and as hospitals have become focused on reducing

avoidable readmissions (The Medical Direction and Medical Care Work Group, 2011, paragraph 1).

Minimum Data Set

The Minimum Data Set (MDS) is a standardized assessment tool for health status that is required for all residents in Medicare and/or Medicaid certified skilled and long-term care facilities. It contains items that measure function in multiple domains including physical, psychological, and psychosocial. The assessment guides the clinical team in identifying a resident's challenges to health and well-being. As a comprehensive assessment, it also facilitates the formation of an individualized plan of care as well as establishes reimbursement for patients with traditional Medicare by quantifying the resources required to adequately care for each patient (CMS, 2012b).

Outcome Prediction

Informed prediction of outcomes can facilitate appropriate placement and guide decisions about the type and intensity of services provided. It is the responsibility of the therapists, in collaboration with the rehab team including the patient and caregivers, to establish objective, realistic, individualized goals for the therapy program (American Physical Therapy Association, 2014). The goals provide guidance for the implementation of therapy interventions that address barriers to the desired outcome(s) and allow the patient to progress toward improved functional independence. Determining appropriate goals requires the therapists to predict each patient's potential for improvement. Investigating the predictive ability of rehabilitation therapists, Taylor (2001, p. 85) noted that "The predictive ability of staff is seen as a fundamental skill

constituting the essence of a cost effective and efficient rehabilitation service … ” Therapists sometimes tend to base predictions on intuition or reasoning strategies that may not be reliable (Callahan & Johnstone, 1999). This may be especially true in the absence of evidence to guide goal setting for older adult with multiple chronic conditions typically receiving therapy services in skilled nursing facilities.

Physical therapists practicing in a health care environment scrutinized for cost-effectiveness of treatment approaches need guidance for clinical decision making. Shewchuk and Francis (1988, p. 357) observed that “A sound clinical decision for the current clinical environment requires from the therapist a contextually relevant, simultaneous evaluation of a bewildering array of variables.” With the more recent expansion of managed care and introduction of Accountable Care Organizations and bundled payment projects, the pressure to make sound decisions is even more crucial in today’s health care environment. Therapists must consider possible intervention plans and goals for each patient based on the results of the evaluation, the various relevant conditions and diagnoses, and the potential and probable consequences of intervention plan. “A comprehensive processing of these variables and the avoidance of potentially costly errors in clinical decision-making situations requires the application of a formalized, systematic method of empirical decision analysis.” (Shewchuk & Francis, 1988, p. 357).

The ability to predict upon initiating a rehabilitation program what a patient’s functional status will be at completion of the program can help guide providers in establishing and implementing an effective plan of care. Having an accurate idea of the

most likely outcome for a patient can help providers establish realistic goals and expectations that allow the patient and/or family to more effectively prepare for discharge. Up to 30% of patients may experience a delay in discharge from acute care hospitals due to non-medical complications, with the most common reason for the additional days being difficulty arranging for appropriate discharge placement (Selker, Beshansky, Pauker, & Kassirer, 1989).

Accurately predicting discharge needs can focus the rehabilitation program and reduce the risk for unnecessary delays that are costly and expose patients to adverse effects of an inpatient stays. If equipment, home modifications and/or assistance will be required after the rehabilitation program, arrangements can be made and caregivers trained in a timely manner, potentially reducing the need for an extended length of stay in order to adequately prepare (McAndrew, McDermott, Vtizakovitch, Warunek, & Holm, 1999). Anticipation of the discharge status can allow for planning the most appropriate level of care in order to make the best use of limited health care dollars.

Patient satisfaction, one of the primary aims of health care reform in the US, is increased when patients and caregivers are involved in setting goals that reflect realistic expectations and well as personal priorities and concerns (Payton, Nelson, & Hobbs, 1998; Moore & Kramer, 1996). Heinemann et al. (1997) noted that "Improved prediction has the potential of benefiting providers by helping them marshal the proper staff resources so that patients' functional gains and satisfaction are maximized." (Heinemann et al., 1997, p. 148).

Community Discharge

Community discharge is a desired goal for many people in SNF rehabilitation programs. The Improving Medicare Post-Acute Care Transformation (IMPACT) Act of 2014 tasked CMS with instituting a measure of discharge to the community as an indicator of the quality of services provided by SNFs (CMS, 2015). Medicare claims data will be used to report the proportion of SNF short stay patients discharged to the community at a facility level beginning in fall of 2017. Results will be available to the public in 2018 for use when making decisions about where to receive care and may ultimately influence reimbursement.

There is a great deal of variability in rates of community discharges across post-acute settings depending on geographical location, ownership, and patient characteristics (RTI International, 2016). The greatest variation is seen in SNF settings, with rates between 31% and 65% reported and an average of 44%. Centers with higher quality ratings, small hospital-based centers, and non-profit facilities were more successful with discharging patients into the community than those with lower ratings, larger centers, and those owned by for-profit companies (Breunig & Ribar, 2015). Other facility characteristics can influence discharge destination rates of short and long term patients including proportion of Medicaid patients (Holup, Gassoumis, Wilber & Hyer, 2016), volume of therapy provided and percent of Medicare admissions (Arling, Williams & Kopp, 2000).

Clinical teams in the SNF setting are expected to establish and implement a comprehensive plan for a successful discharge to the optimal setting for each patient.

Medicare requirements specify that the care plan must be developed within twenty-one days of admission and must include "measurable objectives and timetables customized to the beneficiary" (U.S.D.H.H.S., 2014). When discharge to the community is the desired and reasonable expectation, the team must establish a plan for coordinated care that will maximize the likelihood of a safe transition. In 2013, the Office of Inspector General issued results of a study finding that discharge planning requirements were not met in approximately 31% of SNF stays by Medicare beneficiaries (U.S.D.H.H.S., 2013). Increased guidance to SNFs for effective discharge planning was identified as a need. Examining factors that are associated with successful transitions to the community can facilitate care planning that is informed and targeted to the most significant barriers.

Discharge to community is a modifiable outcome. Interventions including use of health care team communication tools (Kushner, Peters, & Johnson-Greene, 2015), high therapy intensity (Wodchis et al., 2005), and multidisciplinary root cause analysis conferences to identify discharge barriers (Berkowitz et al., 2011) can improve successful transitions. Effective interventions focus on improving functional status and management of medical conditions, suggesting that a focused effort on the part of the clinical team can lead to increased discharges to the community.

Hospital Readmissions

One in five older adults discharged from a hospital are readmitted to the hospital within 30 days and many of the readmissions are avoidable (PerryUndem Research & Communication, 2013). The economic impact of hospital readmissions is significant. Avoidable readmissions cost Medicare $17 billion per year. Patients readmitted to the

hospital experience emotional stress and an increased risk for medical errors in addition to the risk factors presented by any acute admission (Mor, Intrator, Feng, & Grabowski, 2011). For short stay patients in the skilled nursing facility (SNF) a hospital readmission can interrupt the rehabilitation progress and delay or prevent the optimal and desired discharge placement. The Improving Medicare Post-Acute Transformation Act (IMPACT) included a mandate to collect data describing quality including hospital and community discharges from post-acute settings. The primary goal was to advance three primary aims: (1) higher quality of care, (2) better health of communities, and (3) reduced cost of care (Centers for Medicare and Medicaid Services, 2015). Readmission to the hospital within a 30 day time frame for conditions that should have been preventable may be an indication of faulty care coordination and results in unnecessary spending (Laderman, Loehrer, & McCarthy, 2013).

The Affordable Care Act (ACA) reduced Medicare payment rates for hospitals with higher than expected 30-day readmission rates. The program had a three-year phase in starting with payment reductions of one percent in 2012 and increasing to two percent in 2013 and three percent in 2014. During the first year of the readmission reduction program, more than 2,200 hospitals had payment reductions penalties for a total of $280 million (Laderman et al., 2013). The American Health Care Association set its own standards for quality of care in SNF in 2012. Four specific goals were set including a goal of reducing the number of hospital readmissions within 30 days of a SNF stay by 15% within three years (Pruitt, 2013).

Determining the risk for adverse events such as hospital readmission can allow targeting of costly resources at the right patients and the right risk areas. Risk assessment tools that identify specific areas of risk rather than level of risk alone are valuable as they prompt specific interventions to reduce risk.

Decision Tree Analysis

Decision tree analysis is an exploratory technique used to identify factors that significantly contribute to a specific outcome (Ragan & Kang, 2005). This method has advantages over other analytical methods in that available data can be used and the visual presentation of the results may be interpreted by clinicians (Hilbert, Zasadil, Keyser, & Peele, 2014). Decision tree analysis was the most effective model for predicting hospital readmission when compared to logistic regression and use of a neural network in at least one study (Lee, 2012). Results indicated the importance of short hospital lengths of stay, hospital admission through an out-patient department, and an admission diagnosis of neoplasm. Rafiq et al. (2014) used decision tree analysis to identify fall risk factors for the elderly. Females over the age of 75 and those with a history of falling were at increased risk for falls.

Decision trees can be constructed using different algorithms that dictate the rules for development of the tree. CART analysis (Classification and Regression Tree) and CHAID (Chi-Square Automatic Interaction Detection) are two commonly used approaches to decision tree construction. In CART analysis, all variables in the model are considered simultaneously, looking at all the possible splits in each variable with the goal of making each division of the child node as homogeneous as possible relative to the

outcome of interest. The result is a split of cases for each variable (parent node) that is a significant predictor of the outcome into two separate groups (child node). The decision tree initially includes all significant predictors then is pruned to maximize predictive value while minimizing the number of tree branches. In CHAID analysis, a series of statistical tests are performed to determine all possible splits of each variable and rank them using probability distributions (chi-square statistics for categorical variables and F statistics for continuous variables). The result may be two or more subgroups (child nodes) for each variable (parent node) that is a significant predictor of the outcome of interest. The number of splits and resulting child nodes is limited to k-1 where *k* = number of levels of the splitting variable (Ragan & Kang, 2005).

Advantages to using decision tree analysis include:

1. Predictions can be made quickly by use of the constants in the tree

2. It is easy to identify which factors are important in making a prediction by looking at the tree

3. If some of the data is missing, a prediction is still possible by averaging the leaves in the sub-group reached

4. The decision tree provides an easy to interpret visual image (Miller et al, 2014)

Theoretical Framework

Effective measurement of function is a critical element of evidence based practice. Standardized methods of quantifying function allow for comparison of treatment approaches, comparison of outcomes across provider settings, and

identification of patient response to treatment. In an environment of health care spending scrutiny, interventions are increasingly streamlined to prioritize what has been shown to be most effective for helping patients receive the "right care, at the right time, in the right place" (MacKenzie, 2012). Health care models that facilitate cost-effective treatment plans are valuable for guiding this process. The Task Centered Model was developed for use within social work, but is applicable to other health care providers to facilitate exploring relevant variables in an organized way that enhances quality of care.

The Task Centered Model incorporates a short-term problem solving approach to helping people overcome challenges and reach their personal goals (Reid, Abramson, Fortune, & Wasko, 1992). The practitioner elicits goals and barriers to goals from the client early in the intervention program and establishes a plan of tasks (actions) designed to help the client progress toward accomplishment of the goal. The plan is time limited (relatively short duration) and continually focused on the goal and progress made. The tasks should be strategically chosen and prioritized based on importance related to goal achievement. Progress toward goals should be measurable, understandable to the patient, and reviewed regularly during treatment sessions.

This study of the clinical utility of the CARE Item Set is consistent with the framework provided by the Task Centered Model. The foundation of a short term, focused intervention plan fits well into the current health care environment in which length of stay for rehabilitation services in SNFs is decreasing (U.S.D.H.H.S., 2015a). Therapists need to help the patient clarify the desired outcome and barriers to that outcome. If CARE Item Set scores are predictive of specific outcomes (e.g. community

discharge and hospital transfer) when controlling for other variables, this process is more efficient. If the CARE Item Set scores are found to be responsive to change in function, it gives therapists an effective way to identify and communicate progress with patients. The Task-Centered Model provides a framework for utilizing the CARE Item Set in clinical practice to optimize patient outcomes and therapy utilization.

Research Questions

Objective, standardized assessment is an important part of evidence based practice. In post-acute settings, the CARE Item Set provides a reliable, valid measure of functional status with mobility and self-care. It was designed as an outcome measurement tool, but if the CARE Item Set can also inform discharge planning and provide direction for the therapy plan of care by assisting with prediction of adverse events such as hospital readmissions, the value of the tool is multiplied. The basic mobility items (6 items measuring bed mobility and transfers) of the CARE Item Set could potentially serve as a summary description of these important skills at PT evaluation and be a responsive measure to set goals and quantify response to treatment. Few objective assessment tools are available for capturing this basic level of mobility. The ability to use an outcome measurement tool that is (in part) required by CMS for purposes of focusing treatment on the most important skills for patient success, identifying risk factors for adverse events and for quantifying function for PT goals would streamline the assessment and treatment planning process for PTs in post-acute care settings.

Patients participating in physical and/or occupational therapy programs between January and June of 2016 in skilled nursing facilities owned/managed by National HealthCare Corporation were the focus of this study. Short stay patients with completed CARE Item Set as part of physical and/or occupational therapy evaluation and discharge summaries were included in the study. Outpatients and long term care patients were excluded.

Data were extracted from the physical and occupational therapy documentation and the Minimum Data Set, including CARE Item Set scores at admission and discharge, age, diagnoses, discharge placement, PT program duration, and prior level of function. Decision tree and logistic regression analysis provided insight about the relationship between functional status at time of PT/OT evaluations and hospital readmission. Decision tree, logistic regression, and receiver operating characteristics curves analysis clarified the functional tasks that contributed most to the likelihood of discharge to the community. The internal responsiveness of the basic mobility items on the CARE Item Set for demonstrating response to PT treatment was examined by evaluating the standardized response mean of the change scores. The external responsiveness of the basic mobility items was examined using logistic regression to determine if changes in these skills were indicative of differing likelihood of discharge to the community as compared to other inpatient settings.

The specific questions of interest were:

1. To what extent were scores on the bed mobility and the transfer items on the CARE Item Set responsive to change in function for physical therapy patients in a skilled nursing facility?
2. Depending in part on the level of initial function, to what extent was change in basic mobility (bed mobility and transfer item scores on the CARE Item Set) during skilled rehabilitation program in a skilled nursing facility associated with discharge to the community as compared to the hospital or other inpatient settings? The hypothesis was that, when controlling for baseline (evaluation) measures, age, payment by Medicare or managed care, length of stay in the hospital, and length of stay in the therapy program, the more improvement a patient had in mobility, the more likely discharge to the community was.
3. To what extent did functional ability as measured by the CARE item set at time of admission to a rehabilitation program in a skilled nursing facility predict readmission to the hospital?
4. Which mobility and self-care tasks contributed most to risk for hospital readmission?
5. To what extent was the level of function as measured by the CARE item set at time of admission to and discharge from a rehabilitation program in a skilled nursing facility associated with discharge into the community?
6. Which mobility and ADL tasks contributed most to community discharge?

CHAPTER II: RESPONSIVENESS AND PREDICTIVE VALIDITY OF THE BASIC MOBILITY ITEMS OF THE CARE ITEM SET FOR MEASURING BED MOBILITY AND TRANSFERS IN POST-ACUTE REHABILITATION

Introduction

Physical therapists providing care to older adults in skilled nursing facilities (SNF) frequently address bed mobility and transfer limitations as barriers to discharge to the community. Measurement of function allows for quantifying status, setting goals, and identifying response to treatment, but measurement instruments for this basic level of mobility are limited. The CARE Item Set was developed to measure outcomes in post-acute settings and includes basic mobility skills. The purpose of this study was to examine the usefulness of the bed mobility and transfer items of the CARE Item Set for describing basic mobility functional status, setting goals, and measuring response to treatment. To be clinically useful for measuring basic mobility, the items need to measure the same construct, be internally consistent, and demonstrate sensitivity to change that is relevant to an important outcome (e.g. discharge to the community). If a subset (basic mobility) of the broader outcome measurement instrument (CARE Item Set) can be used to assess this specific area of treatment focus, it would be an efficient use of therapists' time and provide a needed tool for physical therapists in post-acute care.

Approximately 9 million (20%) of 44.65 million beneficiaries of Medicare are hospitalized each year and 40% of those require post-acute care for nursing, therapy, or both (Boards of Trustees, 2015). Of those receiving post-acute care in 2008, 42.2% were

discharged from the hospital to a SNF (Medicare Payment Advisory Commission, 2015). SNFs, traditionally known as "nursing homes," have evolved over the past few decades from primarily providing residential long term care services to providing rehabilitative therapies after hospitalization for medically complex patients. Many are unable to return home after hospitalization due to a decline in basic mobility skills and require physical therapy (PT) to work toward the goal of returning to their optimal level of functioning (Mor, Intrator, Feng, & Grabowski, 2010).

The ability to perform basic mobility (bed mobility and transfers) is an important determinant of an older adult's ability to live in the community or return to the community after a hospitalization and is frequently a focus of PT programs in the SNF. In the first six months of 2016, 80.41% of Minimum Data Set (MDS) assessments in SNFs indicated that patients required physical assistance with bed mobility and 78.88% indicated physical assistance was required with transfers (Centers for Medicare and Medicaid Services (CMS, 2016). Objective measurement is important for identifying impairment and need for assistance and for establishing baseline status so that change can be identified timely, but measurement tools including basic mobility tasks are limited. The Rehabilitation Measures Database (Rehabilitation Measures Database, 2010) is a website that provides an extensive list of assessment tools and includes guidance on appropriate administration of the tools as well as summary information on psychometric testing. A query of "functional mobility" yielded 73 tests at the time of this study. Only eight of those included one or more basic tasks (bed mobility and transfers). None of the

tests measure the full range of basic mobility tasks (rolling, supine to/from sitting, transfers).

The CARE Item Set provides for measurement of function across post-acute settings (Gage et al, 2012). It is made up of eight self-care items (eating, oral hygiene, toilet hygiene, upper body dressing, lower body dressing, washing upper body, shower/bathing, and putting on/off footwear) and fourteen mobility items (lying to sitting, sitting to lying, rolling right/left, sit to stand, bed/chair transfers, toilet transfers, walking assistance, picking up objects, car transfers, walking 50 feet with 2 turns, walking 10 feet on uneven surfaces, stepping up 1 step, stepping up 4 steps, and stepping up 12 steps). A single outcome measurement tool is important to allow for comparison of patient responses to treatment across settings.

Therapists typically use outcome measurement instruments to quantify overall response to rehabilitation programs as well as specific tests to evaluate patient function in areas such as balance and gait. In some SNFs, therapists use the CARE item set as a general measure of function with mobility and self-care and to quantify patient responses to the rehabilitation program as a whole. In response to the Improving Medicare Post-Acute Care Transformation Act (IMPACT) of 2014 CMS included nine items from the CARE Item Set in the MDS to describe functional status at admission and discharge from a SNF beginning in October, 2016 (CMS, 2015). If individual items or a combination of items into sub-sets of the complete CARE Item Set would allow for effective measurement of status and progress for specific areas of function such as bed mobility

and transfers, therapists would be able to minimize the number of assessment tools required for completing a thorough evaluation of a patient's function.

In order to use subsets of an instrument to set goals and demonstrate progress in specific areas, there should be supporting evidence that the items represent a common construct and are consistent with one another. Factor analysis can identify any latent variable(s) that explain the variation in scores and identify commonalities between test items that can support grouping of items into sets. Cronbach's alpha provides a measure of internal consistency (how closely related the items are to one another) and can support summing scores of individual items to obtain a composite score.

A psychometrically sound measurement tool should be responsive to change in response to interventions. Responsiveness has two distinct aspects: internal and external (Husted, Cook, Farewell, & Gladman, 2000). Internal responsiveness is the ability of a measure to change over a specific time frame and can be assessed by examining changes in scores from a pre-treatment time (PT evaluation) to a post-treatment time (PT discharge). External responsiveness is the extent to which changes in scores are associated with an outcome of interest. An improvement in function that is associated with a desired outcome can reasonably be considered to represent a meaningful change. If the CARE basic mobility items are sensitive to differences in performance levels, it would be reasonable to expect higher scores (greater independence) for patients who are discharged to the community than for those discharged to institutional settings. Evaluation of the extent to which scores are different for patients with different outcomes is referred to as known groups differences, a type of construct validity.

Basic mobility deficits are frequently encountered by patients admitted to SNF for skilled therapy but objective measurement tools for this level of mobility are limited. The CARE Item Set is routinely used in some SNF settings, including five basic mobility items contributing to the mandatory Section GG on the MDS. If combinations of related items can be used clinically to describe baseline status, establish goals and demonstrate progress for basic mobility tasks, the evaluation process can be more efficient and more effective. The purposes of this study were to:

1. Evaluate the appropriateness of using subsets of the CARE mobility scale items to represent unique constructs, including using the basic mobility items to represent the constructs of bed mobility and transfers,
2. assess the responsiveness of the items and subsets of items for identifying true change over the course of the PT program, and
3. determine the relevance of change in CARE mobility scale and subsets to a desired outcome (discharge to the community)

The research questions of interest were:

1. To what extent are scores on the CARE Item Set mobility scale and subsets responsive to change in function for physical therapy patients in a skilled nursing facility?
2. Depending in part on the level of initial function, to what extent is change in CARE Item Set mobility scores and basic mobility subsets during a skilled rehabilitation program in a skilled nursing facility associated with discharge to the community as compared to the hospital or other inpatient settings? The

hypothesis is that, when controlling for age, payment by either Medicare or managed care, length of stay in the hospital, length of stay in the therapy program, and baseline measures for mobility, the more improvement a patient has in mobility, the more likely it is that the patient will be discharged to the community.

Methods

Participants

Participants were post-acute physical therapy (PT) patients in one of three skilled nursing facilities during January through June of 2016 with the CARE Item Set mobility scale completed at evaluation and discharge. Patients with Medicare Part B or other outpatient payors were not included since the focus was post-acute inpatient program participants. Since existing medical records were used and no identifiable information was recorded, Institutional Review Board expedited approval was granted and no consent was required from participants.

Procedure

A physical therapist assessed each patient at time of initiation (evaluation) and discontinuation (discharge) of PT services using the CARE Item Set. For planned discharges the therapist completed the CARE Item Set as part of the last PT session. If a patient was discharged unexpectedly, the discharge CARE Item Set was completed based on the patient's status at the last PT session. All therapists providing services in the three SNFs in this study complete online training for CARE Item Set administration and

correctly answer at least 80% of post-test questions during the first 30 days of their employment.

The CARE Item Set consists of fourteen mobility items measuring bed mobility, transfer and walking skills. Items are scored on a scale of one (dependent) to six (independent). Therapists code the patient's usual performance considering both safety and quality of the performance. If a patient is unable to attempt the task due to medical restrictions a code of dependent (1) is appropriate. If the patient is unable to perform the task due to safety concerns a score of zero is appropriate. If a patient is unable to complete a task, other tasks requiring the same or a greater level of ability can be coded as "dependent" without direct observation of an attempt of the task (American Health Care Association, 2014).

The therapists indicated each patient's discharge destination on the PT discharge summary. Community discharge settings included assisted living facilities, home, or independent living facilities for the purposes of this study. Patients transferred to other settings (acute hospital, inpatient rehab hospital, skilled nursing facility, long term care, expired, or other) were identified by the researcher for comparison.

The researcher extracted other information including age, therapy payor, number of days of the PT course of treatment (date of evaluation through date of last PT session), number of days between onset of the problem necessitating the PT referral and therapy evaluation, and diagnostic group from the PT evaluation. The evaluating therapist designated a diagnostic group for the condition necessitating the PT referral for each patient. Diagnostic group options were amputation, medical, neurological, orthopedic,

wounds, or unassigned. The therapy payor was identified as either Medicare Part A or Managed Care.

Data Analysis

Data were exported from the electronic therapy record (SmartTx, 2017) and entered into IBM Statistical Packages for the Social Sciences (version 23) and MedCalc Statistical Software 17.2 (MedCalc, 2017) for analysis. Descriptive analysis of demographic and functional characteristics of participants was conducted. Independent sample *t* tests were used to compare baseline and discharge functional scores, age, PT program length, and number of days between condition onset and therapy evaluation between patients who were discharged into the community and those discharged to the hospital or other settings. Crosstabulation allowed comparison of therapy payors between groups based on discharge placement.

The significance of the change in basic mobility scores from admission to discharge was evaluated by calculating the standardized response mean (SRM) as an indicator of effect size. The SRM is the ratio of the observed change and the variability of change scores as indicated by the standard deviation. It is similar to a related samples t-test and is a statistical concept frequently used in physical therapy. This technique for evaluating the significance of the change in scores allows for an estimate of responsiveness without the influence of sample size (Husted et al., 2000). Effect sizes of 0.5 or greater indicate sufficient internal responsiveness (Cohen, 1988).

External responsiveness describes the extent to which changes in scores are associated with an outcome of interest (Husted et al., 2000). For this study, the outcome

of interest was discharge placement to the community. The hypothesis was that, when controlling for baseline functional status, prior level of function, age, length of hospital stay and payor, the greater the improvement in mobility skills that patients had, the more likely it was they were discharged to the community. Known group difference validity was evaluated using logistic regression to determine the extent to which change in mobility functional level facilitated classification of patients into two groups: those who discharged into the community and those who did not.

Factor analysis was used to explore the underlying construct(s) explaining the variation in scores for mobility items. Results informed the appropriateness of using subsets of items including three items (supine to sit, sit to supine, and rolling) as representing a common construct (bed mobility) and three items (sit to stand, chair/bed transfers, and toilet transfers) as representing a separate construct (transfers). Items that represented the same construct as indicated by the factor analysis and clinical reasonableness were combined to form subscales. Cronbach's alpha was calculated to assess the internal consistency of the basic mobility items and provide insight into the appropriateness of summing scores.

When supported by factor analysis and adequate internal consistency, related items were combined to form indexes and scores summed. Supine to sit, sit to supine, and rolling item scores were summed to form a bed mobility index. Sit to stand, chair/bed transfers, and toilet transfer item scores were summed to form a transfer index. The bed mobility and transfer indexes were combined to form a basic mobility index. Scores on the bed mobility index, transfer index, and basic mobility index were analyzed

to determine the responsiveness of the indexes to change over the course of the PT program for patients in this study. Change scores between evaluation and discharge were examined with paired t tests and effect size (standardized response mean) was calculated as an indicator of the sensitivity of the indexes for identifying change in function.

Patients in a post-acute inpatient physical therapy program in the SNF setting with completed CARE Item Set mobility scales at evaluation and discharge were the subjects for this investigation of the clinical utility of the CARE Item Set. Mobility skills were considered since these are critical skills for patient independence and the focus of many PT programs in this setting. Few assessment instruments are available that effectively quantify function at a basic level of mobility (bed mobility and transfers), so the ability to utilize these items as a subset of the CARE Item Set for this purpose would be valuable.

Results

Between January and June of 2016, there were 1001 inpatient admissions to the SNF physical therapy programs participating in this study. Table 2.1 provides demographic and clinical characteristics. Age of patients ranged from 41 to 97 years of age, with a mean of 75. The majority of patients (63.3%) had managed care payors. There was a wide range in the number of days after problem onset and therapy evaluation (*Mean* = 8.14, *SD* = 7.80) and in the duration of the PT program (*Mean* = 6.97 days, *SD* = 11.58). The majority of patients were discharged to the community at completion of the therapy program (*N* = 764, 76.33%). Acute hospital transfers represented 13.3% (*N* = 13.3) of the discharges. The majority of patients (50.9%) had a general medical

diagnosis that primarily necessitated PT. Orthopedic conditions accounted for the second largest group of patients (35.8%).

Table 2.1

Descriptive Statistics of Participants, Responsiveness and Predictive Validity of the Mobility Items of the CARE Item Set

Characteristic	Total (*N* = 1001)		Participants' discharge destination			
			Community (*N* = 760)		Other locations (*N* = 241)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Age (years)	75.00	12.21	77.86	10.32	81.00 *	9.95
Days post onset	8.14	7.80	10.11	42.95	10.77	9.12
PT Duration (days)	16.97	11.58	19.63	13.23	17.73	13.38
	N	*%*	*N*	*%*	*N*	*%*
Payors						
Managed Care	634	63.34	503	66.19	131 **	54.40
Medicare Part A	367	36.67	257	33.82	110 **	45.60
Diagnostic groups						
Medical	510	50.95	380	50.00	130 ***	53.94
Orthopedic	358	35.76	293	38.55	65 ***	26.97
Neurological	73	7.29	47	6.18	26 ***	10.79
Unassigned	50	5.00	33	4.34	19 ***	7.05
Amputation	9	.90	6	.79	3 ***	1.24
Wounds	1	.10	1	.13	0 ***	0

Note. * significant difference between groups, $p < .001$; ** significant difference between groups, Chi-Square = 12.00, $df = 2$, ($p < .01$)
*** significant difference between groups, Chi-Square = 16.17, $df = 5$, ($p < .01$)

Table 2.1
Descriptive Statistics of Participants, Responsiveness and Predictive Validity of the Mobility Items of the CARE Item Set (cont.)

Discharge Destination						
	N	*%*	*N*	*%*	*N*	*%*
Home	710	70.93	706	92.37		
Acute hospital	133	13.29			133	55.19
ALF	54	5.39	54	7.11		
Long term care	33	3.30			33	13.69
SNF	30	3.00			30	12.44
Expired	23	2.30			23	9.54
Hospice	19	1.90			19	7.88
Other	2	.20			2	.83

Note. * significant difference between groups, $p < .001$; ** significant difference between groups, Chi-Square = 12.00, $df = 2$, ($p < .01$)
*** significant difference between groups, Chi-Square = 16.17, $df = 5$, ($p < .01$)

Table 2.2 provides CARE Item Set mobility scores for prior level of function, at PT evaluation and at PT discharge. Discharge scores for each item were higher than evaluation scores indicating improvement in function at completion of the PT program. Table 2.3 shows floor and ceiling effects for all CARE mobility items at beginning (evaluation) and completion (discharge) of the PT program. Floor and ceiling effects provide an evaluation of the effectiveness of the items for measuring the functional status of the patients included in the study. Ceiling effects (percentage of patients who functioned at the highest level of ability indicated by the rating scale) and floor effects (percent of patients scoring at the most dependent level of an item) ideally should be less than 20% for a measurement instrument to adequately measure function within the target patient population (Rehab Measures Database, 2010).

At time of evaluation no patients scored at a dependent level for all three bed mobility items while 18.6% of patients were independent with all bed mobility tasks. One patient scored at a dependent level on all three transfer tasks and 1.9% of patients scored at an independent level at time of PT evaluation. The therapist was unable to score any transfer item with four patients. Most patients (98.1%) experienced transfer deficits on tasks included in the CARE Item Set. At evaluation, significant floor effects were present for complex mobility tasks including picking up an object (29.5%), walking 50 feet with two turns (32.3%), stepping up one step/curb (20.5%), and stepping up twelve steps (22.9%). The therapist was unable to assess these tasks during the evaluation with at least 30% of patients with the exception of walking 50 feet with two turns.

Table 2.2

CARE Item Set Mobility Scores for Prior Level, at Therapy Evaluation and at Therapy Discharge

Mobility Tasks	Prior Level	Admission Level	Discharge Level	Change from Evaluation to Discharge	SRM (95% CI)	Number (%) of Patients with no change	Number (%) with decline
Lying to Sitting	5.72 (.94)	3.53 (1.48)	4.86 (1.61)	1.34 (1.65)*	.81 (.75, .87)	331 (33.1)	45 (4.5)
Sitting to Lying	5.70 (.97)	3.49 (1.47)	4.85 (1.62)	1.36 (1.65)*	.82 (.76, .88)	323 (32.3)	44 (4.4)
Rolling right / left	5.75 (.91)	3.85 (1.59)	4.96 (1.59)	1.10 (1.69)*	.65 (.59, .71)	403 (40.3)	53 (5.3)
Bed Mobility Subset	**17.18 (2.72)**	**10.87 (4.34)**	**14.66 (4.75)**	**3.79 (4.80)***	**.79 (.73, .85)**	**295 (29.5)**	**50 (5.0)**
Chair/Bed Transfer	5.64 (1.02)	3.19 (1.06)	4.36 (1.61)	1.27 (1.43)*	.89 (.83, .95)	257 (25.7)	49 (4.9)
Sit to Stand	5.70 (.97)	3.16 (1.10)	4.39 (1.65)	1.23 (1.47)*	.83 (.77, .89)	275 (27.5)	54 (5.4)
Toilet Transfer	5.61 (1.04)	3.02 (1.09)	4.31 (1.64)	1.29 (1.46)*	.88 (.82, .94)	264 (26.4)	46 (4.6)
Transfers Subset	**16.88 (3.03)**	**9.28 (3.16)**	**13.06 (4.85)**	**3.78 (4.26)***	**.89 (.83, .95)**	**207 (20.7)**	**58 (5.8)**
Basic Mobility	**34.08 (5.44)**	**20.15 (7.01)**	**27.72 (9.13)**	**7.57 (8.32)***	**.91 (.85, .97)**	**125 (12.5)**	**65 (6.5)**
Car transfer	5.12 (1.55)	2.42 (1.37)	3.68 (1.75)	1.26 (1.57)*	.80 (.74, .86)	300 (30)	50 (5)
Walk level of assist	5.47 (1.28)	2.95 (1.28)	3.92 (1.74)	.97 (1.47)*	.66 (.60, .72)	355 (35.5)	67 (6.7)
Pick up object	4.11 (2.57)	1.27 (1.39)	2.29 (2.19)	1.03 (1.66)*	.62 (.56, .68)	560 (55.9)	31 (3.1)
Walk 50’ with 2 turns	5.22 (1.68)	2.29 (1.55)	3.68 (2.01)	1.39 (1.74)*	.80 (.74, .86)	350 (35)	55 (5.5)
Walk 10’ uneven surfaces	4.39 (2.33)	1.78 (1.56)	2.83 (2.06)	1.05 (1.63)*	.64 (.58, .70)	449 (44.9)	51 (5.1)
1 step/curb	4.20 (2.43)	1.64 (1.53)	2.69 (2.11)	1.05 (1.65)*	.63 (.57, .70)	466 (46.6)	47 (4.7)
4 steps	3.16 (2.81)	1.05 (1.38)	1.97 (2.12)	.93 (1.61)*	.57 (.51, .64)	582 (58.1)	35 (3.5)
12 steps	2.46 (2.83)	.69 (1.14)	1.57 (2.05)	.88 (1.58)*	.55 (.49, .62)	658 (65.7)	21 (2.1)
MOBILITY SCALE	66.84 (18.43)	28.94 (11.57)	46.58 (20.89)	20.44 (16.68)	1.23 (1.15, 1.30)	6 (.8)	44 (6.2)

Note. Values are presented as *Mean (standard deviation*); * significant difference, $p < .001$

Table 2.3

Floor and Ceiling Effects of CARE Item Set Basic Mobility Items

CARE Item	PT Evaluation						PT Discharge					
	Floor Effect (Scoring 1)		Ceiling Effect (scoring 6)		Unable to score		Floor Effect (Scoring 1)		Ceiling Effect (scoring 6)		Unable to score	
Lying to Sitting	55	(5.49)	196	(19.58)	1	(.10)	11	(1.10)	61	(6.12)	27	(2.70)
Sitting to Lying	56	(5.59)	191	(19.08)	1	(.10)	12	(1.20)	610	(60.94)	27	(2.70)
Rolling	37	(3.70)	281	(28.07)	14	(1.40)	10	(1.00)	643	(64.24)	31	(3.10)
BED MOBILITY (max score 18)	**0**	**(0)**	**186**	**(18.58)**	**1**	**(.10)**	**0**	**(0)**	**603**	**(60.24)**	**27**	**(2.70)**
Chair/Bed Transfer	81	(8.09)	22	(2.20)	5	(.50)	27	(2.70)	401	(40.06)	31	(3.10)
Sit to Stand	65	(6.49)	28	(2.80)	12	(1.20)	24	(2.40)	419	(41.86)	38	(3.80)
Toilet Transfer	89	(8.89)	21	(2.10)	11	(1.10)	28	(2.80)	391	(39.06)	36	(3.60)
TRANSFERS (max score 18)	**1**	**(0.10)**	**19**	**(1.90)**	**4**	**(0.40)**	**2**	**(0.20)**	**386**	**(38.56)**	**31**	**(3.10)**
BASIC MOBILITY (max score 36)	**0**		**19**	**(1.90)**	**0**		**0**		**377**	**(37.66)**	**24**	**(2.40)**
Car transfer	123	(12.29)	11	(1.10)	134	(13.39)	41	(4.10)	225	(22.48)	94	(9.39)
Walk level of assist	132	(13.19)	4	(.40)	63	(6.29)	42	(4.20)	260	(25.97)	89	(8.89)
Pick up object	295	(29.47)	7	(.70)	389	(38.86)	159	(15.88)	148	(14.79)	336	(33.57)
Walk 50’ with 2 turns	323	(32.27)	3	(.30)	136	(13.59)	103	(10.29)	275	(27.47)	128	(12.79)
Walk 10’ uneven surfaces	199	(19.88)	3	(.30)	317	(31.67)	85	(8.49)	133	(13.29)	260	(25.97)
1 step/curb	205	(20.48)	2	(.20)	351	(35.06)	96	(9.59)	130	(12.99)	287	(28.67)
4 steps	206	(20.58)	94	(9.39)	530	(52.95)	102	(10.19)	91	(9.09)	450	(44.96)
12 steps	229	(22.88)	0		624	(62.34)	107	(10.69)	76	(7.59)	548	(54.75)
Mobility Scale (max score 84)	0		0		0		0		0		24	(2.40)

Note. Values are presented as *Number (percent*) of patients

At time of PT discharge, no patient scored at a dependent level in all three bed mobility tasks. The number of patients at the highest level of independence captured on the CARE Item Set for bed mobility increased from 186 (18.6%) at evaluation to 603 (60.2%) at discharge. For transfer tasks, 386 (38.6%) of patients were independent with all three tasks, an increase of 36.7% from the ceiling noted at time of evaluation. More patients were able to perform the higher level mobility tasks at PT discharge, but the percentages of patients scoring at either the lowest level of the scale (dependent) or unable to perform the task was over 30%. Ceiling effects for the high level tasks was acceptable.

Cronbach's alpha for the 14 item CARE Item Set mobility scale was .93 indicating high internal consistency. Cronbach's alpha for the three item bed mobility subscale, the three item transfer subscale, and the combined six item basic mobility subscale were .95, .97, and .95 respectively. High internal consistency in the subscales supported the appropriateness of proceeding with further assessment of the subscales for measuring basic mobility.

A Principle Components factor analysis was conducted on the 14 mobility items of the CARE Item Set with Varimax rotation. The Kaiser-Meyer-Olkin statistic validated the sample size for the analysis (*KMO* = .91). In the initial analysis, two components had eigenvalues over 1.0 and explained 70.3% of the variance in scores. Table 2.4 provides the factor loadings after rotation. Bed mobility (lying to sitting, sitting to lying, rolling) and transfer (transfer, sit to stand, toilet transfer) items cluster on the same component (basic mobility) along with walking level of assistance. Stepping up on a curb, stepping

up 4 and 12 steps and picking up an object clustered on a second component (advanced mobility). Factor analysis results supported the appropriateness of utilizing three bed mobility items, three transfer items, and/or six combined basic mobility items for functional assessment this group of patients.

Table 2.4
Factor Loadings for Principle Component Exploratory Factor Analysis With Varimax Rotation of CARE Item Set Mobility Scale Items

CARE Mobility Item	Basic Mobility	Advanced Mobility
Chair/Bed Transfer	.889	
Lying to Sitting	.875	
Sitting to Lying	.875	
Sit to Stand	.871	
Toilet Transfer	.867	
Rolling Left and Right	.837	
Walking Level of Assistance	.730	
Walk 50 Feet with Two Turns	.631	
Car Transfer	.586	
Four Steps		.873
Twelve Steps		.836
1 Step		.756
Walk 10 Feet on uneven surface		.620
Pick up object From the Floor		.616

Bed mobility items (lying to sitting, sitting to lying, and rolling) and transfer items (chair/bed transfers, sit to stand, and toilet transfers) were combined to form a bed mobility and a transfer index, respectively. Scores ranged from 0 to 18 for the combination of the three items for each index. Bed mobility and transfer indexes were combined to form a basic mobility index with a total possible score of 36. Significant improvements were experienced in bed mobility, transfers, and with the combined basic mobility index at PT program completion.

Internal Responsiveness

Internal responsiveness statistics are included in Table 2.2. Mean scores for each CARE Item Set mobility item increased during the course of the PT program. Standardized response mean (SRM) for each item indicated adequate internal responsiveness. The complex mobility skills (steps) had the lowest SRM (.55-.63) and the transfers and basic mobility subsets had the highest SRM (.89 and .91 respectively) indicating that the basic mobility skill items were more sensitive to change over time than the higher level skill items with this group of post-acute patients in the SNF. A large percent of patients (40.3%) had no change in rolling side to side ability that corresponded to a large ceiling effect for the item (28.1%). Among patients who were not independent at time of PT evaluation for each item individually and for the bed mobility subset, transfer subset, and basic mobility subset, internal responsiveness (SRM) was higher than for the complete group of patients, ranging from .88 (sit to stand) to 1.12 (lying to sitting). Each basic mobility item and the bed mobility, transfers and combined basic mobility subscales were highly responsive to change among patients who had deficits in

these areas at initiation of the PT program. CARE scores and internal responsiveness statistics for patients who were not independent at time of PT evaluation are provided in Table 2.5.

Table 2.5

CARE Item Set Basic Mobility Scores for Prior Level, at Therapy Evaluation and at Therapy Discharge: Patients with scores less than 6 at admission (for each item separately)

Mobility Tasks	Prior Level	Admission Level	Discharge Level	Change from Evaluation to Discharge	SRM (95% CI)	Number (%) of Patients with no change	Number (%) with decline
Lying to Sitting	5.66 (1.03)	2.92 (.92)	4.64 (1.65)	1.72 (1.53)*	1.12 (1.05, 1.19)**	145 (18.01)	35 (4.35)
Sitting to Lying	5.6 (1.09)	2.81 (.92)	4.53 (1.67)	1.73 (1.58)*	1.10 (1.02, 1.17)**	141 (17.41)	45 (4.32)
Rolling right / left	5.65 (1.05)	3.02 (.99)	4.65 (1.66)	1.63 (1.58)*	1.03 (.96, 1.10)**	141 (19.61)	34 (4.73)
Bed Mobility Subset	**16.88 (3.14)**	**8.65 (2.64)**	**13.73 (4.90)**	**5.08 (4.59)***	**1.11 (1.03, 1.18)****	**118 (14.50)**	**41 (5.04)**
Chair/Bed Transfer	5.63 (1.03)	3.03 (.98)	4.34 (1.59)	1.32 (1.38)*	.96 (.89, 1.02)**	238 (24.31)	46 (4.70)
Sit to Stand	5.54 (1.13)	2.82 (1.01)	4.12 (1.66)	1.30 (1.48)*	.88 (.80, .95)**	250 (25.69)	51 (5.24)
Toilet Transfer	5.51 (1.15)	2.69 (.10)	4.04 (1.65)	1.35 (1.46)*	.93 (.85, 1.00)**	246 (25.10)	43 (4.39)
Transfers Subset	**16.60 (3.32)**	**8.27 (2.89)**	**12.26 (4.86)**	**3.99 (4.25)***	**.94 (.86, 1.01)****	**190 (19.35)**	**56 (5.70)**
Basic Mobility	**33.48 (6.23)**	**16.92 (5.16)**	**25.99 (9.31)**	**9.07 (8.32)***	**1.09 (1.02, 1.16)****	**108 (11.01)**	**63 (6.42)**

Note. Values presented as *Mean (Standard Deviation*) unless otherwise indicated

* significant difference, $p < .001$

** significantly different from SRM of item for all patients ($p < .001$)

External Responsiveness - Known groups differences:

Patients who were discharged to the community had higher discharge scores on the bed mobility index (*Mean* = 16.30, *SD* = 3.18) and on the transfer index (*Mean* = 14.72, *SD* = 3.7) than patients discharged to other care settings (Bed Mobility: *Mean* = 9.51, *SD* = 5.17; Transfers: *Mean* = 7.82, *SD* = 4.29). The difference in bed mobility index scores between the two groups was significant $t(299.67) = 19.29$, $p < .001$. The difference in transfer index scores between the two groups was also significant $t(360) = -22.46$, $p < .001$. The effect size (Cohen's *d*) was large for both bed mobility (*ES* = 1.58) and transfers (1.72) (Cohen, 1988). Patients discharged to the community had higher discharge scores on the Basic Mobility Index (combining the Bed Mobility and the Transfers Indexes) (*Mean* = 31.02, *SD* = 6.27) than those discharged to other settings (*Mean* 17.33, *SD* = 4.29). The difference was significant $t(318) = 22.1$, $p < .001$, with a large effect size of 1.77. Table 2.6 provides results.

Table 2.6
Bed Mobility, Transfer, and (combined) Basic Mobility Index Means for Community Discharges Compared to Discharge to Other Settings

	Discharge Destination			
	Community	Other	*t*	*df*
Bed Mobility Index	16.30 (3.18)	9.51 (5.17)	19.29*	299
Transfer Index	14.72 (3.70)	7.82 (4.29)	22.46*	360
Basic mobility Index	31.02 (6.27)	17.33 (8.95)	22.10*	318

Note. * $p < .001$. Values presented as *Mean (Standard Deviation*)

Logistic regression analysis provided insight into the extent to which basic mobility functional change as measured by the bed mobility and the transfers subscales predict the likelihood of discharge to the community as compared to discharge to other settings (e.g., long term care, skilled nursing, hospital). The hypothesis was that, when controlling for baseline measures for mobility, age, payor source, and length of the PT program, the more improvement a patient has in mobility, the more likely it is that the patient will be discharged to the community. The results of the logistic regression (Table 2.7) indicated that, when controlling for admission functional status with bed mobility and transfers and age, change in basic mobility skills during the course of the PT program was a predictor of community discharge. Improvement in function was positively related to community discharge. As patients improve with basic mobility, they are more likely to be discharged to the community. The odds ratios were 1.27 and 1.38 for change in bed mobility and transfers (respectively), $p < .001$. The Nagelkerke R^2 was .56, indicating that 56% of the variation in discharge placement was explained by change in bed mobility and transfer function as measured by the subscales of the CARE Item Set when controlling for baseline (evaluation) status and age.

Table 2.7

Summary of Logistic Regression Analysis for Variables Predicting Discharge to the Community, Controlling for Variables

Variable	*b*	*SE*	Odds Ratio	95% Confidence Interval Lower	Upper	*df*	*p*
Bed Mobility Admission	.10	.04	1.10	1.02	1.20	1	.016
Bed Mobility Change	.24	.04	1.27	1.12	1.38	1	<.001
Transfer Admission	.26	.05	1.30	1.16	1.44	1	<.001
Transfer Change	.33	.04	1.38	1.27	1.51	1	<.001
Days post onset	.00	.00	1.00	.99	1.01	1	.919
Length of stay	.00	.01	1.00	.99	1.02	1	.805
Payor							
Medicare A	-.53	.21	.59	.39	.88	1	.011
Managed Care (reference)							
Age	-.02	.01	.98	.96	1.00	1	.061

Note. Nagelkerke R square = .56

Discussion

Objective, standardized assessment is an important part of evidence based practice. In post-acute settings, the CARE Item Set provides a reliable, valid measure of functional status with mobility and self-care. The basic mobility items (6 items measuring bed mobility and transfers) of the CARE Item Set can serve as a summary description of these important skills at physical therapy (PT) evaluation and be a responsive measure to set goals and quantify response to treatment. Few objective assessment tools are available for capturing this basic level of mobility. The ability to use an outcome measurement tool that is, in part, required by CMS for purposes of quantifying function for PT goals would streamline the assessment and treatment planning process for PTs in post-acute care settings.

The 14 item CARE Item Set mobility scale provided a range of tasks that effectively represented the functional status of patients in post-acute skilled nursing facility (SNF) PT programs. The ceiling effect for the rolling item (28.1%) was not unexpected considering the finding of the Rasch analysis reported by Gage, et al. (2012) that rolling was the easiest of the mobility items. The large ceiling effect of the basic mobility items at PT discharge reflects the significant progress made in these areas. Floor effects of the higher level mobility tasks at evaluation was not problematic since many patients improved in these areas during the PT course and were able to function at a level described by the CARE mobilty scale by time of PT discharge. While many patients were not able to perform the higher level tasks at evaluation and at discharge, the number/percent decreased.

The CARE Item Set mobility scale items were responsive to change over the course of the PT program. An outcome measurement instrument should be responsive to change in a population of patients to be beneficial for evaluating program effectiveness. It should also effectively identify change in individual patients for whom change is expected – specifically those patients with deficits. Performing a secondary analysis of only those patients who were not independent with basic mobility allowed for a more accurate assessment of the responsiveness to change for these patients. SRMs were significantly higher for the population of patients with deficits in each of the basic mobility tasks at PT evaluation, ranging from .88 (Sit to stand) to 1.12 (lying to sitting). The CARE Item Set Mobility scale demonstrated excellent responsiveness to change for those patients with deficits in the areas included on the scale.

Internal consistency and factor analysis of the six basic mobility items supported using them as a subscale for measurement of bed mobility and transfers, including summing scores for the items to gain summary scores. The three item bed mobility scale, three item transfer scale, and the combined six item basic mobility scale demonstrated excellent sensitivity to change over the course of the PT program with SRMs of .79, .89, and .91 respectively. Improvment in basic mobility skills as measured by the CARE Item Set subscales was associated with higher likelihood of discharge to the community and scores for the bed mobility, transfers, and combined basic mobility subscales were significantly higher for those patients discharged to the community compared to other settings.

Physical therapists serving older adults in skilled nursing facilities (SNF) frequently address bed mobility and transfer limitations as barriers to discharge to the community. Few assessment instruments are available that effectively quantify function at a basic level of mobility (bed mobility and transfers), so the ability to utilize this subset of the CARE Item Set for this purpose would be valuable. The basic mobility subscale items were internally consistent and represented the same construct. The scores were responsive to change over the course of the PT program and were associated with differences in the meaningful outcome of community discharge. The bed mobility subscale, transfers subscale and combined basic mobility subscale of the CARE Item Set mobility scale provided an effective way to describe baseline status, establish goals and demonstrate progress for basic mobility tasks in post-acute care patients in the SNF setting.

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CHAPTER III: ADMISSION FUNCTIONAL STATUS ON THE CARE ITEM SET AND PREDICTION OF HOSPITAL READMISSION FROM A SKILLED NURSING FACILITY

Introduction

In 2011, 1.7 million Medicare fee-for-service beneficiaries received skilled nursing and/or rehabilitation care in skilled nursing facilities, accounting for 2.4 million admissions (Medicare Payment Advisory Commission, 2013). Skilled nursing facilities (SNFs) provide skilled care through Medicare Part A for patients unable to return to their prior living situation after a hospitalization. Of all beneficiaries admitted to a hospital in 2011, approximately 20% were discharged to a SNF.

While hospitalization is sometimes necessary, there is significant risk of adverse outcomes for older adults including functional decline, falls, and delirium (Institute for HealthCare Improvement, n.d.). Hospitalizations are economically costly, and readmissions within 30 days are significantly more costly than an initial stay. A readmission within 30 days of a hospital discharge may be 18-50% more expensive than the initial stay (Elixhauser, Au, & Podulka, 2011).

Approximately 20% of older adults discharged from a hospital return to the hospital within 30 days. Some of these readmissions are planned and necessary, but approximately 10% are the result of inadequate care and are potentially avoidable (PerryUndem Research & Communication, 2013). A disproportionate number of potentially avoidable readmissions (60%) were for patients 65 years of age and older

(Stranges & Stocks, 2010). Over 28% of Medicare beneficiaries in a SNF or discharged from a SNF in 2012 were rehospitalized within 30 days (Medicare Payment Advisory Commission, 2013). The Affordable Care Act addressed the problem of avoidable hospital readmissions by establishing the Readmissions Reduction Program (CMS, 2016). Under this program, CMS is required to reduce payments to hospitals with excessive readmission as an indicator of inadequate care. The program will continue to expand and assess penalties on other providers including skilled nursing facilities as a measure of quality care (Carnahan, Unroe, & Torke, 2016).

Predicting a patient's risk for hospital readmission is an important first step in planning care interventions to minimize risk. Identifying patients at increased risk for readmission and focusing interventions on these patients can effectively reduce 30-day readmissions (Evans & Hendricks, 1993; Koehler, et al., 2009; Naylor, et al., 1999). An increasing number of studies have focused on identifying the most important risk factors. A literature search using key terms "hospital readmission" and "prediction" or "risk factors" yielded 9,413 articles from January 2000 through December 2010, compared to 24,598 articles for the time frame of January 2011 through May of 2016.

Functional impairment has been identified as an independent predictor of hospital readmission. Greater functional independence is associated with lower hospital readmission rates for Medicare beneficiaries discharged from inpatient rehabilitation facilities (Fisher et al., 2013; Ottenbacher et al., 2014; Shih et al., 2015). Mobility and activity of daily living impairment prior to the hospital admission increases the likelihood of readmission (Greysen, Cenzer, Auerbach, & Covinsky, 2015; Soley-Bori et al., 2015).

The ability of older adults to safely and independently move in their environment and take care of daily living needs is important for successful transition to the community and avoidance of hospital readmission. Functional assessment to identify impairments that may increase risk for hospital readmission should be a component of an older adult's inpatient stay (Falvey et al., 2016).

Risk prediction models that are clinically useful for targeting interventions should incorporate data that are simple to collect or use available administrative data, use information that is available early in the patient's stay, and have adequate predictive value (Kripalani, Theobald, Anctil, & Vasilevskis, 2014). Models that are specific to patient populations and care settings may be most useful since risk factors vary. Lee (2012) found decision tree analysis more effective than logistic regression or neural network for identifying the risk factors that contribute most to hospital readmission. It allows for the prediction of a specific outcome (hospital readmission) by identifying the variables and interactions between variables that most significantly differentiate between patients readmitted to the hospital compared to those successfully transitioning to other settings.

The purpose of this study was to use demographic and clinical information and functional measures (CARE Item Set scores) at time of physical (PT) and/or occupational (OT) therapy evaluation in a skilled nursing facility (SNF) to identify patients at increased risk for readmission to the hospital during the SNF stay using decision tree analysis. The questions of interest were:

1. To what extent does functional ability as measured by the CARE item set at time of admission to a rehabilitation program in a skilled nursing facility predict readmission to the hospital?
2. Which mobility and ADL tasks contribute most to risk for hospital readmission?

Methods

Design/Participants

This study involved a retrospective medical record review of patients who participated in an inpatient occupational and/or physical therapy program in a skilled nursing facility and had admission and discharge CARE item set scores recorded in the medical record between January and June of 2016. If a patient had multiple admissions only the first admission was included. Since existing records were used and no identifying information was recorded, expedited IRB was granted.

Variables

Discharge placement. Therapists indicated the discharge destination of each patient on the therapy discharge summary. Possible answer categories were home with home health, home with outpatient therapy, assisted living facility, skilled nursing facility, long term care unit, acute hospital transfer, and expired. Patients who were discharged to the hospital were compared to those discharged to all other locations. Planned readmissions were not considered separately from unplanned admissions since this distinction was not made in the medical record and so was unknown to the researcher.

Demographic variables. Age, hospital length of stay, and payor (Medicare Part A or managed care) were available in the medical record. Demographic variables have been previously found to predict discharge placement (Silverstein, Qin, Mercer, Fong, & Haydar, 2008) and so were included as variables in the analysis.

Functional status. Therapists evaluated functional status on admission and at discharge using the CARE item set and estimated the functional level prior to the hospitalization based on patient/caregiver interview and/or chart review. The CARE Item Set includes eight self-care items (eating, oral hygiene, toilet hygiene, upper body dressing, lower body dressing, washing upper body, shower/bathing, and putting on/off footwear) evaluated by occupational therapists and fourteen mobility items (lying to sitting, sitting to lying, rolling right/left, sit to stand, bed/chair transfers, toilet transfers, walking assistance, picking up objects, car transfers, walking 50 feet with 2 turns, walking 10 feet on uneven surfaces, stepping up 1 step, stepping up 4 steps, and stepping up 12 steps) evaluated by physical therapists. Indexes were calculated for the combined mobility and for the combined self-care scores by summing individual item scores. A total CARE score was calculated by summing the mobility and the self-care index scores.

The CARE Item Set measures function in mobility and self-care abilities across the post-acute continuum of care (Gage et al, 2012). Pilot testing of the CARE Item Set involved Medicare beneficiaries from all post-acute settings. Rasch analysis was used to examine the function of the items for capturing the concept of function, the scope of item difficulty, and the function of the rating scale (Gage et al, 2012). Reliability testing on

the CARE Item Set showed acceptable agreement in scoring, with kappa statistics of 0.78 or higher for interrater reliability.

Medical conditions. The highest rates of hospital readmissions for Medicare beneficiaries in 2011 were for those with congestive heart failure (CHF), septicemia, and pneumonia (Agency for Healthcare Research and Quality, 2014). CMS instituted hospital readmission penalties for hospitals for patients with heart failure and pneumonia in 2012, then expanded the program to include acute exacerbation of chronic obstructive pulmonary disease (COPD) and elective hip/knee replacements in 2015 (CMS, 2016). These targeted diagnoses will be identified from the admission MDS and included in the prediction model.

Data Analysis

Data were exported from the electronic therapy record (SmartTx, 2017) and entered into IBM Statistical Packages for the Social Sciences (version 23) and MedCalc Statistical Software 17.2 (MedCalc, 2017) for analysis. We examined data for errors and logical inconsistencies then analyzed demographic and clinical descriptors for the total dataset and for each of the subsets. We used chi-Square and related samples t-tests to evaluate differences in categorical and continuous variables (respectively) between groups based on discharge placement.

Statistical analysis was performed using decision tree analysis for predictive modeling. Decision analysis is a systematic process of considering variables that explain variation in an outcome of interest to identify the hierarchy and interaction of variables likely to result in particular outcomes. The branches of a decision tree represent different

values of variables that are known or believed to explain variation in the dependent variable of interest – for the purpose of this study, discharge to the hospital compared to discharge to other settings. Decision tree analysis identifies the independent variables that are associated with the target variable and chooses the levels or subgroups of the variables that are most strongly associated with the specific outcome. The independent variable that has the strongest association with the dependent variable will be designated as the first "branch" of the tree and will culminate in a "leaf" for each subgroup or level of the variable that is significantly different relative to the dependent variable. The tree can be more or less flexible depending on the number of "leaves" since each represents the number of identified subgroups within the sample, but the researcher determines the minimum number of subjects within each leaf. Nodes can be added if and when the predictive value of the tree is improved significantly (Dowding & Thompson, 2004).

This approach to analyzing and describing data is clinically useful when it is likely that an accumulation and interaction of variables contribute to the outcome as is the case for medical and rehabilitative care for older adults. Decision tree analysis provides an exploration of these interacting variables and can be used to predict an individual patient's risk for a particular outcome based on their unique profile. Although this study was exploratory in nature, the expectation was that, given the complex medical condition of patients in skilled nursing care, investigation of the interaction of medical/clinical, demographic, and functional factors along with main effects, would enlighten clinicians about the pathways that contribute to risk for hospital readmission from a post-acute rehabilitation program.

Decision trees can be constructed using different algorithms that dictate the rules for development of the tree. In Chi-Square Automatic Interaction Detection (CHAID) analysis, a series of statistical tests are performed to determine all possible splits of each variable and rank them using probability distributions (chi-square statistics for categorical variables and F statistics or continuous variables). The result may be two or more subgroups (child nodes) for each variable (parent node) that is a significant predictor of the outcome of interest. The number of splits and resulting child nodes is limited to *k*-1 where *k* = number of levels of the splitting variable (Ragan & Kang, 2005). Model specifications were set prior to analysis. Stopping and pruning criteria determined the point at which the model stops splitting branches. The maximum tree depth was set at 3 levels below the root, with a minimum number of cases in the parent node set at 100 and minimum in the child node at 50. The significance level for splitting nodes and merging categories was set at .05

A random selection of one half of the total cases was created for development of a classification and decision tree and the remaining cases were included in a separate dataset for testing the model. The resulting decision trees were compared for accuracy in predicting discharge to the community. An acceptable model should accurately predict the outcome in at least 70% of cases (Weatherby, Kang, Shapshak, McCoy, & Chiappelli, 2006). Risk estimate (the percent of patients misclassified) was reported for the models. Sensitivity and specificity for each model were calculated along with positive and negative predictive values. Sensitivity is the probability that the model will predict a community discharge for those who actually were discharged to the community. Specificity is the proportion of cases for which a discharge to other settings was correctly

predicted. Negative predictive value is the proportion of cases predicted to be discharged to other settings who actually were discharged to other settings. Positive predictive value is the proportion of cases predicted to be discharged to the community who actually were discharged to the community. Sensitivity and specificity are characteristics of the prediction model. Positive and negative predictive values are both influenced by the prevalence of a condition within the studied population. The most parsimonious model with the optimal predictive accuracy was selected.

Logistic regression was used to predict the dichotomous outcome of discharge placement to the hospital compared to other settings using the independent variables (function, diagnoses and diagnostic groups, days between condition onset and therapy evaluation, and therapy program duration). This technique allows for both categorical and continuous predictor variables and produces a statistic (R^2) describing the overall effectiveness of the model for explaining variation in the dependent variable (Field, 2013).

Functional status with activities of daily living and mobility at time of physical and/or occupational therapy evaluation using the CARE Item Set, demographic information, and medical conditions frequently associated with hospital readmissions were evaluated to determine the contribution of each to the risk for readmission to the hospital during the SNF stay. A resulting parsimonious model was presented as a decision tree. Logistic regression analysis was used to validate findings and provide further insight into the predictive model.

The questions of interest were:

1. To what extent does functional ability as measured by the CARE item set at time of admission to a rehabilitation program in a skilled nursing facility predict readmission to the hospital?
2. Which mobility and/or ADL tasks contribute most to risk for hospital readmission?

Results

During the six month study period 893 patients were admitted for the first time during the time frame to the one of the SNFs and received occupational and/or physical therapy services. If a patient had more than one admission only the first admission was included in the analysis. Hospital readmission occurred for 12.65% of patients, with the remainder discharged to other locations including 77.94% to the community (home, assisted living facilities or independent living facilities). The payor was designated as either Medicare Part A (36.1%) or managed care (63.9%). The average duration of the therapy program was significantly shorter for patients discharged to the hospital (M = 14.64, SD = 12.45) compared with those discharged to other settings (M = 20.12, SD = 13.39) t (891) = -4.10, $p < .001$. Table 3.1 provides demographic and clinical characteristics.

Table 3.1
Descriptive Statistics of Participants: Admission Functional Status, Hospital Readmission Prediction

			Participants' discharge destination			
	Total		Hospital		Other locations	
Characteristic	(*N* = 893)		(*N* = 113, 12.65%)		(*N* = 780, 87.35%)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Age (years)	78.70	10.22	79.72	10.36	78.55	10.20
Days post onset	9.65	37.58	10.48	7.75	9.53	40.10
Therapy Duration (days)	19.43	13.39	14.64	12.45	20.12 *	13.39
Payors	*N*	*%*	*N*	*%*	*N*	*%*
Managed Care	571	63.94	67	59.29	504	64.62
Medicare Part A	322	36.06	46	40.71	276	35.38
Diagnostic groups						
Medical	457	51.18	59	52.21	398	51.03
Orthopedic	326	36.51	38	33.63	288	36.92
Neurological	63	7.05	9	7.96	54	6.92
Unassigned	41	4.59	5	4.42	36	4.62
Amputation	5	.56	2	1.77	3	.38
Wounds	1	.11	0	0	1	.13
Congestive Heart Failure	261	29.23	45	39.82	216 **	27.69
COPD	292	32.70	45	39.82	247	31.67
Pneumonia	137	15.34	31	27.43	106 ***	13.59
Septicemia	18	2.02	4	3.54	14	1.79
TKR	56	6.27	1	.88	55 ****	7.05
THR	40	4.48	8	7.08	32	4.10
TSR	5	.56	0	0	5	.64
CVA	42	4.70	9	7.96	33	4.23
Discharge Placement						
Home	640	71.67			640	84.49
Acute hospital	113	12.65	113	100		
ALF	52	5.82			52	6.67
Long term care	25	2.80			25	3.21
SNF	25	2.80			25	3.21
Expired	19	2.13			19	2.44
Hospice	16	1.79			16	2.05
Independent Living Facility	4	.45				
Other	2	.22			2	.26

Note. Values are presented as *Mean (Standard Deviation*) or *Number* of patients (*percent*)
* significant difference between groups, p < .001
**significant difference between groups, Chi-Square = 7.022, *df* = 1, p < .05
*** significant difference between groups, Chi-Square = 14.57, *df* = 1, p < .05
****significant difference between groups, Chi-Square = 6.39. df = 1, p < .05

The evaluating therapist indicated the primary reason for the therapy referral as either medical (51.2%), orthopedic (36.5%), neurological (7.1%), amputation (.6%), wounds (.1%) or other (4.36%). There was no significant difference in hospital readmission rates between these broad diagnostic groups. Patients with a diagnosis of pneumonia were more likely to be readmitted to the hospital than those without the diagnosis, (*OR* = 2.40, *95% CI* = 1.52, 3.81). Patients with a diagnosis of heart failure were more likely to be readmitted to the hospital than those without the diagnosis, (*OR* = 1.73, *95% CI* = 1.15, 2.60). Patients admitted to the SNF after total knee arthroplasty were less likely to be readmitted to the hospital than other patients (*OR* = .12, *95% CI* = .02, .86). Patients who were readmitted to the hospital were more dependent with mobility and self-care at time of therapy evaluation and discharge than other patients. Table 3.2 provides CARE Item Set scores for prior level and for therapy evaluation and discharge.

Table 3.2

CARE Item Set Functional Measures

Functional Tasks (CARE Item Set)	Participants' discharge destination											
	Total (*N* = 893)				Hospital (*N* = 113)				other locations (*N* = 780)			
	Prior Level		Admission		Prior Level		Admission Level		Prior Level		Admission Level	
Lying to Sitting	5.72	(.97)	3.53	(1.48)	5.72	(.91)	3.19	(1.55)	5.72	(.98)	3.57	(1.46)
Sitting to Lying	5.71	(.98)	3.48	(1.47)	5.72	(.91)	3.12	(1.52)	5.71	(.99)	3.54	(1.46)
Rolling right / left	5.74	(.93)	3.86	(1.59)	5.77	(.85)	3.51	(1.62)*	5.74	(.95)	3.91	(1.58)*
Chair/Bed Transfer	5.67	(1.00)	3.11	(1.06)	5.73	(.89)	2.76	(1.11)***	5.66	(1.02)	3.16	(1.05)***
Sit to Stand	5.67	(1.03)	3.18	(1.09)	5.68	(1.05)	2.86	(1.16)***	5.66	(1.03)	3.23	(1.08)***
Toilet Transfer	5.65	(1.01)	3.04	(1.09)	5.67	(.98)	2.70	(1.10)***	5.65	(1.02)	3.09	(1.08)***
Car transfer	5.15	(1.55)	2.43	(1.38)	5.09	(1.64)	2.05	(1.36)**	5.16	(1.54)	2.49	(1.38)**
Walk level of assist	5.51	(1.25)	3.01	(1.24)	5.65	(1.03)	2.65	(1.26)***	5.50	(1.28)	3.06	(1.23)***
Pick up object	4.18	(2.54)	1.31	(1.41)	4.26	(2.45)	1.05	(1.27)*	4.17	(2.55)	1.35	(1.42)*
Walk 50' with 2 turns	5.3	(1.63)	2.36	(1.55)	5.25	(1.77)	1.74	(1.41)***	5.31	(1.61)	2.45	(1.55)***
Walk 10' uneven surfaces	4.46	(2.30)	1.83	(1.56)	4.28	(2.38)	1.31	(1.28)***	4.48	(2.29)	1.90	(1.59)***
1 step/curb	4.27	(2.4)	1.69	(1.54)	4.27	(2.42)	1.28	(1.30)***	4.27	(2.40)	1.75	(1.57)***
4 steps	3.25	(2.81)	1.11	(1.42)	3.23	(2.73)	.83	(1.07)*	3.26	(2.82)	1.15	(1.46)*
12 steps	2.51	(2.84)	.73	(1.17)	2.35	(2.79)	.56	(.89)*	2.53	(2.85)	.76	(1.21)*
MOBILITY	**68.93**	**(16.78)**	**34.66**	**(14.12)**	**68.66**	**(16.69)**	**29.59**	**(13.75)*** **	**68.97**	**(16.81)**	**35.39**	**(14.01)*** **
Eating	5.8	(.69)	5.00	(1.11)	5.86	(.65)	4.61	(1.37)***	5.79	(.70)	5.06	(1.06)***
Oral Hygiene	5.74	(.93)	4.68	(1.15)	5.82	(.71)	4.28	(1.25)***	5.73	(.96)	4.73	(1.12)***
Toilet Hygiene	5.63	(1.09)	2.95	(1.23)	5.78	(.76)*	2.42	(1.07)***	5.60	(1.12)*	3.02	(1.23)***
Upper Body Dressing	5.64	(.99)	3.76	(1.21)	5.73	(.65)	3.34	(1.14)***	5.62	(1.03)	3.82	(1.21)***
Lower Body Dressing	5.49	(1.24)	2.61	(1.05)	5.53	(1.17)	2.23	(1.02)***	5.49	(1.26)	2.66	(1.05)***
Wash Upper Body	5.47	(1.23)	3.56	(1.17)	5.59	(.96)	3.23	(1.06)**	5.46	(1.26)	3.61	(1.17)**
Shower/bathe Self	5.26	(1.52)	2.61	(.96)	5.27	(1.46)	2.33	(.88)***	5.25	(1.53)	2.65	(.97)***
Putting on/taking Off Footwear	5.41	(1.42)	2.52	(1.32)	5.5	(1.19)	2.14	(1.08)***	5.40	(1.45)	2.57	(1.34)***
SELF CARE	**38.87**	**(6.90)**	**27.70**	**(7.35)**	**39.35**	**(5.36)**	**24.57**	**(7.28)*** **	**38.80**	**(7.09)**	**28.15**	**(7.25)*** **

Note. Values are presented as *Mean (Standard Deviation)*; *$p < .05$ ** $p < .01$ *** $p < .001$

Decision tree analysis was conducted using the variables indicated in Table 3.3. CHAID algorithm was used with 50% training and testing samples. The parsimonious model selected as most effectively predicting hospital readmission from the SNF is presented in Figure 3.1. Length of stay (LOS) in the SNF therapy program was the variable that contributed most to the risk for hospital readmission. In the first eight days of the therapy program 28.6% of patients were readmitted to the hospital compared to 9.4% of patients remaining in the program more than eight days. For those patients remaining in the SNF therapy program greater than eight days, the strongest determination of hospital readmission was the diagnosis of pneumonia. Twenty percent of these patients with pneumonia were readmitted to the hospital compared to 7.5% of patients without the diagnosis. For patients without pneumonia who remained in the SNF therapy program more than eight days, the amount of decline in self-care independence experienced during the hospitalization determined the risk for readmission. Patients who had more than a 13 point decline in CARE self-care score from prior level of function to OT evaluation were more likely to be readmitted (13.4%) than those with less decline during the hospital stay (3.5%).

Table 3.3
Model Summary: Decision Tree Model Predicting Hospital Readmission from SNF

Growing Method	CHAID	
Dependent Variable	Hospital DC	
Independent Variables	Age Days PostOnset (Days between onset of problem necessitating therapy and first therapy evaluation) Length of Stay in SNF therapy program (LOS) Payor (Medicare or Managed Care) Self-Care Decline Mobility Decline Heart Failure (CHF) COPD, Septicemia Pneumonia Diagnostic Group Description MCC = Multiple Chronic Conditions (COPD and CHF) CHF, COPD and Pneumonia COPD with Pneumonia CHF with Pneumonia CVA CVA with CHF CVA with COPD Hip fracture Hip fracture with CHF Hip fracture with COPD	
Maximum Tree Depth		3
Minimum Cases in Parent Node		100
Minimum Cases in Child Node		50
Independent Variables Included	LOS, COPD with pneumonia, Self-Care Decline	
Number of Nodes		7
Number of Terminal Nodes		4
Depth		3

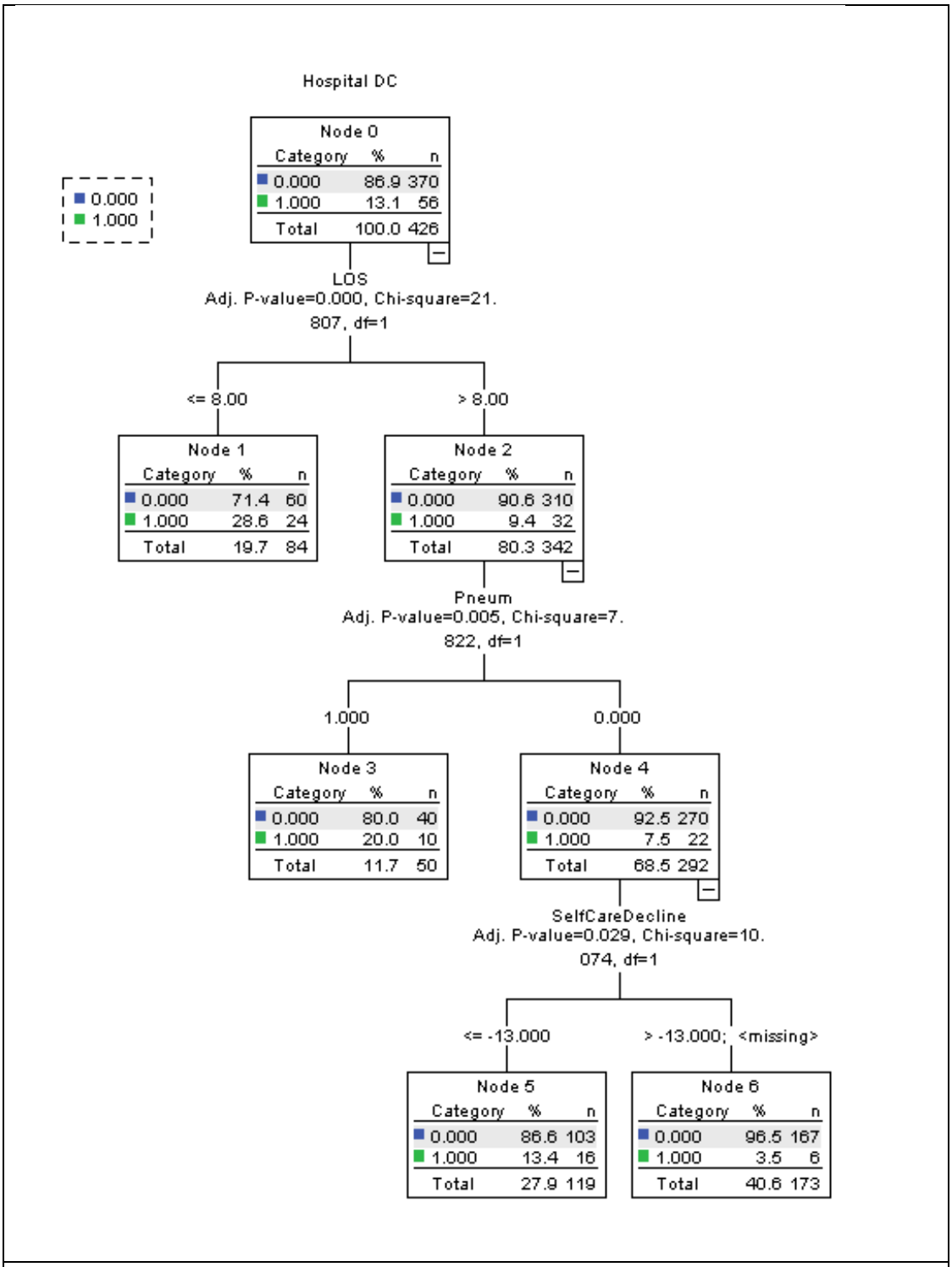

Figure 3.1. Decision Tree: Prediction of Hospital Readmission from SNF
Note. Hospital DC = Hospital Readmission from SNF; LOS = Length of Stay/Duration of therapy program; Pneum = Pneumonia; SelfCareDecline = Decline in self-care ability during hospitalization

The misclassification risk estimate of the training model was 13% (*SE* = .016) indicating that 87% of patients were correctly classified according to outcome. While this would typically indicate high predictive accuracy, the model did not predict hospital readmission for any patients in this sample. The 13% misclassified cases represent the 12.65% of patients whose rehabilitation program was interrupted by a hospital readmission. The decision tree model correctly classified 100% of the patients with an uninterrupted rehabilitation course but none of the patients with a hospital readmission. Results of the test model were consistent with a risk estimate of 12% (*SE* = .015).

Logistic regression analysis was used to determine the extent to which CARE Item Set mobility and self-care scores, targeted medical conditions, age, number of days between condition onset and therapy evaluation, and therapy duration predict the likelihood of hospital readmission. The hypothesis was that, when controlling for these variables, the greater the functional decline during the hospitalization, the more likely it is that the patient would be readmitted to the hospital during the SNF stay. The results of the logistic regression indicated that, when controlling for diagnosis and length of stay in the SNF, decline in self-care is a predictor of hospital readmission. The more decline a patient has in self-care independence during the hospitalization, the more likely they are to be readmitted. The odds ratio is .90, $p < .001$ (larger values of the self-care decline variable indicates less decline). Decline in mobility skills was not a significant predictor of hospital readmission in this model. The Nagelkerke R^2 was .17, indicating that a limited 17% of the variation in readmission incidence was explained by the variables in the model. The most parsimonious model included diagnoses of both COPD and

pneumonia (in the same patient), length of stay in the rehab program, and self-care decline. Table 3.4 provides results.

Table 3.4
Logistic Regression Analysis for Variables Predicting Hospital Readmission from the Skilled Nursing Facility (N = 893)

Variable	*b*	*SE*	Odds ratio	95% Confidence Interval Lower	Upper	Wald statistic	df	*p*
Constant	-2.70	.29	.07			88.55	1	<.001
Self-care decline during hospital stay	-.11	.02	.90	.87	.93	44.00	1	<.001
Therapy program duration (LOS)	-.06	.01	.95	.93	.97	23.67	1	<.001
Diagnosis of COPD and pneumonia	1.15	.31	3.17	1.74	5.77	14.18	1	<.001

Note: Model Chi Square = 83.994, *df* = 4, ($p < .000$); -2 Log Likelihood = 572.826 , Nagelkerke $R^2 = .17$

The relative risk of hospital readmission for patients by diagnosis (Table 3.6) confirmed the finding of relatively more readmissions for patients with both COPD and pneumonia (*N* = 77, *RR* = 2.43, *CI* 1.6-3.65, *p* < .001). This analysis indicated that the highest relative risk was for patients with an operative hip fracture and a diagnosis of COPD (*N* = 14, *RR* = 2.89, *CI* 1.4-5.96, *p* = .004). Patients with a diagnosis of CHF, COPD and pneumonia were more likely to be readmitted (*N* = 12, *RR* = 2.59, *CI* 1.56-4.28, *p* < .001) as were patients with both CHF and pneumonia (without COPD) (*N* = 66, *RR* = 2.52, *CI* 1.65-3.84, *p* < .001). Patients with pneumonia without a diagnosis of CHF or COPD had an increased risk for readmission compared to patients without the diagnosis (*N* = 31, *RR* = 2.07, *CI* 1.43-3.00, *p* < .001).

Table 3.5
Relative Risk of Hospital Readmission for Diagnostic Groups

Diagnosis	N (%)	Relative Risk	95% *CI*	*p*
CHF	262 (17.56)	1.6370	1.16, 2.31	.006
COPD	293 (15.36)	1.3422	0.95, 1.90	.098
Pneumonia	31 (22.63)	2.0692	1.43, 3.00	< .001
CHF and COPD	118 (18.64)	1.5766	1.03, 2.41	.035
COPD and Pneumonia	21 (27.27)	2.4290	1.60, 3.65	< .001
CHF and Pneumonia	66 (28.79)	2.5152	1.65, 3.84	< .001
CHF, COPD and Pneumonia	12 (30.77)	2.5852	1.56, 4.28	< .001
Hip Fracture (Operative)	82 (15.85)	1.2777	0.75, 2.17	.366
Hip Fracture and CHF	17 (29.41)	2.3718	1.11, 5.06	.025
Hip Fracture and COPD	14 (35.71)	2.8899	1.40, 5.96	.004
CVA	42 (21.43)	1.7429	0.95, 3.20	.073

Note. *N* = Number of patients with that diagnosis or combination of diagnoses readmitted to the hospital (*percentage* of the total number of patients)

Discussion

Skilled nursing facilities (SNF) provide nursing and/or therapy services to patients who are unable to return to their prior living situation after a hospitalization. Many of these patients have a goal of returning to their prior level of functioning, but a readmission to the hospital can interrupt the recovery process. Hospital readmissions are economically costly and expose patients to additional risk of adverse outcomes. The purposes of this study were to examine the extent to which functional ability as measured by the CARE Item Set at time of therapy evaluation in a SNF predicts hospital readmission and to identify which functional tasks, if any, contribute most to that risk. Identification of patients at high risk for hospital readmission may allow SNF providers to effectively target interventions to reduce the risk.

Between groups differences (chi-square and related samples *t*-tests), decision tree, and logistic regression analyses were used to explore the contribution of functional, medical, and demographic variables to the likelihood of hospital readmission and answer the research questions. Mobility and self-care CARE Item Set scores were lower (indicating more dependency) at therapy evaluation and discharge for patients who were readmitted to the hospital compared to other patients. Decision tree and logistic regression analysis confirmed the contribution of self-care decline during the hospital stay to increased risk for readmission. Length of stay in the therapy program was the strongest predictor of hospital readmission in the CHAID decision tree model. Patients remaining in the SNF therapy program longer than eight days were less likely to be readmitted to the hospital.

Medical conditions were identified as significant contributors to readmission risk. Patients with pneumonia, COPD with co-occurring pneumonia, CHF and/or operative hip fractures were at increased risk for readmission. Logistic regression analysis indicated that, when controlling for diagnoses of CHF and COPD with pneumonia, decline in self-care abilities during the hospital stay was a significant predictor of readmission. The CHAID decision tree model indicated that the effect of self-care decline on readmission risk was significant, but only for those patients with diagnosed pneumonia.

Functional ability as measured by the CARE Item Set at time of therapy evaluation in the SNF has a limited effect on readmission risk. While a statistically significant difference was found between groups for mobility and self-care scores, only self-care abilities were identified by the predictive models as contributing to readmission risk.

Limitations of this study

Documentation of readmission to the hospital was obtained from therapy discharge summaries based on the therapists' understanding of the discharge placement and may or may not accurately describe the disposition of the patient. There was insufficient information to determine if the patient was actually readmitted to the hospital or experienced an observation stay. Planned readmissions were not accounted for in this dataset. This study focused exclusively on patients returning to the hospital directly from the SNF. The risk for readmission continues after the patient is discharged from the SNF but information was unavailable to examine contributors to risk after discharge. It is reasonable to suspect that functional dependence would put patients at higher risk for

hospital readmission when a patient is living in the community (e.g. after being discharged from the SNF) than when residing in an inpatient setting in which assistance is readily available. The purpose of this study was to evaluate risk factors that may necessitate hospital readmission and interfere with the rehabilitation trajectory while in the SNF.

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CHAPTER IV: CRITICAL FUNCTIONAL SKILLS FOR COMMUNITY DISCHARGE FROM A SKILLED NURSING FACILITY

Introduction

Approximately 20% of all Medicare beneficiaries admitted to a hospital in 2011 were unable to be discharged to the community and required skilled therapy and/or nursing in a skilled nursing facility (SNF) (Medicare Payment Advisory Commission, 2013). The goal of inpatient post-acute care for many of these patients is to return to a community setting. The purpose of this study was to identify and prioritize functional tasks that contribute to the likelihood of discharge from a SNF to the community. This insight can help occupational (OT) and physical therapists (PT) design and implement a therapy plan of care focused on the functional areas most relevant to community discharge.

Increasing cost and anticipation of a growing proportion of older adults in the population have made it necessary to closely examine health care spending. Measures of service quality allow for more informed health care decisions and potential new reimbursement systems incentivizing services that contribute to the important goals of health care reform: improved population health, improved customer experience, and reduced cost (Medicare Payment Advisory Commission, 2016; Institute for Healthcare Improvement, n.d.). The Improving Medicare Post-Acute Care Transformation (IMPACT) Act of 2014 tasked the Centers for Medicare and Medicaid Services (CMS) with instituting a measure of discharge to the community as an indicator of the quality of services provided by SNFs (CMS, 2015). Medicare claims data will be used to report the

proportion of SNF short stay patients discharged to the community at a facility level. Results will be available to the public to aid decisions about where to receive care and may ultimately influence reimbursement.

The percentage of community discharges vary across post-acute settings depending on geographical location, ownership, and patient characteristics (RTI International, 2016). The greatest variation is seen in SNF settings, with between 31% and 65% (average 44%) of patients discharged to the community. Centers with higher quality ratings, small hospital-based centers, and non-profit facilities were more successful at discharging patients into the community than those with lower ratings, larger centers, and those owned by for-profit companies (Breunig & Ribar, 2016). Other facility characteristics can influence discharge destination for short and long term patients including proportion of Medicaid patients (Holup, Gassoumis, Wilber & Hyer, 2016), volume of therapy provided and percent of Medicare admissions (Arling, Williams & Kopp, 2000).

Clinical teams in the SNF are expected to establish and implement a comprehensive plan for a successful discharge to the optimal setting for each patient. CMS requires that the care plan be developed within twenty-one days of admission and include "measurable objectives and timetables customized to the beneficiary" (U.S.D.H.H.S., 2014). When discharge to the community is the desired and reasonable expectation, the team must establish a plan for coordinated care that will maximize the likelihood of a safe transition. In 2013, the Office of Inspector General reported that discharge planning requirements were not met in approximately 31% of SNF stays by

Medicare beneficiaries (U.S.D.H.H.S., 2013). They identified a need for increased guidance for effective discharge planning to SNFs. Examining factors that are associated with successful transitions to the community can facilitate care planning that is informed and targeted to the most significant barriers.

Discharge to community is a modifiable outcome. Interventions such as health care team communication tools (Kushner, Peters, & Johnson-Greene, 2015), high therapy intensity (Wodchis et al., 2005), and multidisciplinary root cause analysis conferences to identify discharge barriers (Berkowitz et al., 2011) can improve successful transitions. Effective interventions focus on management of medical conditions and improving functional status, suggesting that a targeted effort on the part of the clinical team can lead to increased discharges to the community. PT and OT plans of care should emphasize those functional skills that are crucial for community discharge.

The CARE Item Set was developed by measurement experts and representatives from professional organizations and post-acute settings to measure functional abilities across the post-acute care spectrum (Gage et al., 2012). Items were developed that would be sensitive to changes in patient ability with mobility and self-care at both high and low ends of severity seen in these settings, including inpatient rehab hospitals, home health care, long term care hospitals, and SNFs. Pilot testing of the CARE Item Set was conducted with Medicare beneficiaries from all post-acute settings. Reliability testing on the CARE Item Set showed that the basic ADL and mobility items were reliable within provider settings, with kappa statistics of 0.78 or higher for interrater reliability. Reliability between post-acute settings was acceptable, with 70% or more of the raters

scoring consistently with the mode in videotaped patient scenarios. Internal consistency of the items was high, with Cronbach's alpha at least .95 for CARE items at admission and at discharge. Rasch analysis was used to examine the function of the items for capturing the concept of function and the scope of item difficulty. Results indicated limited ceiling/floor effects, adequate rating scale function and acceptable item fit. The CARE Item Set allows effective measurement of mobility and self-care function for patients in skilled nursing facility rehabilitation programs and can provide a basis for further analysis to identify the most critical functional skills associated with community discharge.

Decision tree analysis is an exploratory process that examines prediction of a specific outcome (community discharge) by identifying the variables and interactions between variables (i.e., functional tasks, diagnostic groups) that most significantly differentiate between patients discharged to the community and those discharged to other settings. The branches of a decision tree represent different values of variables that are known or believed to explain variation in the dependent variable of interest. Decision tree analysis identifies the independent variables that are associated with the target variable and chooses the levels or subgroups of the variables that are most strongly associated with the specific outcome. The independent variable that has the strongest association with the dependent variable will be designated as the first "branch" of the tree and will culminate in a "leaf" for each subgroup or level of the variable that is significantly different relative to the dependent variable. The tree can be more or less flexible depending on the number of "leaves" since each represents the number of identified subgroups within the sample, but the researcher determines the minimum number of

subjects within each leaf. Nodes can be added if and when the predictive value of the tree is improved significantly (Dowding & Thompson, 2004).

This approach to analyzing and describing data is clinically useful when it is likely that an accumulation and interaction of variables contribute to outcomes as is the case for medical and rehabilitative care for older adults. Decision tree analysis provides an exploration of these interacting variables and can be used to predict an individual patient's risk for a particular outcome based on their unique profile. Although this study is exploratory in nature, the expectation is that, given the complex medical condition of patients in skilled nursing care, investigation of the interaction of medical/clinical, demographic, and functional factors along with main effects, will enlighten clinicians about the pathways that lead to functional outcomes and discharge placement after a post-acute rehabilitation program.

Receiver operating characteristic (ROC) curves are frequently used to evaluate the discriminative ability of a model or variable for accurately classifying patients into groups. A ROC curve plots sensitivity (the number of patients accurately classified as having a condition/outcome based on the selected cutoff value) on the y-axis and 1-specificity (the number of patients accurately classified as not having the condition/outcome based on the selected cutoff value) on the x-axis. Optimal cutoff scores for determining likelihood of the condition/outcome can be calculated using Youden Index for ROC analysis (Youden, 1950). Youden's Index is a function of both sensitivity and specificity. Values between 0 and 1 are possible, with values closer to 1 representing a high level of effectiveness for accurately identifying the target outcome

and values closer to 0 less effective. The area under the ROC curve (AUC) provides an indicator of the overall effectiveness of the variable for accurately classifying patients. The AUC for each variable represents the probability that the variable will accurately classify patients by discharge placement. The greater the AUC, the greater the ability of the variable to classify patients discharged to the community compared to other settings. Comparison of AUC for different variables or measures allows the researcher to rank them by the accuracy of outcome prediction.

Physical and occupational therapists address mobility and self-care limitations to help patients achieve the highest practical level of functioning. For many patients the goal of post-acute inpatient rehabilitation is to return to the community. This study investigated the functional tasks that were most significantly associated with community discharge. Results can inform care planning and prioritization of treatment goals and interventions.

The research questions were:

1. To what extent is functional ability as measured by the CARE item set at time of discharge from a rehabilitation program in a skilled nursing facility associated with discharge to the community?
2. Which mobility and/or ADL tasks contribute most to the likelihood of discharge to the community?

Methods

Design/Participants

This study involved a retrospective medical record review of patients who participated in an inpatient physical and occupational therapy program in one of three skilled nursing facilities from January through June of 2016 and had admission and discharge CARE item set scores recorded. Only the first admission in which the patient participated in both OT and PT during the study period was considered. Outpatients were not included. Since existing records were used and no identifying information was recorded, expedited IRB approval was granted.

Variables

Discharge placement. Therapists indicated the discharge placement for each patient on the therapy discharge summary. Discharge to home, assisted living facilities and independent living facilities were considered as community discharges. Other possible discharge destinations (skilled nursing facility, long term care unit, acute hospital transfer or other locations) were contrasted with community discharge for analysis.

Demographic variables. Age, payor (Medicare Part A or managed care), and length of time (days) between onset of the condition necessitating therapy and the therapy evaluation were included in the therapy evaluations.

Functional status. Therapists evaluated functional status on admission and at discharge using the CARE Item Set and estimated the functional level prior to hospitalization through patient/caregiver interview and/or medical record review. Occupational therapists assessment performance with eight self-care items (eating, oral hygiene, toilet

hygiene, upper body dressing, lower body dressing, washing upper body, shower/bathing, and putting on/off footwear) and physical therapists assessed fourteen mobility items (lying to sitting, sitting to lying, rolling right/left, sit to stand, bed/chair transfers, toilet transfers, walking assistance, picking up objects, car transfers, walking 50 feet with 2 turns, walking 10 feet on uneven surfaces, stepping up 1 step, stepping up 4 steps, and stepping up 12 steps).

Medical conditions. Therapists indicate the primary diagnostic group (medical, orthopedic, neurological, amputation or wounds) necessitating the therapy referral as part of the therapy evaluation. A diagnostic subgroup (total hip replacement, total knee replacement, total shoulder replacement, operative hip fracture, or stroke) was indicated by the therapist on the evaluation and included in the model. Comorbidities of congestive heart failure, chronic obstructive pulmonary disease, septicemia, and pneumonia were included in the model if coded as present on the admission Minimum Data Set.

Data Analysis

Data were exported from the medical record and the electronic therapy record (SmartTx, 2017) and entered into IBM Statistical Packages for the Social Sciences (version 23) and MedCalc Statistical Software 17.2 (MedCalc, 2017) for analysis. Data were examined for errors and logical inconsistencies. Demographic and clinical descriptors were analyzed for the total dataset and for patients discharged to the community compared to those discharged to other settings. Functional status with self-care and mobility at time of physical and/or occupational therapy evaluation and

discharge using the CARE Item Set and demographic/clinical information were evaluated to determine the contribution of each to the likelihood of community discharge from the SNF. Payor (Medicare Part A or managed care), diagnostic group, length of time (days) between onset of the condition and therapy evaluation, and prior level of function were considered in the model as well. A resulting parsimonious model was presented as a decision tree. Receiver operating characteristics (ROC) curve and area under the curve (AUC) were used to provide further insight into the contribution of functional tasks to community discharge.

The decision tree model was developed using CHAID (Chi Square Automatic Interaction Detection) algorithms. In CHAID analysis, a series of statistical tests are performed to determine all possible splits of each variable and rank them using probability distributions (chi-square statistics for categorical variables and F statistics for continuous variables). The result may be two or more subgroups (child nodes) for each variable (parent node) that is a significant predictor of the outcome of interest. The number of splits and resulting child nodes is limited to k-1 where k = number of levels of the splitting variable (Ragan & Kang, 2005). The model specifications were set prior to analysis. Stopping and pruning criteria determined the point at which the model stops splitting branches. The maximum tree depth was set at 3 levels below the root, with a minimum number of cases in the parent node set at 100 and minimum in the child node at 50. The significance level for splitting nodes and merging categories was set at .05

The resulting decision trees were compared for accuracy in predicting discharge to the community. An acceptable model should accurately predict the outcome in at least 70% of cases (Weatherby, Kang, Shapshak, McCoy, & Chiappelli, 2006). Risk estimate

(the percent of patients misclassified) and standard error was reported for the models. Sensitivity and specificity for each model was calculated along with positive and negative predictive values. Sensitivity is the proportion of true positives (number of patients predicted by the model to be discharged to the community who actually were discharged to the community) divided by the total number of patients discharged to the community. Specificity is the proportion of true negatives (number of patients predicted by the model to be discharged to settings other than the community who actually were discharged to other settings) divided by the total number of patients who were discharged to other settings. Negative predictive value is the proportion of cases predicted to be discharged to other settings who actually were discharged to other settings (true negatives divided by total number of patients predicted by the model to be discharged to other settings). Positive predictive value is the proportion of cases predicted to be discharged to the community who actually were discharged to the community (true positives divided by the total number of patients predicted by the model to be discharged to the community). Sensitivity and specificity are characteristics of the prediction model. Positive and negative predictive values are both influenced by the prevalence of a condition within the studied population. The parsimonious model with optimal predictive accuracy was selected.

Receiver operating characteristic (ROC) curves were used to verify decision tree findings, determine the sensitivity and specificity of potential values of the CARE items that were related to community discharge, and identify of a cutoff score at which both are maximized. The area under the ROC curve (AUC) was calculated as an indicator of the overall effectiveness of the variable for identifying patients who were discharged to the

community. The AUC for each variable represents the probability that the variable will accurately classify patients by discharge placement and allows for comparison of the accuracy of variables. An AUC of 0.9-1.0 indicates excellent accuracy, 0.7-0.9 moderate accuracy, and 0.5-0.7 low accuracy (Akobeng, 2007; Fischer, Bachman, & Jaeschke, 2003). Comparison of the AUC of the variables allows for ranking them in order of the ability to classify patients by discharge placement.

Results

During the 6 month study period, 857 patients were admitted to one of the skilled nursing facility inpatient OT and PT programs. If a patient had multiple admissions during the study time frame, only the first admission during which the patient participated in both OT and PT was included. Table 4.1 provides demographic and clinical characteristics. The majority of patients were discharged to the community (*N* = 666, 77.71%) including home (618, 72.2%) and assisted living facilities (48, 5.6%). Hospital readmissions accounted for 12.6% of discharges. The average therapy program duration was 19.39 days (*SD* 13.29). Chi square test indicated a significant difference in discharge destination between patients with managed care payors and those with Medicare Part A. Patients with managed care payors were more likely to be discharged to the community compared to those with Medicare (*OR* = 1.68, *95% CI* = 1.21, 2.34).

Table 4.1
Descriptive Statistics of Participants

Characteristic	Total (*N* = 857)		Participants' discharge destination: Community (*N* = 666, 77.71%)		other locations (*N* = 191, 22.29%)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Age (years)	78.52	10.24	77.72	10.24	81.31 *	9.78
Days post onset	9.71	38.34	9.53	43.29	10.36	7.80
Therapy Duration (days)	19.39	13.29	19.74	13.25	18.19	13.43
	N	*%*	*N*	*%*	*N*	*%*
Payors						
Managed Care	549	64.06	445	66.82	104 **	54.45
Medicare Part A	308	35.94	221	33.18	87 **	45.55
Diagnostic groups						
Medical	439	51.23	332	49.85	107 ***	56.02
Orthopedic	311	36.29	262	39.34	49 ***	25.65
Neurological	62	7.23	41	6.16	21 ***	10.99
Unassigned	39	4.55	27	4.05	12 ***	6.28
Amputation	5	.58	3	.45	2 ***	1.05
Wounds	1	.12	1	.20		
Discharge Destination						
Home	618	72.11	618	92.79		
Acute hospital	108	12.60			108	56.54
ALF	48	5.60	48	7.21		
Long term care	24	2.80			24	12.57
SNF	24	2.80			24	12.56
Expired	18	2.10			18	9.42
Hospice	15	1.75			15	7.85
Other	1	.12			1	.52

Table 4.1
Descriptive Statistics of Participants (cont.)

			Participants' discharge destination			
			Community		other locations	
Characteristic	Total (*N* = 857)		(*N* = 666, 77.71%)		(*N* = 191, 22.29%)	
Functional Measures: CARE Item Set						
	M	*SD*	*M*	*SD*	*M*	*SD*
Self-care prior level	38.95	6.71	39.46	6.03	37.34 *	8.35
Self-care admission	27.76	7.39	28.95	6.84	23.54 *	7.71
Self-care discharge	36.82	11.43	40.51	8.35	23.82 *	11.36
Mobility prior level	69.12	16.63	70.4	15.91	64.70 *	18.25
Mobility admission	34.77	14.1	36.72	13.42	27.95 *	14.33
Mobility discharge	51.75	0.77	58.47	16.44	28.29 *	16.89

Note.
* significant difference between groups, p < .001
**significant difference between groups, Chi-Square = 11.07, *df* = 2, (*p* < .05)
*** significant difference between groups, Chi-Square = 16.37, *df* = 5, (*p* < .05)

The most common reasons for therapy referral were medical (51.2%) and orthopedic conditions (36.3%). Chi square test indicated a significant difference in discharge placement between groups of patients based on diagnostic group. Patients with orthopedic conditions were more likely to be discharged to the community (*OR* = 1.88, *95% CI* = 1.31, 2.69).

Patients discharged to the community were more independent prior to the hospitalization than patients discharged to other locations with mobility tasks (*M* = 70.4,

SD = 15.91 and *M* = 64.7, *SD* = 18.25, respectively); *t*(855) = 4.22, *p* = .006) and self-care tasks (*M* = 39.46, *SD* = 6.03 and *M* = 37.34, *SD* = 8.35, respectfully); *t*(849) = 3.89, *p* < .001). Functional independence scores were higher (more independent) at admission to and discharge from the rehab program for patients discharged to the community. CARE Item Set scores for prior level and for admission and discharge status are provided in Table 4.2 (mobility) and Table 4.3 (self-care).

Table 4.2

CARE Item Set Functional Measures: Mobility

	Participants' discharge destination								
	Total (*N* = 857)			Community (*N* = 666)			Other Locations (*N* = 191)		
Functional Tasks (CARE Item Set)	Prior Level	Admission	Discharge	Prior Level	Admission	Discharge	Prior Level	Admission	Discharge
Lying to Sitting	5.73 (.92)	3.53 (1.48)	4.92 (1.58)	5.77 (.87)*	3.68 (1.44)***	5.45 (1.06)***	5.59 (1.08)	3.00 (1.49)	3.09 (1.7)
Sitting to Lying	5.72 (.94)	3.49 (1.48)	4.91 (1.58)	5.76 (.89)*	3.65 (1.44)***	5.44 (1.07)***	5.58 (1.08)	2.93 (1.45)	3.06 (1.69)
Rolling right / left	5.75 (.91)	3.86 (1.59)	5.01 (1.56)	5.78 (.87)	4.00 (1.57)***	5.50 (1.07)***	5.63 (1.02)	3.39 (1.59)	3.34 (1.79)
Chair/Bed Transfer	5.69 (.94)	3.11 (1.06)	4.44 (1.58)	5.72 (.9)	3.25 (.99)***	4.96 (1.2)***	5.58 (1.04)	2.62 (1.15)	2.63 (1.39)
Sit to Stand	5.68 (.97)	3.17 (1.11)	4.48 (1.6)	5.72 (.92)	3.31 (1.02)***	5.00 (1.23)***	5.55 (1.12)	2.69 (1.28)	2.68 (1.39)
Toilet Transfer	5.67 (.97)	3.03 (1.11)	4.40 (1.6)	5.72 (.9)*	3.17 (1.03)***	4.92 (1.25)***	5.49 (1.16)	2.53 (1.24)	2.61 (1.39)
Car transfer	5.17 (1.53)	2.44 (1.38)	3.77 (1.75)	5.27 (1.43)***	2.58 (1.34)***	4.29 (1.44)***	4.81 (1.79)	1.94 (1.37)	1.98 (1.52)
Walk level of assist	5.55 (1.17)	3.02 (1.23)	4.04 (1.68)	5.59 (1.15)	3.18 (1.15)***	4.51 (1.37)***	5.42 (1.22)	2.44 (1.33)	2.41 (1.66)
Pick up object	4.19 (2.53)	1.33 (1.41)	2.42 (2.21)	4.37 (2.45)***	1.43 (1.43)***	2.83 (2.24)***	3.57 (2.73)	0.96 (1.26)	0.99 (1.35)
Walk 50' with 2 turns	5.33 (1.58)	2.36 (1.55)	3.81 (1.96)	5.42 (1.49)**	2.59 (1.51)***	4.38 (1.64)***	5.04 (1.84)	1.58 (1.41)	1.83 (1.7)
Walk 10' uneven surfaces	4.50 (2.27)	1.83 (1.57)	2.97 (2.05)	4.67 (2.19)***	2.00 (1.57)***	3.45 (1.92)***	3.94 (2.46)	1.25 (1.41)	1.27 (1.52)
1 step/curb	4.32 (2.37)	1.70 (1.54)	2.80 (2.1)	4.47 (2.31)***	1.83 (1.57)***	3.29 (2.00)***	3.81 (2.52)	1.23 (1.32)	1.09 (1.45)
4 steps	3.29 (2.80)	1.12 (1.42)	2.10 (2.15)	3.44 (2.8)**	1.23 (1.48)***	2.48 (2.21)***	2.75 (2.75)	0.76 (1.12)	0.77 (1.24)
12 steps	2.53 (2.84)	.74 (1.17)	1.68 (2.11)	2.70 (2.87)***	0.81 (1.23)***	1.99 (2.22)***	1.91 (2.64)	0.49 (.92)	0.61 (1.12)
MOBILITY	69.12 (16.63)	34.73 (14.12)	51.77 (20.74)	70.40 (15.91)***	36.72 (13.42)***	58.47 (16.44)***	64.66 (18.28)	27.80 (14.33)	28.38 (16.88)

Note. Values are presented as *Mean (Standard Deviation)*; *$p < .05$ ** $p < .01$ *** $p < .001$

Table 4.3

CARE Item Set Functional Measures: Self Care

Functional Tasks (CARE Item Set)	Participants' discharge destination								
	Total (*N* = 857)			Community (*N* = 666)			other locations (*N* = 191)		
	Prior Level	Admission	Discharge	Prior Level	Admission	Discharge	Prior Level	Admission	Discharge
Eating	5.81 (.65)	5.01 (1.11)	5.37 (1.2)	5.83 (.64)*	5.19 (.95)***	5.70 (.65)***	5.72 (.7)	4.39 (1.4)	4.19 (1.8)
Oral Hygiene	5.76 (.89)	4.69 (1.15)	5.20 (1.33)	5.79 (.86)*	4.87 (1.01)***	5.57 (.86)***	5.63 (.98)	4.06 (1.39)	3.89 (1.78)
Toilet Hygiene	5.64 (1.05)	2.95 (1.24)	4.45 (1.71)	5.69 (.99)*	3.14 (1.2)***	5.01 (1.32)***	5.47 (1.22)	2.30 (1.14)	2.50 (1.48)
Upper Body Dressing	5.65 (.94)	3.78 (1.22)	4.83 (1.44)	5.71 (.9)**	3.95 (1.18)***	5.27 (1.05)***	5.46 (1.06)	3.17 (1.16)	3.28 (1.57)
Lower Body Dressing	5.51 (1.22)	2.60 (1.06)	4.24 (1.71)	5.59 (1.12)**	2.73 (1.03)***	4.78 (1.38)***	5.22 (1.48)	2.15 (1.04)	2.37 (1.39)
Wash Upper Body	5.48 (1.22)	3.57 (1.17)	4.57 (1.58)	5.55 (1.15)**	3.73 (1.12)***	5.03 (1.22)***	5.24 (1.39)	3.01 (1.17)	2.96 (1.65)
Shower/bathe Self	5.26 (1.52)	2.61 (.97)	3.96 (1.71)	5.36 (1.42)***	2.73 (.92)***	4.46 (1.49)***	4.90 (1.77)	2.19 (1.00)	2.20 (1.38)
Putting on/taking Off Footwear	5.42 (1.4)	2.51 (1.33)	4.23 (1.85)	5.50 (1.33)**	2.64 (1.34)***	4.79 (1.53)***	5.14 (1.6)	2.07 (1.17)	2.27 (1.5)
SELF CARE	38.95 (6.71)	27.74 (7.39)	36.83 (11.42)	39.41 (39.41)***	28.98 (6.79)***	40.60 (8.28)***	37.35 (7.85)	23.41 (7.75)	23.70 (11.17)

Note. Values are presented as *Mean (Standard Deviation*); *$p < .05$ ** $p < .01$ *** $p < .001$

Exploration of decision tree models for the contribution of the independent variables (functional status, age, duration of therapy program, diagnostic groups) to the dependent variable (community discharge) yielded inconsistent results. Transfer and/or toileting related tasks were designated as the first branch in 13 of 14 models (bed/chair transfers in 6 models, toilet hygiene in 2 models, sit to stand in 3 models and toilet transfers in 2 models). Subsequent branches of the tree varied between models. Predictive accuracy of the development models ranged from 85% to 89.3%.

The instability of the decision tree models was not unexpected given the high correlation between the functional tasks. To improve stability of the exploratory models, some CARE items were grouped into indexes based on statistical and clinical reasonableness. A description of indexes formed is provided in Table 4.4. Toilet transfers and toilet hygiene are components of the same functional task of toileting. Upper body dressing, lower body dressing and putting on/taking off footwear can reasonably be considered as distinct but related components of dressing. Washing upper body is a typically a component of showering/bathing oneself. Bed mobility includes the specific tasks of moving from lying to sitting, sitting to lying, and rolling. Transfers include rising from sitting and moving between surfaces including chair and bed. Walking typically includes a range of tasks including turns and uneven surfaces. Clinically the individual tasks within these groups of tasks are addressed together, so combining them for determining their relevance to discharge placement is reasonable.

Table 4.4
Indexes formed from CARE Item Set

CARE Item Set Items	Index for analysis	Range of possible scores *	Reliability (Cronbach's alpha)
Toilet transfers and toilet hygiene	Toileting	0-12	.87
Upper body dressing, lower body dressing, putting on/taking off footwear	Dressing	0-18	.95
Wash Upper Body, Shower/bathe self	Bathing	0-12	.92
Lying to sitting on side of bed, Sit to lying, rolling left and right	Bed mobility	0-18	.98
Sit to Stand, Chair/bed to chair transfers	Transfers	0-12	.98
Walking assistance, walk 50 feet with 2 turns, walking 10 feet on uneven surfaces	All Walking	0-18	.91

Note. * Higher scores indicate more independence
Five additional CARE Item Set variables were not included in indexes

Principle component factor analysis with Varimax rotation identified three components explaining the variation in scores on the combined CARE mobility and self-care scales. Results supported the bathing, bed mobility, and transfer indexes. The toilet transfer item was more closely related to the other transfer items than the toilet hygiene item but was kept in a toileting index since the two tasks are typically addressed concurrently in therapy sessions. Walking on uneven surfaces was more closely related to stair climbing than to other walking tasks but was kept in a walking index since it is typically addressed in therapy sessions along with the other walking tasks. Table 4.5 provides results of the principle component factor analysis. Cronbach's alpha ranged from .87 to .98 for each of the indexes indicating excellent reliability and reasonableness of combining scores for each of the indexes (see Table 4.4).

Table 4.5
Principle Component Factor Analysis with Varimax Rotation of all CARE Item Set Items

	Component		
	1	2	3
1 step/curb	.272	.345	**.766**
12 steps	.156	.063	**.863**
4 steps	.185	.132	**.881**
Walk 10’ uneven surfaces	.277	.450	**.660**
Pick up object	.227	.314	**.668**
Car transfer	.371	.599	.501
Chair/Bed Transfer	.450	**.761**	.332
Lying to Sitting	.382	**.840**	.155
Rolling right / left	.367	**.812**	.138
Sitting to Lying	.395	**.837**	.164
Sit to Stand	.431	**.766**	.348
Toilet Transfer	.438	**.766**	.346
Walk 50’ with 2 turns	.345	**.636**	.515
Walk level of assist	.335	**.668**	.476
Eating	**.784**	.286	.132
Lower Body Dressing	**.785**	.413	.302
Oral Hygiene	**.791**	.315	.184
Putting on/taking Off Footwear	**.779**	.379	.278
Shower/bathe Self	**.756**	.355	.340
Toilet Hygiene	**.784**	.439	.237
Upper Body Dressing	**.841**	.362	.221
Wash Upper Body	**.841**	.290	.275

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Decision tree models using indexes of related functional items were more stable. The most effective model for accurately classifying patients based on discharge placement is presented in Figure 4.1. Toileting (toilet transfers and toilet hygiene) at discharge was identified as the functional task that best discriminated between patients discharged to the community and those discharged to other settings. Among patients who were more dependent with toileting (scoring 6 or less on the index), only 30.9% were discharged to the community compared to 80.3% of patients scoring 6-9 on the index and 99.5% of those scoring greater than nine. Additional branches did not add to the predictive accuracy of the model.

Risk statistics indicated high accuracy of the model. The misclassification risk estimate was .12 (*SE* = .016) indicating that 88% of the cases were classified correctly. A sensitivity of 92.5% indicated high probability that the model will accurately predict a community discharge. Specificity of 70.0% indicated adequate probability that the model will accurately predict discharge to settings other than the community. Negative predictive value (the proportion of cases predicted to be discharged to other settings who actually were discharged to other settings) was 69.1%. Positive predictive value (the proportion of cases predicted to be discharged to the community who actually were discharged to the community) was 92.8%. The model was validated with a random selection of 50% of subjects with resulting misclassification of 14% of patients (*SE* = .016). Statistics regarding predictive accuracy of the model are presented in Table 4.6.

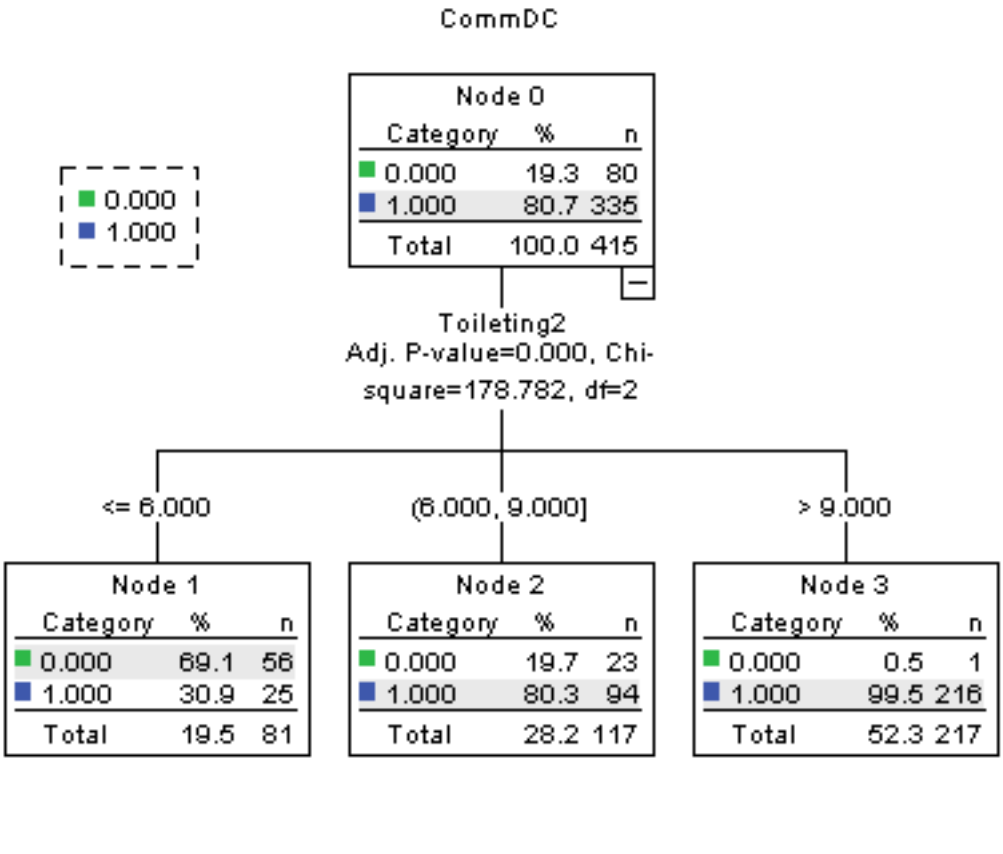

Figure 4.1. CHAID Decision Tree for Functional Tasks Associated with Discharge to the Community

Note. CommDC = Discharge to the community; Toileting2 = Functional status with toileting at time of discharge from SNF

Table 4.6
Predictive Accuracy of CHAID Decision Tree Models for Predicting Community Discharge

		Predicted		
		Community Discharge	Other Discharge Location	Percent Correct
Training Model	Observed Community Discharge	310	25	92.5
	Observed Other Discharge Location	24	56	70.0
	Overall Percentage	80.5	19.5	88.2
Testing Model	Observed Community Discharge	307	24	92.7
	Observed Other Discharge Location	36	75	67.6
	Overall Percentage			86.4

Note. Misclassification estimate = .12, *SE* = .016

ROC curve and AUC analysis validated the decision tree finding that toileting was the functional task most significantly associated with community discharge and established a hierarchy of items based on accuracy of classifying patients. All variables had at least fair effectiveness for classifying patients by discharge placement. Toileting (toilet transfers and toilet hygiene) had the highest AUC (.91, *CI* .89-.93) indicating high accuracy. A cutoff score of 7.5 on the toileting index had the optimal sensitivity (.87) and specificity (.83). Transfers (sit to stand and chair/bed transfer) had and AUC of .89 (*CI* .87, .92). A cutoff score of 7 maximized sensitivity (91.44%) and specificity (68.69%). Thresholds associated with community discharge, AUC, sensitivity, specificity, and Youden's Index for each variable or index is included in Table 4.7.

Table 4.7
Functional task thresholds from Receiver Operating Characteristic Curve Analysis and Accuracy Statistics

Functional Task – Discharge Status	Optimal cutoff score	Sensitivity	Specificity	AUC (95% Confidence Interval)	Youden's Index	*p*
Toileting	7	86.58	82.29	.91 (.89, .93)	.69	.000
Transfer	7	91.44	68.69	.89 (.87, .92)	.60	.000
Dressing	11	81.20	80.10	.88 (.86, .91)	.61	.000
Bathing	7	79.77	76.41	.87 (.84, .89)	.56	.000
Bed Mobility	15	76.31	85.86	.86 (.83, .89)	.62	.000
Car Transfer	3	79.97	82.83	.86 (.83, .89)	.63	.000
All Walking	11	68.8	88.89	.86 (.83, .89)	.58	.000
Oral care	5	70.78	87.76	.84 (.80, .87)	.59	.000
Eating	5	76.21	77.04	.81 (.77, .84)	.53	.000
Steps	3	70.97	79.80	.77 (.74, .80)	.51	.000
Pick up object	2	57.99	83.33	.73 (.69, .76)	.41	.000

Discussion

Mobility and self-care dependence are frequently barriers to community discharge for patients in post-acute inpatient rehabilitation programs and the focus of OT and PT programs. Identification of the functional tasks that are most important for community discharge can inform therapy care planning and prioritization of treatment goals and interventions. The CARE Item Set allows for effective measurement of functional skills in post-acute settings and provided the basis for this study of functional tasks and their association with community discharge from the SNF.

Patients discharged to the community were more likely to be younger, have managed care payors and have orthopedic conditions necessitating therapy than patients discharged to other settings. Not surprisingly, functional independence as measured by the twenty two functional tasks included in the CARE Item Set (eight self-care skills and fourteen mobility skills) prior to hospitalization, at therapy evaluation and at therapy discharge was higher for patients discharged to the community compared to other patients. Exploration of the hierarchy of specific functional skills in association with community discharge was inconclusive when using all CARE items individually. After grouping items based on statistical and clinical appropriateness predictive modeling was more stable and allowed for reasonable and clinically applicable conclusions.

Toileting was the most critical functional task for community discharge in this group of inpatients in SNF rehabilitation programs. This is consistent with the findings

of Matsuo et al. (2015) that family caregivers base rehabilitation discharge decisions more on the need for assist with toileting than any other functional task. While assistance for other mobility and self-care tasks may be provided based on caregiver availability and convenience, toileting takes place throughout the day (and possibly nights) and at times that are difficult to anticipate. The personal nature of assisting someone with toileting presents another barrier to caregivers choosing to support a community discharge. Bathing and dressing are other personal tasks associated with discharge placement, reasonably reflecting caregivers' hesitancy with providing this level of assistance. The ability to transfer (sit to/from standing and chair/bed transfers) relatively independently was also important for community discharge as it constitutes another task that typically must occur throughout the day.

Understanding the functional tasks that are most significantly related to community discharge allows OT and PT in the SNF to focus treatment goals and interventions on what matters most for the desired outcome of most patients – to return to the community. Individualized examination and evaluation of patients – their goals and barriers/facilitators to those goals – guides each patient's therapy plan of care, but understanding commonalities among groups of similar patients can further enlighten therapists as they facilitate their patients' progress toward accomplishing their goals. Focusing therapy plans of care on toileting and transfer tasks may be the most efficacious approach for patients with dependency in those areas whose goal is to return to the community from the SNF.

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CHAPTER V: DISCUSSION
CLINICAL UTILITY OF THE CARE ITEM SET

In 2011, 1.7 million Medicare fee-for-service beneficiaries received skilled nursing and/or rehabilitative care in skilled nursing facilities, accounting for 2.4 million admissions (Medicare Payment Advisory Commission, 2013). With post-acute care services accounting for a large proportion of the spending variance and 1/3 or more of hospitalized Medicare beneficiaries discharged to post-acute settings, health care reform is reasonably focused on these levels of care (Gage et al., 2012a). The escalating cost of health care and increasing numbers of older adults make it necessary to focus on effectiveness and efficiency of care. The CARE Item Set was developed to provide objective assessment of function across posts-acute settings so that informed decisions about the most clinically effective and cost effective level of care for each patient can be made (Gage et al, 2012b).

Clinical measurement of outcomes is important for evaluating change over time, discriminating different types of patients and patient needs, and for outcome prediction to inform goal setting and treatment planning. Informed prediction of outcomes can facilitate appropriate placement and guide decisions about the type and intensity of services provided (MacDermid et al., 2014). The purpose of this study was to examine the effectiveness of the CARE Item Set for measuring basic mobility, identifying the functional skills that contribute most to the desired outcome of community discharge, and assessing risk for an interruption of the therapy program due to a hospital readmission.

The ability to perform basic mobility (bed mobility and transfers) is an important determinant of an older adult's ability to live in the community or return to the community after a hospitalization and is frequently a focus of PT programs in the SNF. Objective measurement is important for identifying impairment and need for assistance and for establishing baseline status so that change can be identified timely, but measurement tools including basic mobility tasks are limited. If individual items or a combination of items into sub-sets of the CARE Item Set would allow for effective measurement of status and progress for specific areas of function such as bed mobility and transfers, therapists would be able to minimize the number of assessment tools required for completing a thorough evaluation of a patient's function.

Internal consistency and factor analysis of the six basic mobility items supported using them as a subscale for measurement of bed mobility and transfers, including summing scores for the items to gain summary scores. The three item bed mobility scale, three item transfer scale, and the combined six item basic mobility scale demonstrated excellent sensitivity to change over the course of the PT program with SRMs of .79, .89, and .91 respectively. Improvment in basic mobility skills as measured by the CARE Item Set subscales was associated with higher likelihood of dishcharge to the community and scores for the bed mobility, transfers, and combined basic mobility subscales were significantly higher for those patients discharged to the community compared to other settings. The bed mobility subscale, transfers subscale and combined basic mobility subscale of the CARE Item Set mobility scale provided an effective way to describe baseline status, establish goals and demonstrate progress for basic mobility tasks in post-acute care patients in the SNF setting. The ability to use an outcome measurement tool

that is, in part, required by CMS for purposes of outcome prediction and for quantifying function for PT goals can streamline the assessment and treatment planning process for therapists in post-acute care settings.

Skilled nursing facilities (SNF) provide nursing and/or therapy services to patients who are unable to return to their prior living situation after a hospitalization. Many of these patients have a goal of returning to their prior level of functioning, but a readmission to the hospital can interrupt the recovery process. Hospital readmissions are economically costly and expose patients to additional risk of adverse outcomes. The purposes of this study were to examine the extent to which functional ability as measured by the CARE Item Set at time of therapy evaluation in a SNF predicts hospital readmission and to identify which functional tasks, if any, contribute most to that risk. Identification of patients at high risk for hospital readmission may allow SNF providers to effectively target interventions to reduce the risk.

Functional ability as measured by the CARE Item Set at time of therapy evaluation in the SNF has a limited effect on readmission risk. While mobility and self-care scores were significantly different between groups ($p < .001$), only decline in self-care abilities during the hospital stay contributed to readmission risk in the decision tree and logistic regression prediction models. Length of stay in the SNF was the strongest predictor of hospital readmission in the decision tree model. Patients were more likely to be readmitted during the first eight days of the SNF stay. Patients with medical conditions including pneumonia, COPD, heart failure and operative hip fracture were at increased risk of readmission.

Mobility and self-care dependence are frequently barriers to community discharge for patients in post-acute inpatient rehabilitation programs and the focus of OT and PT programs. Identification of the functional tasks that are most important for community discharge can inform therapy care planning and prioritization of treatment goals and interventions. The CARE Item Set allows for effective measurement of functional skills in post-acute settings and provided the basis for this study of functional tasks and their association with community discharge from the SNF.

Toileting was identified as the most critical functional task for community discharge in this group of inpatients in SNF rehabilitation programs. Understanding the functional tasks that are most significantly related to community discharge allows OT and PT in the SNF to focus treatment goals and interventions on what matters most for the desired outcome of most patients – to return to the community. Individualized examination and evaluation of patients – their goals and barriers/facilitators to those goals – guides each patient's therapy plan of care, but understanding commonalities among groups of similar patients can further enlighten therapists as they facilitate their patients' progress toward accomplishing their goals. Focusing therapy plans of care on toileting and transfer tasks may be the most efficacious approach for patients with dependency in those areas whose goal is to return to the community from the SNF.

The CARE Item Set is a clinically useful instrument for quantifying performance levels for basic mobility tasks (bed mobility and transfers). It allowed for identification of toileting and transfers as critical functional tasks for community discharge from the skilled nursing facility (SNF) setting. The usefulness of the CARE Item Set for

identifying patients at increased risk for hospital readmission was limited in this group of patients in OT and/or PT programs in the SNF.

Opportunities for Further Study

As the use of the CARE Item Set in post-acute settings expands and a larger database develops additional analyses will be possible using larger numbers of patients and multiple settings. Considering additional variables (diagnostic groups, measures of cognition, depression, and adverse events such as falls) would be possible with the ability to merge CARE Item Set data with other relevant databases such as the Minimum Data Set in the SNF setting or the Outcome and Assessment Information Set (OASIS) in home care. Using interim functional measures during the rehabilitation program would allow for an examination of the functional trajectories of patients.

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APPENDICES

APPENDIX A: CARE Item Set Item Descriptions: Self-Care

Task	Task Description
Eating *	The ability to use suitable utensils to bring food to the mouth and swallow food once the meal is presented on a table/tray. Includes modified food consistency
Oral Hygiene *	The ability to use suitable items to clean teeth. If the patient has dentures: the ability to remove and replace dentures from & to mouth, & manage equipment for soaking & rinsing
Toilet Hygiene *	The ability to maintain perineal hygiene, adjust clothes before & after using toilet, commode, bedpan, urinal. This task does not include getting to the toilet/commode or placing the bedpan/urinal. If managing ostomy, includes wiping opening but not managing equipment
Upper body dressing	The ability to put on and remove shirt or pajama top. Includes buttoning if applicable
Lower body dressing	The ability to dress and undress below the waist, including fasteners. Does not include footwear.
Wash upper body	The ability to wash, rinse, and dry the face, hands, chest, and arms while sitting in a chair or bed.
Shower / bathe self	The ability to bathe self in shower or tub, including washing, rinsing, and drying self. Does not include transferring in/out of tub/shower.
Putting on / taking off footwear	The ability to put on and take off socks and shoes or other footwear that are appropriate for safe mobility

(CARE Tool Institutional Admission, 2010)
* Item included in Minimum Data Set Section GG

APPENDIX B: CARE Item Set Descriptions: Mobility

Task	Task Description
Lying to sitting on side of bed *	The ability to safely move from lying on the back to sitting on the side of the bed with feet flat on the floor, no back support
Sit to lying *	The ability to move from sitting on side of bed to lying flat on the bed
Rolling left and right	The ability to roll from lying on back to left and right side, and roll back to back
Sit to stand *	The ability to safely come to a standing position form sitting in a chair or on the side of the bed
Chair / bed-to-chair transfer *	The ability to safely transfer to and from a chair (or wheelchair). The chairs are placed at right angles to each other
Toilet transfer *	The ability to safely get on and off a toilet or commode.
Walking *	Code the level of independence with walking the longest distance the patient walks in corridor or similar space. If patient ambulates less than 10 feet, choose… level of assistance as "1/dependent"
Picking up object	The ability to bend/stoop from a standing position to pick up small object such as a spoon from the floor.
Car transfer	The ability to transfer in and out of a car or van on the passenger side. Does not include the ability to open/close door or fasten seat belt.
Walk 50 feet with two turns *	The ability to walk 50 feet and make two turns.
Walking 10 feet on uneven surfaces	The ability to walk 10 feet on uneven or sloping surfaces, such as grass or gravel.
1 step (curb)	The ability to step over a curb or up and down one step.
4 steps	The ability to go up and down steps with or without a rail.
12 steps	The ability to go up and down 12 steps with or without a rail.

(CARE Tool Institutional Admission, 2010)
* Item included in Minimum Data Set Section GG

APPENDIX C: CARE Item Set Coding: Self-Care and Mobility Items

Numerical Score	Score Description	Score Definition
6	Independent	Patient completes the activity by him/herself with no assistance from a helper
5	Set-up or Clean-up Assistance	Helper SETS UP or CLEANS UP; patient completes activity. Helper assists only prior to or following the activity
4	Supervision or Touching Assistance	Helper provides VERBAL CUES or TOUCHING/STEADYING assistance a patient completes activity. Assistance may be provided throughout the activity or intermittently
3	Partial / Moderate Assistance	Helper does LESS THAN HALF the effort. Helper lifts, holds or supports trunk or limbs, but provides less than half the effort
2	Substantial / Maximal Assistance	Helper does MORE THAN HALF the effort. Helper lifts or holds trunk or limbs and provides more than half the effort
1	Dependent*	Helper does ALL the effort. Patient does none of the effort to complete the task

* When the patient can't perform the task because of medical reasons, a rating of 1/dependent is chosen (American Health Care Association, National Association in Support of Long Term Care, Therapy Outcome Measures Workgroup, 2014)

APPENDIX D: Institutional Review Board Approval

IRB
INSTITUTIONAL REVIEW BOARD
Office of Research Compliance,
010A Sam Ingram Building,
2269 Middle Tennessee Blvd
Murfreesboro, TN 37129

MIDDLE TENNESSEE STATE UNIVERSITY

IRBN001 - EXPEDITED PROTOCOL APPROVAL NOTICE

Tuesday, January 31, 2017

Investigator(s): Linda Bloodworth (Student PI), Norman Weatherby (FA), Minsoo Kang and Brian Hinote
Investigator(s') Email(s): lcc3k@mtmail.mtsu.edu; norman.weatherby@mtsu.edu; minsoo.kang@mtsu.edu; brian.hinote@mtsu.edu
Department: Health and Human Performance

Study Title: Clinical utility of the CARE item set
Protocol ID: **17-2114**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXPEDITED** mechanism under 45 CFR 46.110 and 21 CFR 56.110 within the category *(5) Research involving materials* A summary of the IRB action and other particulars in regard to this protocol application is tabulated as shown below:

IRB Action	APPROVED for one year from the date of this notification	
Date of expiration	1/31/2018	
Participant Size	1,200 (ONE THOUSAND TWO HUNDRED)	
Participant Pool	Deidentified electronic patient records owned by National Healthcare Corporation	
Exceptions	(1) Permitted to review patient records (2) Informed consent is waived	
Restrictions	1. Mandatory signed disclosure statement by NHC (on file) 2. Patients must be 18 and older 3. Video data must be deleted/destroyed once they are analyzed 4. Inclusion/exclusion criteria on file must be implemented	
Comments	This protocol has been reviewed under the Expedited Category 5 "Research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for nonresearch purposes (such as medical treatment or diagnosis)."	
Amendments	**Date**	**Post-approval Amendments** NONE

This protocol can be continued for up to THREE years (1/31/2020) by obtaining a continuation approval prior to 1/31/2018. Refer to the following schedule to plan your annual project reports and be aware that you may not receive a separate reminder to complete your continuing reviews. Failure in obtaining an approval for continuation will automatically result in cancellation of this protocol. Moreover, the completion of this study MUST be notified to the Office of Compliance by filing a final report in order to close-out the protocol.

Continuing Review Schedule:

Reporting Period	Requisition Deadline	IRB Comments
First year report	12/31/2017	INCOMPLETE
Second year report	12/31/2018	INCOMPLETE
Final report	12/31/2019	INCOMPLETE

The investigator(s) indicated in this notification should read and abide by all of the post-approval conditions imposed with this approval. Refer to the post-approval guidelines posted in the MTSU IRB's website. Any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918 within 48 hours of the incident. Amendments to this protocol must be approved by the IRB. Inclusion of new researchers must also be approved by the Office of Compliance before they begin to work on the project.

All of the research-related records, which include signed consent forms, investigator information and other documents related to the study, must be retained by the PI or the faculty advisor (if the PI is a student) at the secure location mentioned in the protocol application. The data storage must be maintained for at least three (3) years after study completion. Subsequently, the researcher may destroy the data in a manner that maintains confidentiality and anonymity. IRB reserves the right to modify, change or cancel the terms of this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
Middle Tennessee State University

Quick Links:

Click here for a detailed list of the post-approval responsibilities.
More information on expedited procedures can be found here.