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Community Integration After In-Patient Rehabilitation for Lower Extremity Musculoskeletal Disorders: A Pilot Study

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A thesis submitted in partial fulfillment of the requirements for the Master of Science degree in Health and Rehabilitation Sciences

COMMUNITY INTEGRATION AFTER IN-PATIENT REHABILITATION FOR LOWER EXTREMITY MUSCULOSKELETAL DISORDERS: A PILOT STUDY

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by

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Abstract

Purpose: To investigate change in community integration (CI) and functional status following discharge from in-patient musculoskeletal (MSK) rehabilitation, and to explore the concordance between the Reintegration to Normal Living Index (RNLI) and patient interviews. **Participants:** Twenty-one individuals with lower extremity MSK disorders discharged home after rehabilitation. **Methods:** For all outcome measures, categories of change between successive time points were created using the minimal detectable change. Change patterns were evaluated at the group and individual level across four time intervals. Percent agreement quantified concordance between interview and RNLI data. **Results:** Change over time was confirmed at the group level. However, individual-level analyses revealed much variability in change patterns. High concordance (81%) was found between the two methods of reporting change in CI. **Significance:** The individual-level findings indicate heterogeneity in recovery patterns, which if assessed as a group would have not been identified. Interview findings support the RNLI for measuring CI for the target population.

Keywords: community integration, community reintegration, community re-entry, function, musculoskeletal disorders, lower extremity, in-patient rehabilitation, minimal detectable change

Co- Authorship Statement

This study was a secondary analysis of the data derived from a prospective cohort pilot study conducted by Drs. Bert Chesworth, Jan Polgar and Marita Kloseck. Chandni Chadha developed the research question and the original plan for data analysis. This plan was progressively refined through discussion with the advisory committee (Drs. Bert Chesworth, Iris Gutmanis and Susan Muir). Chandni Chadha was solely responsible for conducting the analysis and writing the original draft of the thesis. The advisory committee reviewed thesis drafts, providing comments and suggestions for improvement.

Dedication

I dedicate this thesis to the almighty GOD who gave me strength and serenity to complete this project and to my family for their endless love, support and encouragement.

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I would like to thank a number of people who made this thesis possible and an unforgettable experience for me. First of all, my heartfelt gratitude to my supervisor, Dr. Bert Chesworth. It's like a dream coming true. Dr. Chesworth, I would not have made it this far without your constant guidance, motivation and encouragement throughout the process. Over the last two years, I have learned a whole new aspect of research from you and I will always be thankful to you for providing me such an opportunity.

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List of Abbreviations

Abbreviation	Meaning
ANOVA	Analysis of Variance
BBS	Berg Balance Scale
BCRS	Barriers to community reintegration Scale
CHART	Craig Handicap Assessment and Reporting Technique
CHART: SF	Craig Handicap Assessment and Reporting Technique: Short Form
CIM	Community Integration Measure
CIQ	Community Integration Questionnaire
Com-QOL	Comprehensive Quality of Life Scale
df	Degree of Freedom
EIS	External Integration Scale
EMR	Extensor mechanism rupture
GAS	Goal Attainment Scale
ICC	Intraclass Correlation Coefficient
ICF	The International Classification of Functioning Disability and Health
IM	Intramedullary
KAS	Katz Assessment Scale
LHS	London Handicap Scale
LQOI	Lehman Quality of Life Interview
MCI	Measure of Community Integration
MDC	Minimal Detectable Change
MSK	Musculoskeletal
m-FIM™	motor subscale of the Functional Independence Scale
OA	Osteoarthritis
ORIF	Open Reduction Internal Fixation
POPS	Participation Objective and Participation Subjective
RA	Rheumatoid arthritis

List of Abbreviations (cont'd)

Abbreviation	Meaning
SCI	Spinal Cord Injury
SEM	Standard Error of Measurement
SIS	Stroke Impact Scale
SPRS	Sydney Psychosocial Reintegration Scale
TBI	Traumatic Brain Injury
TJR	Total Joint Replacement
TUG	Timed Up and Go
VAS	Visual Analogue Scale
WHO	World Health Organization

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Chapter 1: Introduction

Musculoskeletal (MSK) disorders, such as arthritis, back pain, osteoporosis and fractures are the most prevalent chronic health conditions affecting hundreds of millions of people around the world (Woolf & Pfleger, 2003). MSK disorders result in pain and functional limitations and are the most common cause of disability among older adults. The pain and functional limitations associated with MSK disorders significantly affects the quality of life and poses a major burden to the health care system (Woolf & Pfleger, 2003). The prevalence of most MSK disorders increases with age and the growing elderly population will further increase the burden of these health conditions on society (Mackay, Canizares, Davis, & Badley, 2010).

Rehabilitation services benefit individuals with MSK disorders by helping them to regain their functional independence, to live in a satisfactory environment, to fulfill their social roles, and finally, to improve their quality of life (Munin, Begley, Skidmore, & Lenze, 2006). Community integration is considered as an ultimate goal of rehabilitation for individuals after an illness or injury (McColl, Davies, Carlson, Johnston, & Minnes, 2001; Salter, Mcclure, Foley, & Teasell, 2011; Wood-Dauphinee, Opzoomer, Williams, Marchand, & Spitzer, 1988).

Despite being an ultimate goal of rehabilitation, community integration has not been measured routinely in MSK patient populations, either clinically or in research settings. Instead, rehabilitation outcomes for individuals with MSK problems have focused more on physical independence and performance of basic activities of daily living. However, it has been reported that even after attaining satisfactory functional independence, reintegration to home and community activities and social roles remains the most challenging part of rehabilitation (Bourdeau, Desrosiers, & Gosselin, 2008). This study therefore aimed to investigate the ability of individuals with lower extremity MSK problems to reintegrate into the community after discharge from an in-patient sub-acute rehabilitation setting.

Chapter 2: Literature Review

2.1 MSK Disorders: An Overview

MSK disorders refer to the broad range of disorders affecting the bones, joints, muscles and connective tissue. These disorders encompass a spectrum of conditions including a) bony disorders such as fractures and osteoporosis, b) joint disorders such as arthritis, and c) soft tissue disorders such as fibromyalgia (Stolee, Lim, Wilson, & Glenny, 2012). MSK disorders are a diverse group of conditions, i.e. there is no single underlying pathophysiology uniting all conditions, but they are linked anatomically and by their association with the resulting adverse effects including pain and impaired physical functioning (Woolf & Pfleger, 2003). According to a report by the Canadian Orthopaedic Care Strategy Group (COCSG) 2010, eleven million Canadians (aged 12-years or above) were affected by MSK disorders, incurring an economic burden of about $35.4 billion.

Osteoarthritis (OA) is one of the most common joint disorders among older adults (Perruccio, Davis, Hogg-Johnson, & Badley, 2011). OA affects one in eight Canadians, and almost everyone over 65 years of age has OA in at least one joint (Arthritis Alliance of Canada, 2011). OA can occur in any joint, but is most common in the weight-bearing joints of the lower extremity (e.g. hip, knee, foot, and ankle). The Arthritis Alliance of Canada (2011) reported that among all the cases of OA, 40% had moderately severe hip and/or knee OA. Hip fracture is the most common injury to the musculoskeletal system in older adults resulting in significant mortality and ongoing disability (Taylor, Barelli, & Harding, 2010). Approximately 30,000 hip fractures occur annually in Canada, with 95% of fractures resulting directly from a fall (McGlasson, 2011).

2.2 Post-Acute Rehabilitation for MSK Disorders

Rehabilitation helps to improve physical functioning and the overall quality of life of older adults with a MSK disorder (Munin et al., 2006; Stolee et al., 2012). Rehabilitation services can be provided in various settings including in-patient, out-patient, and home-based settings. Patients, who are not medically or functionally stable enough to receive rehabilitation in their home, or out-patient setting, typically require in-patient rehabilitation after their acute care surgical admission in order to return to the community (Munin et al., 2006).

In-patient rehabilitation services are provided by healthcare professionals such as nurses, physiotherapists, occupational therapists and physicians specialized in physical medicine and rehabilitation. These services aim to assist clients to maximize their physical, cognitive, perceptual, psychological, and social abilities so that they can adapt to their environment, achieve a higher level of functional independence, reintegrate to society, and maintain significant social interaction (Bourdeau et al., 2008)

Successful rehabilitation is traditionally defined as improvement in health status, functional independence, and discharge to one's initial living environment with a major focus on reducing impairments (Bourdeau et al., 2008). Health care providers typically focus on physical independence and performance of basic activities of daily living as rehabilitation outcomes for patients with MSK conditions, whereas participation in activities and roles within the home and community is more representative of individual patients' goals (Brown et al., 2004). Following discharge from rehabilitation to their previous living situation, most patients continue to face difficulties when performing some activities of daily living and participating in social roles (Noreau et al., 2004). The transition to community life remains a challenge for most older adults discharged from rehabilitation, which potentially leads to depression, social isolation, and poor quality of life. Resuming community activities and the individual's social roles are the most problematic areas of recovery, even with an adequate level of functional independence (Bourdeau et al., 2008; Wood-Dauphinee & Williams, 1987).

2.3 Community Integration

Literature in the area of community integration and community reintegration reveals that both terms are used synonymously. In this thesis, the two terms will be used interchangeably.

A person is considered to be successfully rehabilitated when the regained functional independence allows the resumption of one's usual community activities and roles (Griffen, Hanks, & Meachen, 2010; Yasui & Berven, 2009). Integration back into the community is beneficial to the individual as well as to the society because it enhances quality of life, combats depression, facilitates longer living, and limits institutionalization (Rintala, Hart, Priebe, & Ballinger, 1998).

Despite these benefits, there exists no universally accepted definition of community integration. A variety of definitions have been proposed and summarized over years. Definitions of community integration obtained from the literature are compiled chronologically in Appendix A. Generally, the construct of community integration is multidimensional, extending beyond the basic activities of daily living and to include participation in activities and social roles at home and in the community. Resuming participation in these activities and roles is defined as community reintegration (McColl et al., 2001; Resnik et al., 2012).

The concept of community integration has been reported to be closely related to the "participation" domain of the International Classification of Functioning, Disability and Health (ICF) as defined by the World Health Organization (WHO) (Winkler, Unsworth, & Sloan, 2006). There is a growing consensus that the participation domain of the ICF is a useful framework to define and measure community integration as it connects physical and cognitive impairments with activities essential to role function, thereby informing the extent of one's reintegration to society (Resnik & Allen, 2007).

Community integration includes both an objective dimension and a subjective experience (Griffen, Rapport, Bryer, & Scott, 2009). The objective dimension of community integration involves quantifiable elements in the domains of physical

integration, social integration, and productive activities; whereas the subjective dimension involves a qualitative evaluation of one's personal connection with community (for example, being familiar and connected, feeling accepted, and a perception of social participation) (Yanos, Stefancic, & Tsemberis, 2012).

2.4 Approaches to Measure Community Integration

Measuring community reintegration as a rehabilitation outcome helps a clinician to understand how well an individual is returning back into the community and resuming his or her life roles after an injury or illness (Abdallah, Cohen, Sanchez-Almira, Reyes, & Ramirez, 2009). Community integration can be measured using either an objective or subjective approach. The objective approach to measuring community integration involves the quantity of participation (frequency, intensity, and use of assistive devices) whereas the subjective approach assesses the quality; type (perceived difficulty, limitation, and autonomy in participation); and satisfaction with participation (Resnik et al., 2012; Yanos et al., 2012).

Objective measures of community integration measure participation from the societal perspective which compares individuals with an illness or injury to the general population, with an assumption that "more is better" (Salter et al., 2011). Although comparison to an average person and societal expectations can provide an assessment of the degree to which a person is integrated within the community, it fails to assess the preferences, personal choices and values of the individual reintegrating into the community. However, the subjective measurement of community integration provides more valuable information about an individual's perceived participation which the objective approach fails to capture (Mascialino et al., 2009). Several studies have reported a weak or no association between frequency or intensity of participation in home or community activities and roles with satisfaction in participating in these activities (Brown et al., 2004; Johnston, Goverover, & Dijkers, 2005; Minnes et al., 2003). This indicates the importance of measuring community integration from a person's own perspective rather than comparing it to an external normative standard. Therefore, subjective measurement of community reintegration is important and critical. Other

approaches to measuring community reintegration include the identification of facilitators and barriers of community reintegration. Assessing facilitators or barriers of community reintegration will help the clinician to further understand and improve patients' ability to successfully reintegrate into the community (Resnik et al., 2012).

2.5 Community Integration Outcome Measures

A large number of assessment tools are available to measure community integration, but no one tool has been identified as an ideal assessment approach due to the challenges in defining the construct. This section discusses only the most commonly reported tools that measure the multidimensional nature of community integration.

2.5.1 Craig handicap assessment and reporting technique (CHART). The CHART was developed around the WHO concept of handicap (Whiteneck, Charlifue, Gerhart, Overholser, & Richardson, 1992). The original version of the CHART consisted of 27 items and five domains; a sixth domain was added later, resulting in a total of 32 items. The six domains of the CHART are: physical independence, mobility, occupation, social integration, economic self-sufficiency and cognitive independence. Each domain is scored out of a maximum score of 100 resulting in a total score for the tool ranging from 0 – 600, with a higher score indicating a better level of integration.

The CHART was developed to assess change in participation resulting from neurological impairments and disabilities. It was originally developed and tested among patients with spinal cord injury (SCI) and later with patient the following groups: traumatic brain injury (TBI), stroke, burn injury, multiple sclerosis and amputation (Walker, Mellick, Brooks, & Whiteneck, 2003). A short-form version of the CHART (CHART: SF) is also available which consists of 19 items for the same six domains. The CHART provides an objective assessment of integration by collecting information about the degree to which the respondent fulfils the roles typically expected of a person without a disability (Salter, Foley, Jutai, Bayley, & Teasell, 2008).

2.5.2 Community integration questionnaire (CIQ). The CIQ is a brief measure of community integration which has been used widely for individuals with TBI. The scale authors define integration as opposite to handicap as defined by the WHO. The CIQ consists of 15 items that assess role performance in three subscales: home integration, social integration, and productivity (Willer, Rosenthal, Kreutzer, Gordon, & Rempel, 1993). Each subscale has a different number of items and a unique score. Subscale scores are summed to yield a total score ranging from 0 – 29, where a higher score indicates a greater degree of community integration (Willer, Ottenbacher, & Coad, 1994).

The CIQ items were originally created by an expert panel that included individuals with TBI. The measure was originally designed for individuals with TBI, but has also been used for individuals with SCI, aphasia, multiple sclerosis, and cerebral palsy (Hirsh, Braden, Craggs, & Jensen, 2011). The CIQ measures behavioural indicators of integration by assessing the frequency with which an individual performs an activity and the assistance or supervision required to perform the activity rather than measuring the success of integration from the individual's point of view (Salter et al., 2008).

2.5.3 Reintegration to normal living index (RNLI). The RNLI is a simple and brief quantitative measure of reintegration which assesses the extent to which individuals achieve reintegration after a traumatic injury or incapacitating illness. Reintegration to normal living is defined by the scale's author as "the reorganization of physical, psychological, and social characteristics of an individual into a harmonious whole so that one can resume well-adjusted living after an incapacitating illness or injury" (Wood-Dauphinee & Williams, 1987). The RNLI is composed of 11 declarative statements and covers nine domains of reintegration. There are several ways to score the tool. It can be rated on a 10 cm visual analogue scale (VAS), where the VAS is anchored by the statements "does not describe my situation" (1 or minimum integration), and "fully describes my situation" (10 or complete integration). The scores on the 11 statements are summed to provide a total score out of 110 points which is proportionally converted to create a total score out of 100. Three or four point categorical scoring systems are also available. In the 3-point categorical system an additional category was inserted in between two anchor points ("partially describes my situation") yielding a total score of

11 to 33, with a higher score indicating better integration. In the four point categorical system, two additional categories were inserted in between the two point categorical system, "somewhat describes my situation" and "mostly describes my situation". The item scores on a four point categorical system are summed to generate a total score which can vary from 11 to 44, with a higher score indicating a greater level of perceived community integration.

The RNLI statements were derived from a literature review and information gathered from consultation and testing with advisory panels which consisted of a variety of health care professionals, patients, family members, and members of the clergy (Wood-Dauphinee et al, 1988; Wood-Dauphinee & Williams, 1987). Unlike the CHART and CIQ, it focuses on the subjective experience of an individual with regard to his or her functional ability and personal autonomy (Donnelly & Engg, 2005; Salter et al., 2008; Wood-Dauphinee et al., 1988).

2.5.4 Community integration measure (CIM). The CIM is a short, simple client-centred measure of integration. It consists of 10 declarative statements which measure perceived community integration in four domains: general assimilation, support, occupation, and independent living (McColl et al., 2001). Each statement is rated on a 5-point Likert scale yielding a total score ranging from 10 to 50. Higher scores indicate a greater level of community integration.

The CIM was developed from a literature review on community integration and from the words and ideas about community integration obtained from individuals with acquired brain injury (ABI). Although the measure was developed for patients with ABI, it has also been used for patients with SCI (McVeigh, Hitzig, & Crave, 2009). Like the RNLI, the CIM also focuses on the subjective experience of integration rather than the objective aspect of community integration (Salter et al., 2008).

To sum up, a variety of tools have been developed to measure community integration but no one tool has been established as a gold standard. The CHART and CIQ are commonly used objective measures of community integration, while the RNLI and CIM are the two most commonly used subjective measures of community integration.

2.6 Measurement of Community Integration among Different Patient Populations

To explore previous research on community integration, quantitative studies measuring the multidimensional nature of the construct were reviewed and summarized. A search of the CINHAL, PUBMED and SCOPUS databases for all English articles published from 1980 to September 2012 was conducted. The following key words were used: community integration, community reintegration, community re-entry and reintegration to normal living. As community integration has been defined as a multidimensional construct, only studies measuring the construct from a multidimensional perspective were reviewed. The reference lists of the searched publications were also identified and reviewed.

The majority of published literature found was conducted using patients with TBI, SCI, stroke, and mental illness. Only a few studies measured community integration in patients with MSK conditions and amputation. The details of the studies on patients with these conditions are listed in chronological order in Appendix B. Literature on the four most commonly studied target populations (TBI, SCI, stroke and mental illness) are stratified by their study design in Tables 1 and 2, and further summarized below.

2.6.1 Cross-sectional studies on community integration. Cross-sectional studies on community integration are presented in Table 1. This table highlights that the focus of most studies was the identification of factors associated with community integration.

The factors affecting community integration are presented in Table 2. For different target populations age, gender, race, education, injury severity, depression, pain, social support, and driving status are the most common factors that impact community integration.

Some studies compared community integration between patient groups and healthy community-dwelling persons. All of these publications reported lower levels of community integration among patient samples (Abdallah et al., 2009; Boschen, Gargaro, & Tonack, 2005; Linden, Crothers, O'Neill, & McCann, 2005; Yanos et al., 2012).

One cross-sectional study design was analysed to gain insight into community integration over time (Corrigan, Smith-Knapp, & Granger, 1998). Corrigan and colleagues compared the community integration of 95 patients with TBI, stratified by their time since discharge from in-patient rehabilitation (6-months to 5-years). They reported that the CHART & CIQ scores were relatively stable over a 5 year interval; but on average were below normative values. The CHART occupation subscale and CIQ home integration subscale showed better scores for patients who had been discharged for a longer period of time.

Table 1

Summary of cross-sectional studies on community integration of four different patient populations

Patient population	Number of studies	Study purpose (n)[a]	Community integration outcome measure (n)[a]
TBI	21	• Identify factors affecting/predicting/ associated with community integration (18) • Compare community integration between patients with TBI and members of general public (1) • Agreement between patients and family members/ proxies (2) • Compare community integration as a function of time (2) • Pattern of community integration (1)	• CIQ (14) • CHART (7) • CIM (5) • SPRS (1) • POPS (1) • KAS (1)

Note. TBI= Traumatic Brain Injury; CIQ = Community Integration Questionnaire; CHART = Craig Handicap Assessment and Reporting Technique; SPRS = Sydney Psychosocial reintegration scale; CIM = Community Integration Measure; POPS = Participation Objective and Participation Subjective; KAS = Katz Assessment Scale.

[a]Number of studies.

Table1 (cont'd)

Patient population	Number of studies	Study purpose (n)[a]	Community integration outcome measure (n)[a]
SCI	12	• Identify factors affecting or associated with community integration (8) • Compare community integration of patients with SCI and support providers with non-SCI and non-support providers in general public (1) • Compare community integration of sports and non-sports participants (1) • Efficacy of community integration program (1) • Measure community integration of rehabilitated population and to compare community integration based on demographic characteristics (1)	• CHART (7) • RNLI (2) • CIQ (1) • CIM (1) • MCI (1)

Note. SCI = Spinal Cord Injury; CHART = Craig Handicap Assessment and Reporting Technique; RNLI = Reintegration to Normal Living Index; CIM= Community Integration Measure; MCI = Measure of Community Integration.

[a]Number of studies.

Table 1 (cont'd)

Patient population	Number of studies	Study purpose (n)[a]	Community Integration Outcome Measure (n)[a]
Stroke	6	• Identify factors affecting or associated with community integration (5) • Measure community integration as an outcome of stroke (1) • Measure patients perception on reintegration (1)	• RNLI (3) • CHART (1) • CIM (1) • LHS (1) • GAS (1) • SIS (1)

Note. RNLI = Reintegration to Normal Living Index; CHART = Craig Handicap Assessment and Reporting Technique; CIM = Community Integration Measure; LHS= London Handicap Scale; GAS = Goal Attainment Scale; SIS = Stroke Impact Scale.

[a]Number of studies.

Table 1 (cont'd)

Patient population	Number of studies	Study purpose (n)[a]	Community integration outcome measure (n)[a]
Mental Illness	10	• Identify barriers, factors affecting or associated with community integration (7) • Compare community integration of person with mental illness living in supported housing with residents of community (2) • Compare community integration of older adults with schizophrenia with aged matched peers in community (1) • Examine relationship between community integration and subjective well-being (1) • Examine the association between rehabilitation to improve homelessness and community integration (1)	• EIS (3) • LQOI(1) • RCAS (1) • Com QOL(1) • BCRS (1) • Abury and Myner Scale (2) • 12 item sense of community scale (1) • Descriptors of neighbourhood social social interaction (1) • The Sense of Community Index (1) • The 12-item community integration scale (1) • The Social Capital Survey: SF (1) • Perceived barrier to community integration (1)

Note. EIS = External Integration Scale; LQOI = Lehman Quality of Life Interview; RCAS = Resident Choice Assessment Scale; Com QOL = Comprehensive Quality of Life Scale; BCRS = Barriers to community reintegration Scale.

[a]Number of studies.

Table 2

Summary of factors affecting community integration

Factors affecting community integration	Conditions
Cognitive levels	TBI
Duration of acute hospital stay	TBI
Employment status at the time of injury	TBI
Functional measure scores at admission and discharge from rehabilitation	TBI
Hospital discharge destination	TBI
Living status	TBI
Mechanism of injury	TBI
Pre-injury community integration scores	TBI
Pre-injury caregiver distress and family functioning	TBI
Performance on neuropsychological and neurobehavioral measures	TBI
Availability of resources	SCI
Government policies	SCI
Natural environment	SCI
Presence of co-morbidities	SCI
Self-esteem	SCI
Sports participation	SCI
Socio-economic status	SCI
Balance self-efficacy	Stroke
Income	Stroke
Abnormal involuntary movement	Mental Illness
Length of time in neighborhood	Mental Illness
Age	TBI, SCI
Injury severity	TBI, SCI

Note. TBI = Traumatic Brain Injury; SCI= Spinal Cord Injury.

Table 2 (cont'd)

Factors affecting community integration	Conditions
Race	TBI, SCI
Education	TBI, Mental Illness
Pain	SCI, Stroke
Social support	SCI, Stroke
Driving status	TBI, SCI, Stroke
Gender	TBI, SCI, Mental Illness
Depression	TBI, Stroke, Mental Illness

Note. TBI = Traumatic Brain Injury; SCI= Spinal Cord Injury.

2.6.2 Longitudinal studies on community integration. The longitudinal studies of community integration in different target populations are summarized in Table 3. In comparison to the cross-sectional studies, a very small number of longitudinal research projects have been done on community integration. Most studies with a prospective follow-up have focused on patients with TBI, while only a few focused on patients with SCI or stroke.

The prospective studies measuring change in community integration among patients with TBI showed variable results. Some studies reported no change in mean community integration scores over time, while others reported initial declines followed by gradual improvement over time. Sander and colleagues (1996) found no change in community integration between 1-, 2-, 3- or 4-years post injury for a sample of 53 patients with TBI who received acute medical care and in-patient rehabilitation (Sander, Kreutzer, Rosenthal, Delmonico, & Young, 1996). Similarly, Sander, Roebuck, Struchen, Sherer, and High (2001) also demonstrated no significant change in the CIQ scores of 24 patients with mild to severe TBI after discharge from post-acute rehabilitation to approximately 1-year post discharge and to 5-years post discharge. However, they reported some fluctuations in community integration scores over time for individual cases. Some individuals showed improvement from discharge to each follow-up while others declined, but improvement was more common than decline. The results of individual level analyses in this study suggested that community integration is not stable for everyone after discharge. In contrast, the results of a study by Willemse-van Son and associates (2009) showed that the total CIQ scores for 119 patients with moderate to severe TBI declined 3-months post-injury as compared to their pre-injury CIQ scores. The scores showed gradual improvement in community integration over time with maximum improvement occurring during the first year post injury and a slow improvement over the next 1- to 3-years (Willemse-van Son, Ribber, Hop, & Stam, 2009).

Another prospective study measuring change in community integration among 178 people who were aging with SCI (20 years after injury), reported a significant decline over time in the physical independence, mobility, and occupation domains of the

CHART (Charlifue & Gerhart, 2004). The study authors also reported that despite the significant decline over time, there were no drastic differences in community integration between any follow-up intervals. Whiteneck and collegues (1999) also reported a decline in the mobility domain of the CHART of 347 individuals with SCI over a 5-years interval (Whitneck, Tate, & Charlifue, 1999). In contrast, Hu et al. (2012) reported a non-significant increase in total CHART: SF scores and a significant increase in the physical independence and mobility domains of CHART: SF for 26 patients with SCI at 1-year in the community than at discharge from a rehabilitation hospital. They also reported a significant decline in the cognitive independence domain of the CHART: SF.

To summarize, most studies measuring community integration have used a cross-sectional design, with most of them identifying the determinants of community integration. A few studies have measured the concept longitudinally to report change in community integration over time. The results of these studies were variable; reporting no change, improvement or decline in community integration over time.

Table 3

Summary of longitudinal studies on community integration among four different patient populations

Patient Population	No. of Studies	Study Purpose (n)[a]	Community Integration Outcome Measure (n)[a]	Assessment Time Points
TBI	10	• Change in community integration over time (3) • Identify factors affecting/associated with community integration (6) • Effectiveness of different rehabilitation programs (4)	• CIQ – 10 • CHART – 1	• 1, 2 and 3 or 4 years post injury • Admission and discharge from post-acute rehabilitation, in-between 5 to 19 months after discharge and in-between 2 to 5 years after discharge • Pre and post treatment • Within 6 months and at 1 year post injury • Baseline and 90 days of follow-up • Pre and post treatment and 1 year after end of treatment • Hospital admission, 3, 6, 12, 18, 24 and 36 months post injury

Note. TBI = Traumatic Brain Injury; CIQ = Community Integration Questionnaire; CHART = Craig Handicap Assessment and Reporting Technique.

[a]Number of studies.

Table3 (cont'd)

Patient Population	No. of Studies	Study Purpose (n)[a]	Community Integration Outcome Measure (n)[a]	Assessment Time Points
TBI (cont'd)				• Inclusion to the program (3 months waiting period), start of the treatment, end of the treatment and one year after treatment • Within 2 weeks of admission to post- acute rehabilitation and 1 month after discharge

Note. TBI = Traumatic Brain Injury.

[a]Number of studies.

Table 3 (cont'd)

Patient Population	No. of Studies	Study Purpose (n)[a]	Community Integration Outcome Measure (n)[a]	Assessment Time Points
SCI	3	• Change in community integration over time (3) • Identify factors affecting/ associated with change in community integration over time (1)	• CHART (3)	• Discharge from rehabilitation therapy and 1 year post discharge • 2 assessments 5 years apart (5 & 10 or 10 &15 or 15 & 20 or 20 & 25) years post injury • 20 years after injury – 3 measurement points at 3 years interval
Stroke	1	• Early Discharge and rehabilitation effectiveness (1)	• RNLI (1)	• 1 month assessment (after 4 weeks of intervention) and 3 months assessment (2 months later)

Note. TBI = Traumatic Brain Injury; SCI = Spinal Cord Injury; CHART = Craig Handicap Assessment and Reporting Technique.

[a]Number of studies.

2.6.3 Community integration of patients with MSK disorders. Only one study was found that examined the concept of community reintegration in patients with an MSK disorder. This research focused on predictors of community reintegration in older adults with either a neurological or MSK condition who were discharged from an intensive rehabilitation unit. The study reported functional independence, balance, grip strength, and general well-being to be the best predictors of reintegration to normal living for older adults discharged from in-patient rehabilitation explaining 27% of the variance in the RNLI scores (Bourdeau et al., 2008). Although this study was the first to document factors affecting reintegration of patients with MSK problems, it was limited because the sample of this study had patients with mixed diagnoses (MSK and neurological sample).

2.7 Summary of literature review on community integration

This literature review has identified the following gaps: 1) despite the fact that most patients face various difficulties when reintegrating into the community, this goal of rehabilitation has not been well-studied among patients with an MSK disorder, 2) community integration is a multidimensional, dynamic, personal, and culturally bounded concept, therefore it should be measured over time (longitudinal) and individually; but according to the literature most studies to date have measured the concept cross-sectionally and the longitudinal work done has mostly described the results at group level, 3) although a subjective approach to measuring community integration provides more valuable information from the patients' perspective, most of the published studies used an objective approach.

Chapter 3: Objectives

The primary objective of this study was to explore the longitudinal patterns of change in community integration and functional status of patients discharged from in-patient MSK rehabilitation.

The secondary objective was to explore the concordance between the change in level of community integration, as reported by a quantitative measure of community integration (RNLI), and patients' subjective descriptions about their change in community integration over the same time period.

Chapter 4: Methods

4.1 Design & Participants

This study was a secondary analysis of data derived from a prospective cohort pilot study: Identifying Senior's Rehabilitation Needs to Enhance Community Participation Following Discharge from In-patient Musculoskeletal Rehabilitation (Chesworth, Polgar & Kloseck, 2008). Study participants were recruited from the in-patient MSK rehabilitation unit at Parkwood Hospital in London, Ontario between December 2009 and July 2010. Following discharge patients were measured at 2-weeks, 6-weeks, 3-months and 6-months.To be included in the study patients must have been admitted for a lower extremity musculoskeletal problem with a planned discharge to their home in the community. Exclusion criteria were an inability to understand written or spoken English, inability to provide informed consent, or a planned discharge to a formal long-term care home or any other supported living environment.

4.2 Data Collected

4.2.1 Demographic & descriptive data. The demographic variables collected were age, sex, height, and weight (used to calculate body mass index (BMI) in kg/m^2) and living status at discharge (lives alone or with spouse/partner/other family member). Additional data collected were related to the primary health condition for which the patients were admitted to the in-patient rehabilitation facility: primary diagnosis at admission; surgical intervention; and weight-bearing status at discharge from the in-patient rehabilitation setting.

4.2.2 Outcome measures. The outcome measures collected were: the RNLI, the motor subscale of the Functional Independence Scale (m-FIM^{TM}), the Berg Balance Scale (BBS), and the Timed Up and Go (TUG) Test.

4.2.2.1 Reintegration to normal living index. The RNLI (Wood-Dauphinee & Williams, 1987) is a patient-reported outcome measure that quantifies the ability of an individual who has experienced a traumatic or incapacitating injury or illness to resume to their normal activities, including activities of daily living and social activities. This

instrument focuses on an individual's perception of and satisfaction with reintegration to 'their' normal living activities, rather than what is considered normal by society (Bourdeau et al., 2008). The RNLI consists of 11 declarative statements about physical, social and psychological aspects of everyday life that cover nine domains of reintegration: mobility, self-care abilities, daily activities, recreational activities, social activities, family roles, personal relationships, presentation of self and general coping skills. In this study, the following 4-point adjectival ordinal scoring system was used: 1= does not describe my situation, 2= somewhat describes my situation, 3= mostly describes my situation, 4= fully describes my situation. The item scores are summed to generate a total score, which can vary from 11 to 44, with a higher score indicating a greater level of perceived community integration. This scaling method was chosen over the others mentioned in the literature review on the recommendation of the tool developer (S.L. Wood-Dauphine, personal communication, November 19, 2008).

Development of the RNLI was based on a literature review and information gathered from consultation and testing with advisory panels. The advisory panels were comprised of health care professionals (physicians, social workers, physical and occupational therapists, and psychologists); patients with a variety of health conditions (myocardial infarction, cancer and other chronic disorders); family members of these patients; and members of the clergy. Based on the method of development the RNLI shows good content validity. Factor analysis of the scale by the authors highlighted two subscales: daily functioning (8 items), and perception of self (3 items) (Wood-Dauphinee et al., 1988). Stark, Edwards, Hollingsworth, and Gray (2005) proposed two different subscales: a social subscale (6 items), and physical subscale (5 items). Psychometric studies on the RNLI demonstrated good construct validity. When administered to 70 patients with myocardial infarct or cancer, it showed excellent correlation (Pearson's correlation coefficient $r = 0.68$) with the Quality of life Index (QLI) (Spitzer et al., 1981) and moderate correlation ($r = 0.41$) with a measure of psychological well-being. The Daily Functioning subscale of the RNLI has been shown to have an excellent correlation with the QLI Activity and Daily Living items ($r = 0.67$); however Perception of Self scores were reported to have an adequate correlation ($r = 0.36$) with the Support and Outlook items of the QLI. The internal consistency of the RNLI for two samples (n =

414, n= 50) of community-dwelling persons aged 75 years and above were adequate (Cronbach's alpha = 0.83) and excellent (Cronbach's alpha = 0.76) in the two samples, respectively. The RNLI has been shown to have excellent test-retest reliability (r = 0.83) in a sample of community-dwelling older adults (Steiner et al., 1996). It has also been shown to be sensitive to change in a mixed sample of 70 patients with diagnoses of cancer and myocardial infarction (Wood-Dauphinee et al., 1988).

4.2.2.2 Motor subscale of the functional independence measure. The m-FIM™ was developed by a national task force co-sponsored by the American Academy of Physical Medicine and Rehabilitation and the American Congress of Rehabilitation Medicine. The scale was designed to assess the level of independence when performing activities of daily living. The m-FIM™ consists of 13 items including self-care (6 items), sphincter control (2 items), transfers (3 items), and locomotion (2 items). Each item is scored from 1 to 7 based on the level of assistance required with a total score ranging from 13 to 91, where 13 represents complete dependence and 91 represents complete independence. In this current study, the telephone script of the motor subscale of the FIM™ (Phone m-FIM™) was used (Petrella, Overend, & Chesworth, 2002). The minimum and maximum values for the Phone m-FIM™ differ depending on the presence or absence of bowel and bladder problems. For patients with no bowel or bladder dysfunction, the total score can be as low as 13 with a maximum of 91. For those who have either a bowel or a bladder problem, the scale varies from 14 to 96. For patients with both a bowel and a bladder problem, the scale limits are 15 and 101. Higher scores on the Phone m-FIM™ indicate better functional independence. The Phone m-FIM™ has been shown to have acceptable predictive and concurrent validity and sensitivity to change in patients with hip fracture who were discharged home following in-patient rehabilitation (Petrella et al., 2002).

4.2.2.3 Berg balance scale. The BBS (Berg, Wood-Dauphinee, Williams, & Maki, 1989) is a performance-based measure that evaluates 14 everyday activities to assess static and dynamic balance. Each of the test items are scored on a 5-point ordinal scale from 0 (unable to perform the tasks) to 4 (fully able to perform the tasks). Intermediate values on the scale are defined differently depending on the specified

activity. The item scores are summed for a total maximum score of 56 points, which indicates excellent balance. The BBS has been shown to have good content (Berg et al., 1989) validity. The criterion-related validity of the BBS for older adults with a disability was supported by moderate to high correlation of the BBS with the Barthel Index (r = 0.67), the Fugl Meyer Balance Test (r = 0.62), TUG scores (r = -0.76) and the Tinetti Balance Scale (r = 0.91) (Berg et al., 1992a; Steffen et al., 2002). The BBS has been shown to have high internal consistency for a sample of elderly residents (Cronbach's alpha = 0.83) (Berg, Wood-Dauphinee, & Williams, 1995). It has also demonstrated excellent test-retest reliability with an intraclass correlation coeffiecient (ICC) = 0.97, for a sample which consisted of elderly residents and stroke patients and is also shown to be responsive to change (Berg et al., 1992a).

4.2.2.4 Timed up and go test. The TUG (Podsiadlo & Richardson, 1991) is a performance-based test that measures functional mobility. More specifically, it measures the time required for an individual to stand up from a standard chair with armrests, walk three meters at a comfortable pace, turn around, and walk back to the chair and sit down. During the test, participants are allowed to use their assistive devices for walking, the armrests of the chair to stand up and to wear their normal shoes. A digital stopwatch is used to measure the time, in seconds, to complete the test. Timing commences with the instruction 'go' and stops when the participant returns to a complete sitting position. The TUG test has shown both convergent validity (TUG scores were highly correlated with BBS and Tinetti Balance Scale and were moderately correlated with the Barthel Index for a sample of 31 elderly subjects) and discriminant validity (TUG scores were poorly correlated with the Community Illness Rating Scale for a sample of 2,305 elderly Canadians) (Berg, Maki, Williams, Holliday, & Wood-Dauphinee, 1992b; Rockwood, Awalt, Carver, & MacKnight 2000). It has also been shown to have moderate test-retest reliability with an ICC = 0.80 and is responsive to change for in-patient orthopaedic rehabilitation patients (Yeung, Wessel, Stratford, & MacDermid, 2008).

4.2.3 Participant interview. Participants were interviewed by Dr. Susan Muir (advisory committee member) at each follow-up visit to evaluate how they felt they were doing with respect to returning to their usual routine. In the open ended interview, participants were asked to respond to the following prompt: "We are now trying to figure out each week how or what is important to you. You are now at home and issues about getting back to your usual routine may change as you get better. We want to figure out how these changes affect you". During the interview, Dr. Muir simplified the prompt as required to elicit information on activities they are able to do or not able to do, that is important to them or that they were doing before the surgery or before their admission to the in-patient rehabilitation unit. At each successive interview, participants were reminded of their prior comments and asked to reflect on changes since the last home visit. The participants' answers were recorded in written form. Interview duration varied from 5 – 15 minutes.

4.3 Procedure

Approval for the study was obtained from the Health Sciences Research Ethics Board of Western University (see Appendix C1) and the Lawson Health Research Institute (see Appendix C2). Participant recruitment was initiated by the resource nurse on the MSK in-patient rehabilitation unit of Parkwood Hospital. Each time a patient was admitted to the unit with a lower extremity MSK problem, the resource nurse would inform the research assistant of the potential study participant after obtaining the patient's consent to be contacted by the research assistant. The research assistant would then screen the participant according to the inclusion criteria. The study letter of information was provided to all patients who met the inclusion criteria. Patients who agreed to participate in the study were recruited during their in-patient stay. All participants provided written informed consent.

Some of the baseline descriptive and outcome measure data were collected from the participants' medical files at Parkwood Hospital. The m-FIM^{TM}, the BBS, and the TUG are routinely captured during the in-patient stay at admission and discharge from Parkwood Hospital and therefore the discharge values were abstracted from the participants' medical files. Follow-up data collection took place in participants' homes at 2-weeks, 6-weeks, 3-months and 6-months post-discharge. At all follow-up visits,

patients were interviewed and asked to complete the RNLI, the Phone m-FIM™, the BBS, and the TUG. During each visit, patients were also asked if they had fallen since discharge (yes/no) and if yes, were they injured (yes or no). Injured was defined as requiring a visit to a physician or emergency department or an admission to hospital. If yes, was the injury a fracture: yes/no. The BBS and the TUG were not performed on some of the patients at all of the time points due to weight-bearing restrictions that precluded safe performance of the test.

4.4 Statistical Analysis

Descriptive statistics were used to describe the sample at discharge from in-patient rehabilitation and at each follow-up time point after discharge. Descriptive statistics included the mean, standard deviation, minimum and maximum values for continuous variables and the frequency and percentage for categorical variables. Only patients who had outcome measure data at all measurement time points were included in the analysis for this thesis. The one sample t-test was used to compare age in the analytic and total samples. The one sample chi-square test was used to make the same comparison for the following nominal variables: gender, living status (lives alone: yes/no), primary diagnosis dichotomized as lower extremity fractures versus all others; surgical intervention dichotomized as arthroplasty versus all others and weight-bearing status dichotomized as weight-bearing as tolerated versus all others.

4.4.1 Investigation of longitudinal patterns of change at the group level. To evaluate the group change across time, a Friedman ANOVA by ranks was conducted for each outcome measure (Winer, 1971). The null hypothesis was that no differences existed in the mean rank of a given outcome measure over time. When a significant difference was found, the Wilcoxon signed ranks test (Portney & Watkins, 2000) was used to test for differences between two successive time points. The Bonferroni correction factor (Portney & Watkins, 2000) was applied for repeated testing because up to 4 statistical tests could be conducted for each outcome measure. The adjusted threshold for significance was considered $p = 0.013$ (e.g. 0.05/4). All statistical analyses were performed using PASW (version 18.0, SPSS Inc., Chicago IL).

4.4.2 Investigation of longitudinal patterns of change at the individual level.

4.4.2.1 Establishing the minimal detectable change. To investigate the individual longitudinal patterns of change, the minimal detectable change (MDC) was used to define the presence or absence of change between two successive time points. True change was defined as the presence of a change score that was equal to or greater than the MDC for the given outcome measure.

The MDC calculations were performed using the following formula: MDC_{90} = SEM x √2 x 1.645. The standard error of measurement (SEM) was calculated as: SEM = s √ (1 – r), where s = standard deviation and r = the reliability coefficient, which for this study was the ICC test-retest value for a given outcome measure as reported in the literature (Portney & Watkins, 2000).

One published ICC and MDC for the RNLI was found in the literature (Pang, Lau, Yeung, Liao, & Chung, 2011). These values were generated during the development of the Chinese version of the tool. The sample was composed of patients who were more than one year post stroke. Furthermore, the authors transformed the VAS version of the RNLI scale to a minimum and maximum of 25 and 100, respectively. Therefore we transformed our RNLI values to the same range. To calculate the standard error of measurement (SEM), we used the average standard deviation of our RNLI values across all time points to introduce sample specific variability when calculating the MDC.

There were no published MDC values found for the m-FIM™ in the literature. We used the ICC value reported by Ottenbacher et al. (1994) as this sample consisted of community-based adults aged 60 years and above and therefore was a sample that most closely resembled our cohort. In contrast to the current pilot study, their ICC value was calculated from observations using a scale ranging from 13 to 91. Therefore, we transformed our m-FIM™ values to this scale. Then we used the average standard deviation of these values across all time points along with the reported ICC to calculate the SEM needed for estimating the MDC.

Various MDC values have been reported in literature for the BBS (Conradsson et al., 2007; Donoghue, 2009; Heingkaew, Jitaree, & Chaiyawat, 2012; Romero, Bishop, Velozo, & Light, 2011; Steffen & Seney, 2008; Stevenson, 2001) and the TUG (Flansbjer, Holmback, Downham, Patten, & Lexell, 2005; Huang et al., 2011; Ries, Echternach, Nof, & Blodgett, 2009; Yeung et al., 2008); however the published MDC values were inconsistent and were generated with different patient populations than those in the current study, therefore we used the same approach for calculating the SEM as we did for the RNLI and the m-FIM™ to incorporate the variance of our sample into the calculations of the MDC. We used the ICC test-retest value for the BBS that was generated from a sample of 18 elderly residents and six stroke patients (Berg et al., 1992a). We used the ICC test-retest value for the TUG that was calculated from a cohort of 147 individuals receiving in-patient rehabilitation for orthopedic problems (Yeung et al., 2008).

4.4.2.2 Assessing individual change over time using the MDC. The patterns of change in community integration and functional status over time were assessed for each patient by calculating the raw change scores (for example RNLI at 6-weeks minus RNLI at 2-weeks) for each assessment interval. This value was then compared to the calculated MDC value. Change scores were categorized as ‘improvement’ when the change was greater than or equal to the MDC, reflecting positive change; ‘decline’ when the change score was greater than or equal to the MDC but reflected negative change; or ‘no change’ when the value was less than the MDC. For the RNLI, data were available for four time points and therefore the change was assessed for three assessment intervals. For the m-FIM™, BBS and TUG, data were available for five time points because discharge values from the MSK in-patient rehabilitation service for these measures were available. Therefore, the change for these measures was assessed for four assessment intervals.

4.4.2.3 Calculating the probability of change over time. The calculation of probabilities gives insight into the certainty (or uncertainty) that a given event will occur (Armitage, Berry, & Matthews, 2001). Therefore, to describe the longitudinal patterns of change in community integration from this perspective, the probability of improvement, no change and decline during each assessment interval was determined for the RNLI and

the m-FIM^{TM}. For the first assessment interval, the probability of each change category was calculated using the following formula: P(A) = the number of times an event A occurred/the total number of possible outcomes (Armitage et al., 2001). For the next assessment interval, the joint probability of each change category was calculated by multiplying P(A) for the previous assessment interval by P(A) for the current assessment interval. For subsequent assessment intervals, the joint probability of each change category was calculated by multiplying the joint probability for the previous assessment interval by P(A) for the current time period. Then the odds of selected longitudinal patterns of change through the 6-month follow-up period were calculated by dividing the probability of that change pattern occurring by the probability of it not occurring. We arbitrarily decided to use the following labels when referring to the following time periods: 'early' change for discharge to 2-weeks and 2-weeks to 6-weeks; 'intermediate' change for 6-weeks to 3-months; 'late' change for 3-months to 6-months. This analysis was not performed with the BBS and the TUG because of the small number of patients with data at all five time points.

4.4.3 Concordance between a quantitative measure and patient descriptions of change in community integration. To accomplish the secondary objective, all transcripts from the patient interviews at 2-weeks and at 6-months were read independently by C.C. and Dr. Muir. Only comments that reflected at least one of the nine domains of reintegration: mobility, self-care abilities, daily activities, recreational activities, social activities, family roles, personal relationships, presentation of self, and general coping skills were identified. Then these comments were compared and categorized independently by each assessor as describing one of three possible states of change between 2-weeks to 6-weeks: improvement, no change or decline. Any discrepancies between the raters on the change category were resolved by consensus. For the RNLI, change scores between 2-weeks and 6-months after discharge were compared to the MDC and assigned to a change category as described earlier. Concordance between the change in community reintegration as identified by the interview data and a change in community reintegration as measured by the RNLI was calculated using the raw percentage of agreement. Agreement statistics that adjust for chance agreement were not used because of the pilot nature of the study.

Chapter 5: Results

5.1 Sample Descriptives

Twenty-five patients agreed to participate in the study. Four participants were excluded from the data analysis for this thesis because of a missing follow-up interview, leaving 21 subjects for the longitudinal analysis. Descriptive characteristics of the total sample (n = 25) and the sample included in the analysis (n= 21) are displayed in Table 4. One-sample statistical tests revealed no significant differences between the analytic and the total sample with respect to age, gender, living status, primary diagnosis, surgical intervention, and weight-bearing status ($p > 0.05$). Two study participants experienced a fall at 6-weeks, two participants had a fall at 3-months and one had a fall at 6-months. Only one of these falls resulted in an injury, in this case an arm fracture.

The mean scores for each outcome measure as a function of time are shown in Table 5. Friedman ANOVA tests showed the mean rank for each outcome measure score changed significantly over time (RNLI: $\chi 2$ (3df) = 14.67, $p = 0.002$; m-FIM^{TM}: $\chi 2$ (4df) = 52.70, $p \leq 0.0001$; BBS: $\chi 2$ (4df) = 13.50, $p = 0.009$; TUG: $\chi 2$ (4df) = 28.85, $p \leq 0.0001$). Levels of significance for the post hoc tests for each outcome measure are shown in Table 6. This table demonstrates a statistically significant change in RNLI scores between 6-weeks to 3-months, a significant change in the m-FIM^{TM} scores during the middle two time points and a significant change in the TUG scores between first two time points ($p < 0.013$).

Table 4

Descriptive characteristics of sample

Variable	Total Sample(n=25)	Analytical Sample(n=21)
	Mean (SD), [Min – Max]	
Age, years	77.2 (9.1), [54 – 92]	77.4 (10.0), [55 – 88]
Body Mass Index, kg/m^2	29.5 (7.4), [20.5 -50.6]	30.1 (7.7), [23.3 – 50.6]
	N (%)	
Gender, female	19 (76.0%)	17 (81.0%)
Lives Alone, yes	13 (52.0%)	9 (42.9%)
Primary Diagnosis:		
Hip Fracture	9 (36.0%)	8 (38.1%)
Other Lower Limb Fracture - Pelvic, Fibula, Ankle	3 (12.0%)	3 (14.3%)
OA (Hip, Knee)	9 (36.0%)	8 (38.1%)
Other Diagnosis (RA, PTR, ANH)	4 (16.0%)	2 (9.5%)
Type of Surgery:		
TJA (Hip & Knee)	12 (48.0%)	9 (42.9%)
Bipolar Hemiarthroplasty	2 (8.0%)	1 (4.8%)
Revision TJA (Knee)	1 (4.0%)	1 (4.8%)
Other Surgeries (IM Rod, DHS Hip Pinning, ORIF)	8 (32.0%)	8 (38.1%)
No Surgery	2 (8.0%)	2 (9.5%)
Weight-Bearing Status:		
Weight-Bearing as Tolerated	13 (52.0%)	10 (47.6%)
Protected Weight-Bearing	4 (16.0%)	3 (14.3%)
50% Weight-Bearing	8 (32.0%)	8 (38.1%)

Note. n = sample size; SD = standard deviation; N = number of patients; OA = Osteoarthritis; RA = Rheumatoid arthritis; PTR = Patellar tendon rupture; ANH = Avascular Necrosis of Hip, TJR = Total joint replacement; IM = Intramedullary; ORIF = Open reduction internal fixation.

Table 5

Group mean test scores for outcome measures by time of assessment (n = 21 except where indicated)

Outcome Measure	Time of Assessment				
	Discharge	2-weeks	6-weeks	3-months	6-months
	Mean (SD)				
RNLI	…[a]	75.8 (10.8)	82.6 (12.1)	89.0 (10.9)	89.5 (11.1)
m-FIM™	76.5 (2.8)	78.7 (5.4)	82.1 (3.9)	84.7 (3.4)	85.2 (4.9)
BBS n = 8[b]	41.1 (4.3)	45.0 (4.8)	50.1 (4.9)	50.6 (4.7)	51.1 (5.2)
TUG n = 13[b]	34.6 (11.4)	26.0 (9.1)	19.9 (6.2)	16.6 (6.6)	13.8 (4.1)

Note. n = number of patients; SD = Standard Deviation; RNLI = Reintegration to Normal Living Index (mean scores on a scale range of 25 – 100); m-FIM™ = motor- Functional Independence Measure (mean scores on a scale of 13 – 91); BBS = Berg Balance Scale; TUG = Timed up and go. For RNLI, m-FIM™ and BBS – higher scores indicate better status, for TUG – lower scores indicate better status.

[a]not measured at discharge; [b]different n values because BBS and TUG test were not performed for some of the patients due to weight-bearing restriction and concerns.

Table 6

Levels of significance for post-hoc tests for outcome measures by assessment interval

Outcome Measures	p-values			
	Time Point			
	D/C – 2Wk	2- 6Wk	6Wk – 3Mo	3 – 6Mo
RNLI	….*	0.021	**0.004**	0.736
m-FIM™	0.100	**0.002**	**0.002**	0.087
BBS	0.092	0.028	0.351	0.673
TUG	**0.011**	**0.006**	0.013	0.046

Note. Significant p-values ($p < 0.013$) are in boldface. RNLI = Reintegration to Normal Living Index; m-FIM™ = motor – Functional Independence Measure; BBS = Berg Balance Scale; TUG = Timed up and go; D/C = discharge; Wk = weeks; Mo = months. *not measured at discharge.

5.2 Longitudinal Patterns of Change

The calculated MDC_{90} values for each measure are shown in Table 7. Applying these values to the individual change scores revealed three patterns of change across the time points between discharge and 6-months: continuous improvement, no change or a mixed pattern of change. The distribution of patients in each change category is shown in Table 8. This table shows that the variability in patterns of change for all four outcome measures is evident with 76.2% to 100% of patients showing a mixed pattern of change across time.

The proportion of patients, who improved, made no change or declined in their RNLI scores over time are shown in Figure 1. This figure illustrates that the proportion of patients exhibiting improved RNLI scores decreases over time, while the proportion of patients who demonstrate no change increases. This figure also highlights that none of the study participants exhibited declines in their RNLI scores from 6-weeks to 3-months; however, a small proportion (4.5%) showed decline during the three to 6-months' time frame.

The proportion of patients, who improved, made no change or declined in their m-FIM™ scores over the four assessment intervals are shown in Figure 2. The proportion of patients showing improvement in functional independence is variable across the four time periods with 38.1% of patients showing improvement during three to 6-months after discharge. Some proportion of patients declined in their m- FIM™ scores during each assessment interval; but more importantly, more than a quarter of patients declined during the initial 2-weeks of transition home following discharge.

The proportion of patients, who improved, made no change or declined in their BBS scores over the four assessment intervals are shown in Figure 3. The balance scores for most of the patients improved during the first 6-weeks after discharge. Thereafter, the proportion of patients showing an improvement in their balance scores decreased over time.

The proportion of patients exhibiting improvement in their functional mobility, as measured by the TUG score, decreased over time with 84.6% exhibiting no change in the TUG scores during 6-weeks to 3-months and 3 to 6 months timeframe (see Figure 4).

Table 7

Minimal detectable change by outcome measure

Outcome Measure	MDC_{90}
RNLI	9.4
m- FIM™	1.7
BBS	1.9
TUG	7.8

Note. RNLI = Reintegration to Normal Living Index (scale minimum to maximum: 25 – 100); m-FIM™ = motor- Functional Independence Measure (scale minimum to maximum: 13 to 91); BBS = Berg Balance Scale (scale: 0 to 56), TUG = Timed up and go (seconds); MDC_{90} = Minimal Detectable Change at 90% confidence interval.

Table 8

Percentage of patients by longitudinal patterns of change from discharge to 6 Months post discharge (n = 21 except where indicated)

	Pattern of change from discharge to 6-months after discharge		
Outcome Measure	Continuous Improvement	No Change	Mixed
RNLI[a]	0	23.8	76.2
m-FIM™	4.8	0	95.2
BBS	0	0	100
n = 8			
TUG	0	23.1	76.9
n = 13			

Note. RNLI = Reintegration to Normal Living Index; m-FIM™ = Motor-Functional Independence Measure; BBS = Berg Balance Scale; TUG = Timed up and go; n = number of patients measured at all the assessment time points.

[a]RNLI pattern of change was assessed from 2 weeks to 6 months after discharge as RNLI was not measured at discharge.

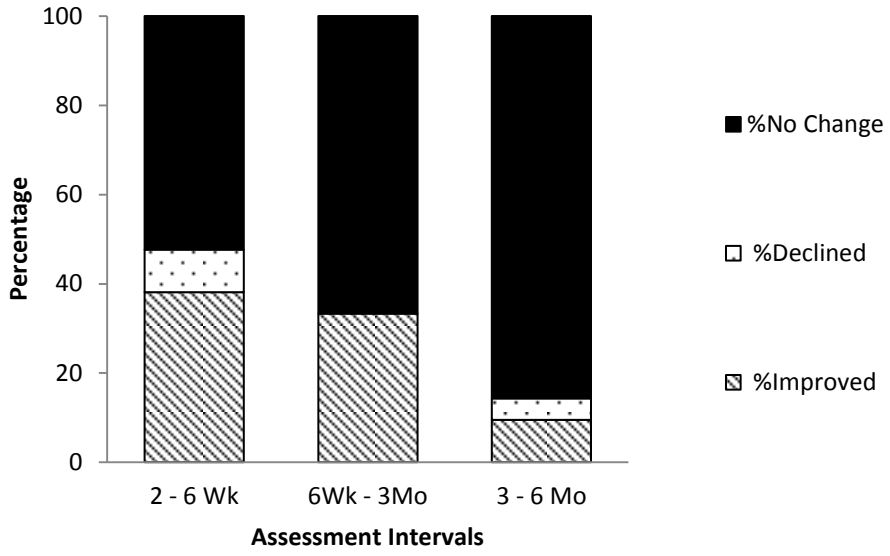

Figure 1: Proportion of the sample exhibiting each category of change in their RNLI scores during the three assessment intervals (n = 21). Each bar indicates the proportion of patients who improved, made no change or declined during each assessment interval. Wk = weeks; Mo = months.

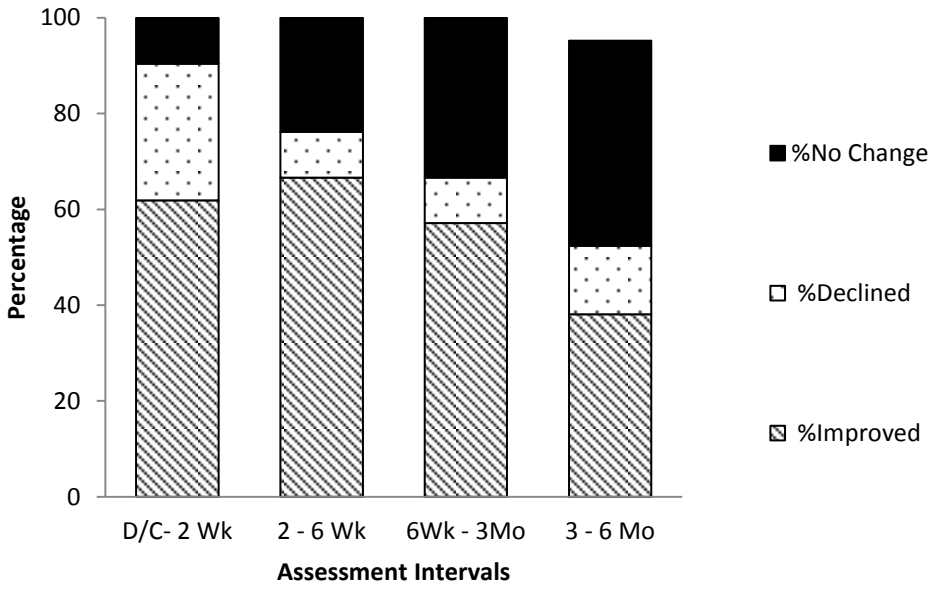

Figure 2: Proportion of the sample exhibiting each category of change in their m-FIM™ scores during the four assessment intervals (n = 21). Each bar indicates the proportion of patients who improved, made no change or declined during each assessment interval. D/C = discharge; Wk = weeks; Mo = months.

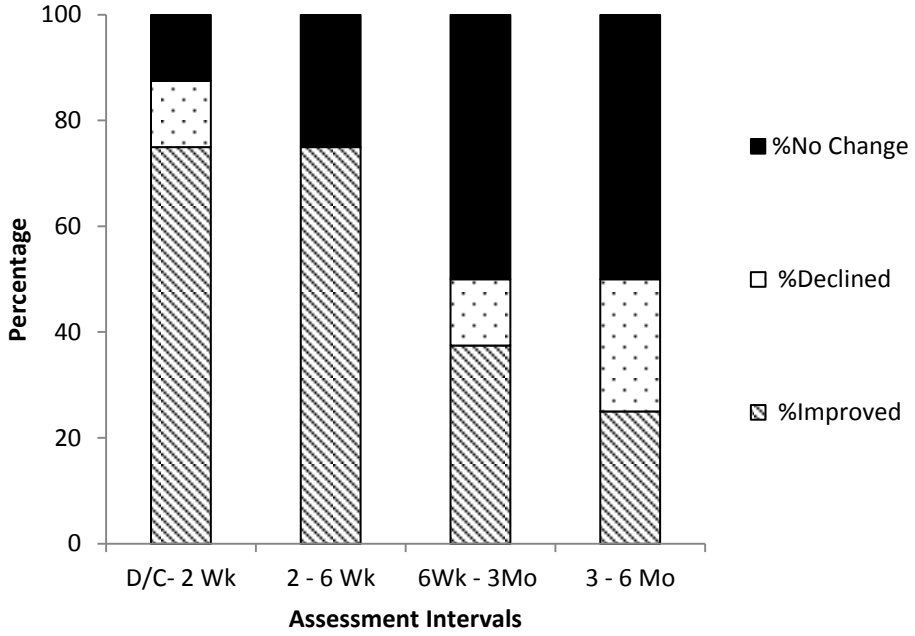

Figure 3: Proportion of the sample exhibiting each category of change in their BBS scores during the four assessment intervals (n = 8). Each bar indicates the proportion of patients who improved, made no change or declined during each assessment interval. D/C = discharge; Wk = weeks; Mo = months.

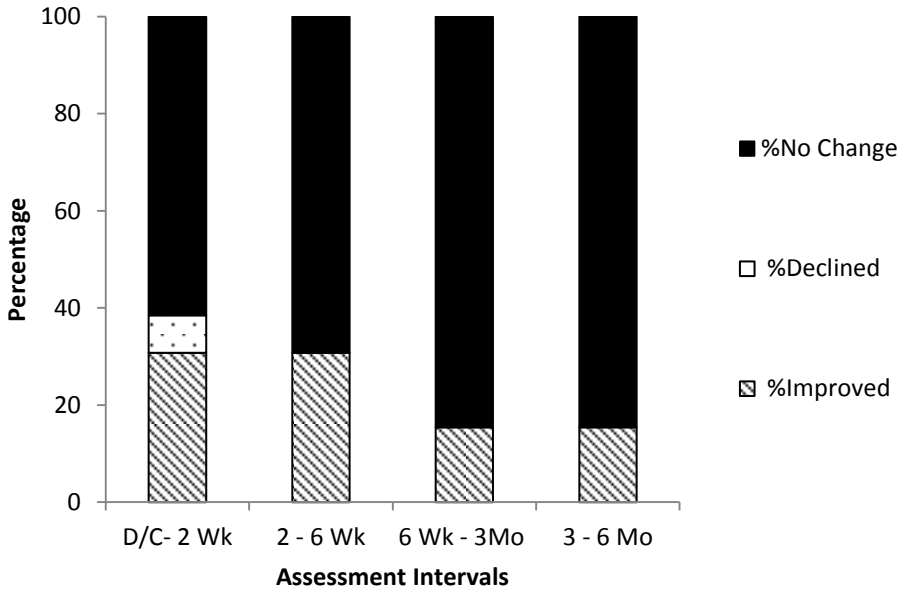

Figure 4: Proportion of the sample exhibiting each category of change in their TUG scores during the four assessment intervals (n = 13). Each bar indicates the proportion of patients who improved, made no change or declined during each assessment interval. D/C = discharge; Wk = weeks; Mo = months.

The probabilities of patterns of change in community integration are shown in Figure 5. The probability of early improvement and no further change by 6-months was 0.29 (see inset circle #1). The middle row of cells show the probability of no change in community integration up to 6-months after discharge was 0.24 (see inset circle #2). The probability of declining in community reintegration over 6-months (see inset circles #3) was 0.10 (i.e. 0.05 for the late decliners [middle row] plus 0.05 for the early decliners [bottom row]). The bolded cells in the late time frame show that the probability of improvement was 0.62 (i.e. 0.10 + 0.29 + 0.05 + 0.18). Looking at 6-month change trajectories with at least one time period showing improvement and no decline, the odds of some temporal component of improvement in community integration compared to any other change pattern trajectory was 1.63. The odds of some decline were 0.11 and the odds of no change at all over 6-months were 0.32.

The probabilities of patterns of change in functional status are shown in Figure 6a and 6b. The probability of continuous improvement throughout 6-months of follow-up after discharge was 0.09 (see inset circle # 1, Figure 6a). The first row of Figure 6b shows the probability of delayed improvement by 6-months, following an initial plateau in function was 0.10 (i.e. 0.05 + 0.05) (see inset circle #1, Figure 6b). The bolded cells in the late time frame of Figure 6a and 6b shows that the probability of some transient decline over 6-months was 0.49 (i.e. 0.05 + 0.05 + 0.05 + 0.05 + 0.05 + 0.09 + 0.05 + 0.05 + 0.05). This translates to odds of a change trajectory showing some transient decline versus any other trajectory is equal to 0.96. The odds of continuous improvement in functional status after discharge were 0.10. The odds of delayed improvement were 0.11.

Figures 7a and 7b illustrate the probabilities of patterns of change in community integration given the probability of change in m-FIM^{TM} scores during the first 2-weeks after discharge. The probability of declining in community integration over 6-months, given an improvement in function between discharge and 2-weeks was 0.10 (i.e. 0.05 + 0.05) (see inset circle # 1, Figure 7a). In contrast, the bolded cells in the late time frame

of Figure 7a show that the probability of improvement in community integration by 6-months given an improvement in function in the first 2-weeks was 0.43 (i.e. 0.05 + 0.19 + 0.05 + 0.14). The bottom row of Figure 7b highlights that among those who had an early decline in their functional status, the probability of no change in their level of integration over 6-months was 0.10 (see inset circle # 1, Figure 7b).

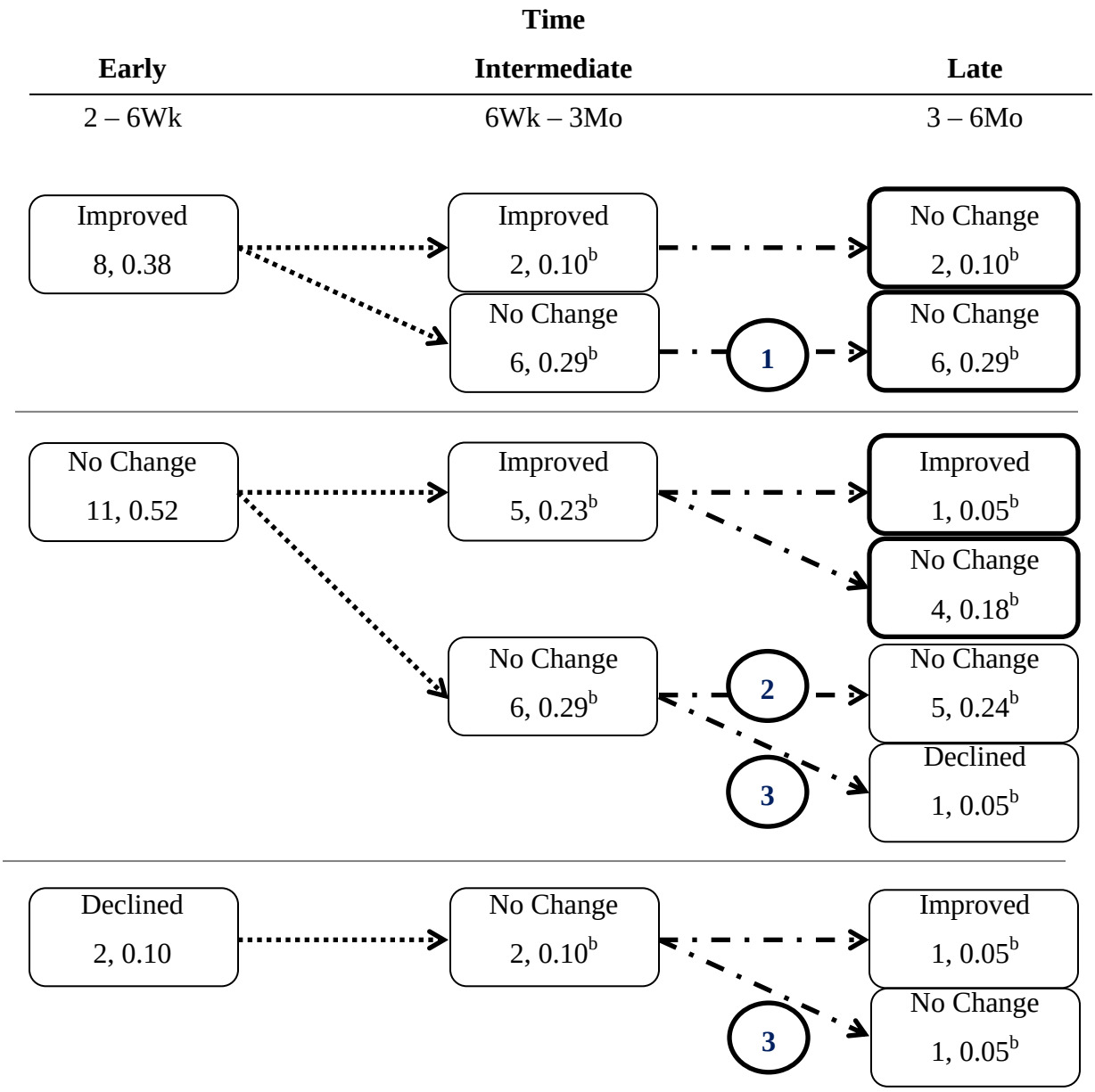

Figure 5: Pattern of change in RNLI scores over all three assessment intervals (n=21). Each box indicates the number of participants exhibiting the indicated pattern of change followed by the probability of change. Inset circles and bolded cells highlight probabilities discussed in the text. [b]Joint probabilities. D/C = discharge; Wk = weeks; Mo = months.

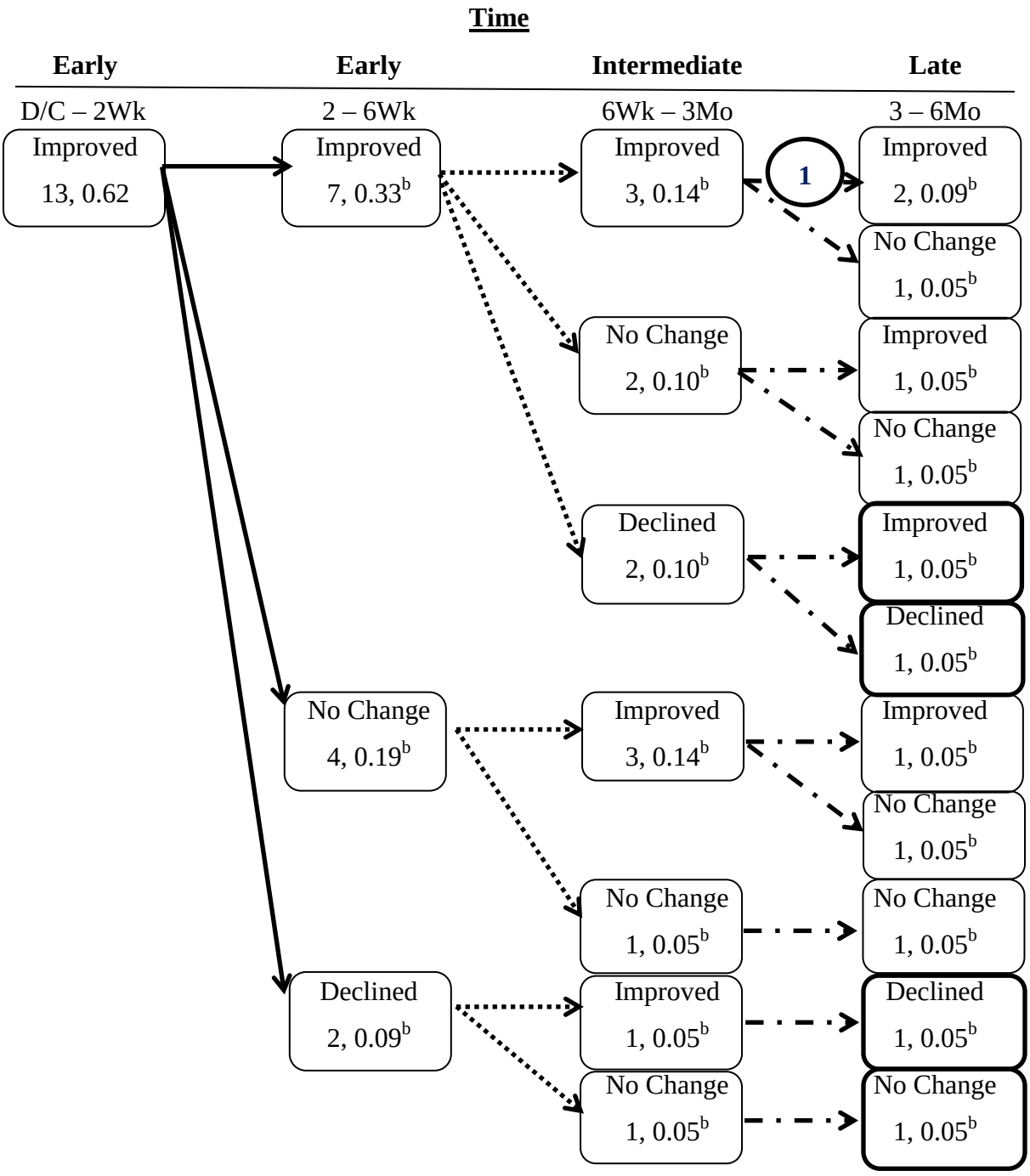

Figure 6a: Pattern of change in m-FIM™ scores for the patients who improved during discharge to 2-weeks after discharge (n=13). Each box indicates the number of participants exhibiting the indicated pattern of change followed by the probability of change. Inset circles and bolded cells highlight probabilities discussed in the text. [b]Joint probabilities. D/C = discharge; Wk = weeks; Mo = months.

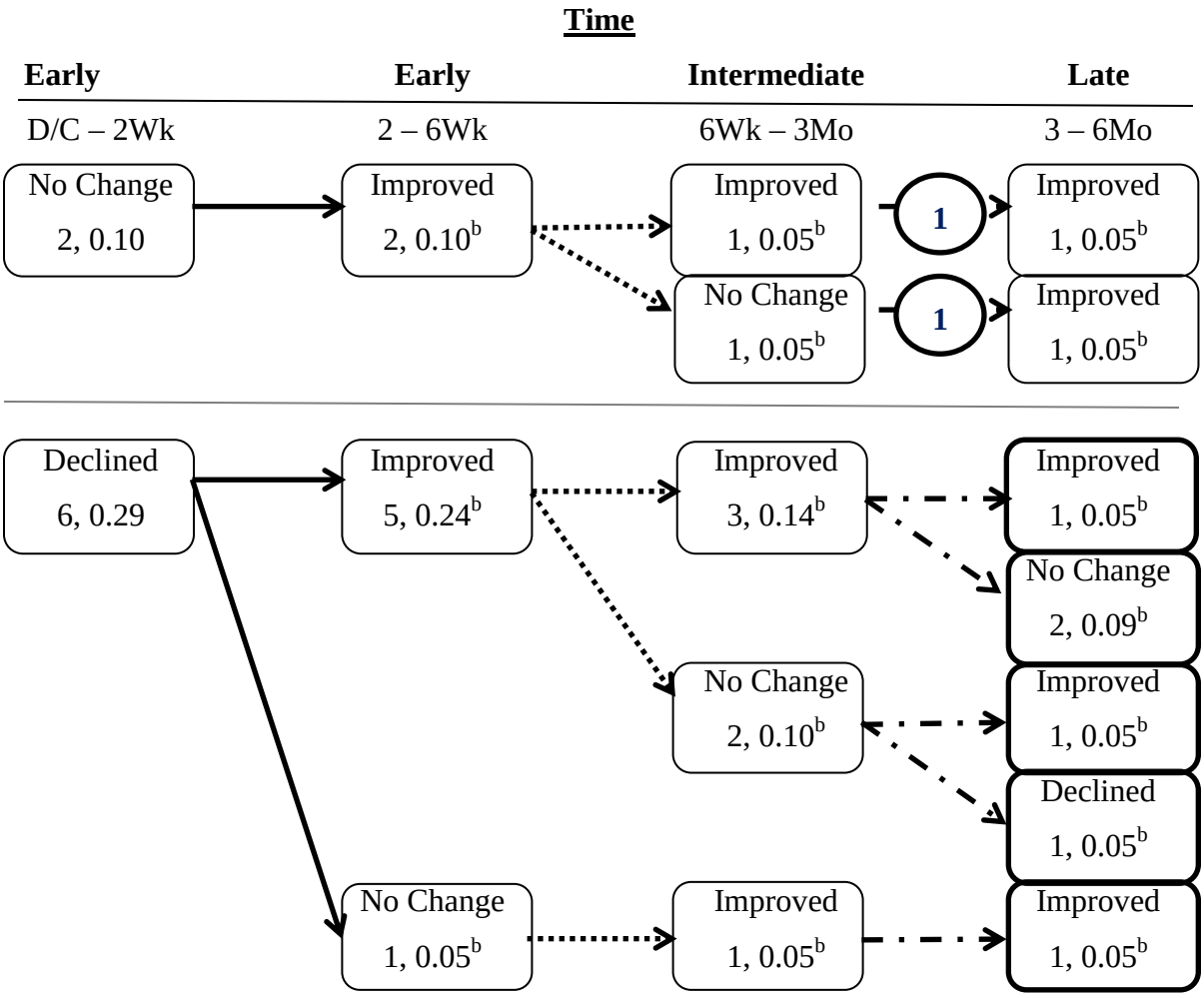

Figure 6b: Pattern of change in m-FIM™ scores for patients who made no change or declined during discharge to 2-weeks after discharge (n=8). Each box indicates the number of participants exhibiting the indicated pattern of change followed by the probability of change. Inset circles and bolded cells highlight probabilities discussed in the text. [b]Joint probabilities. D/C = discharge; Wk = weeks; Mo = months.

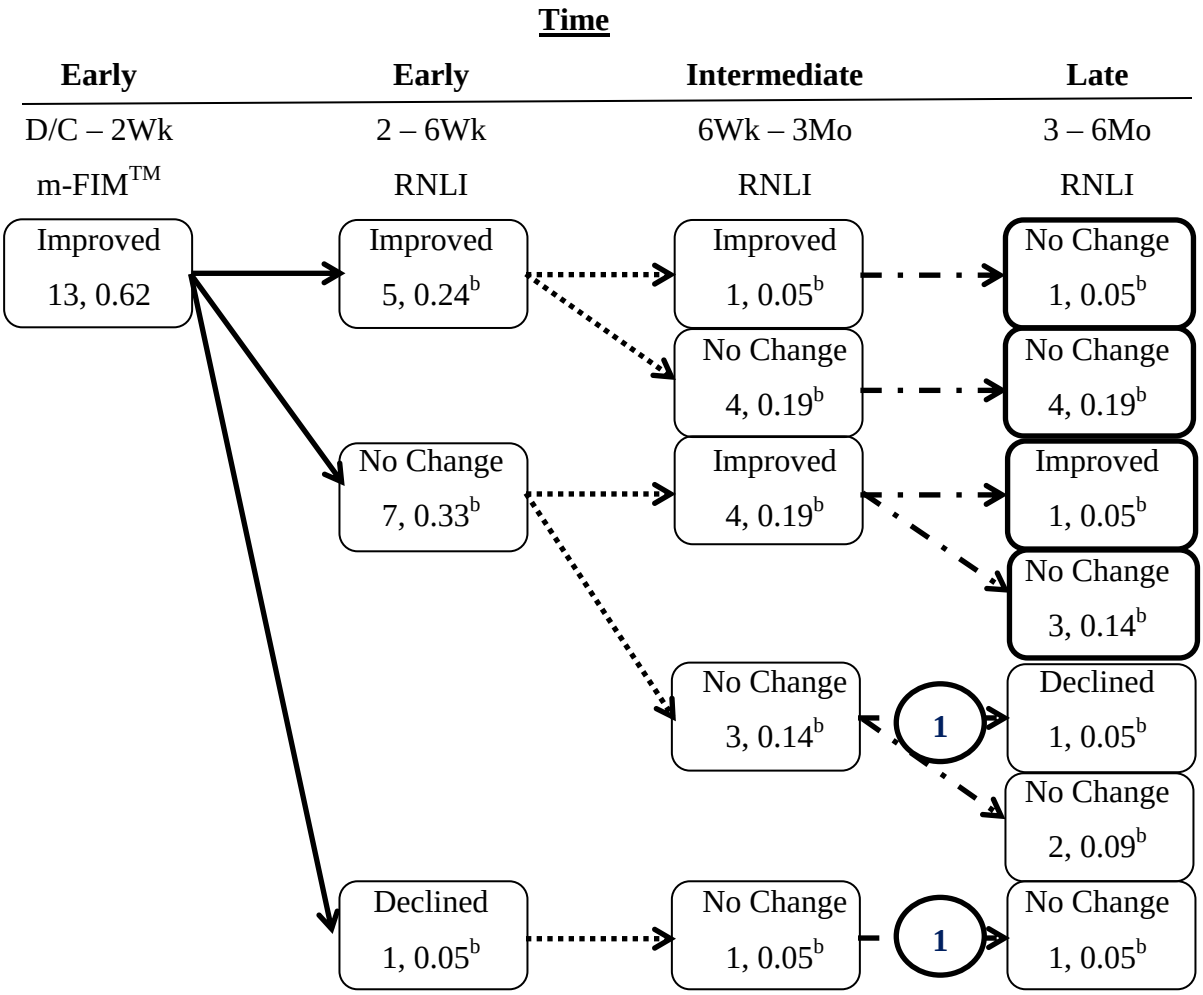

Figure 7a: Pattern of change in RNLI scores for the patients who improved in their m-FIM™ during discharge to 2-weeks after discharge (n=13). Each box indicates the number of participants exhibiting the indicated pattern of change followed by the probability of change. Inset circles and bolded cells highlight probabilities discussed in the text. [b]Joint probabilities. D/C = discharge; Wk = weeks; Mo = months.

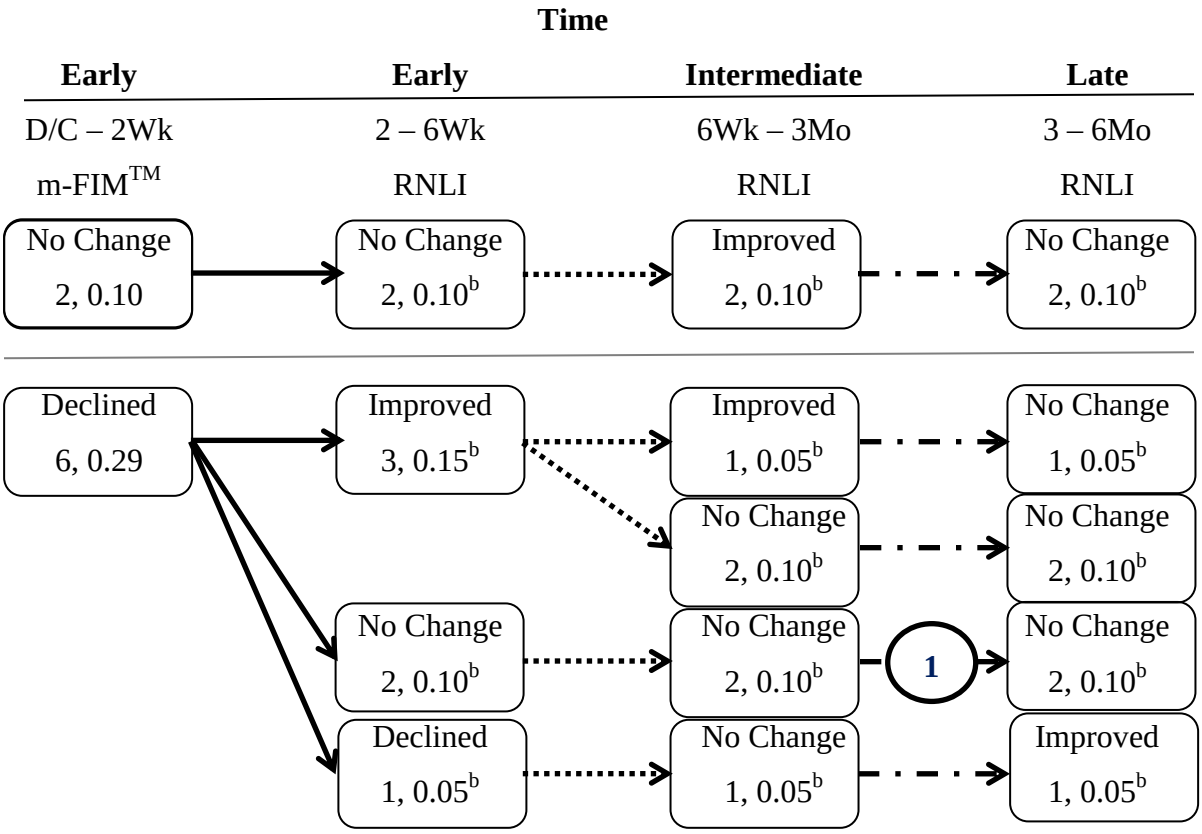

Figure 7b: Pattern of change in RNLI scores for the patients who made no change or declined in their m-FIM™ scores during discharge to 2-weeks after discharge (n=8). Each box indicates the number of participants exhibiting the indicated pattern of change followed by the probability of change. Inset circles highlight probabilities discussed in the text. [b]Joint probabilities. D/C = discharge; Wk = weeks; Mo = months.

5.3 Concordance between a Quantitative Measure and Patient Descriptions of Change in Community Integration

On the basis of the interview comments, 76.2% of participants described improvement in their level of community integration 6-months after discharge. An example of these types of comments from a participant who indicated improvement in his or her level of community reintegration at 6-months compared to 2-weeks after discharge are shown in Table 9. Deterioration in the level of community reintegration was reported among 19.0% of the participants. An example of these types of comments from a participant who verbalized deterioration in his or her level of community reintegration is presented in Table 10.

The change in level of community integration as reported by the change in RNLI scores between 2-weeks and 6-months after discharge is shown in Table 11. The table shows that positive change (improvement) in the RNLI occurred in 71.4% of participants. Negative change (deterioration) in community integration status was found in 14.3% of the study participants.

The level of concordance between RNLI change scores and patients comments regarding the change in the level of community integration over time is displayed in Table 12. The table shows that 81.0% of participants verbalized changes that were consistent with the direction of true change indicated from their RNLI scores.

Table 9

Example of a patient with comments reflecting improvement in community integration

Patient's Comments	
2 weeks	6 months
Difficulty going out due to transporting equipment and snow.	Going out for walking.
Not able to drive yet.	Driving car.
Not doing own shopping.	Able to do own shopping.
Not doing laundry- have a cleaning lady.	Putting out garbage and doing all the household work.
Frustrated with the need to continue the use of standard walker.	Puts cane in car but hasn't been using it all.
Can't go up and down stairs – husband able to sleep in the bedroom but she is sleeping on main floor.	

Table 10

Example of a patient with comments reflecting deterioration in community integration

Patient's Comments	
2 weeks	6 months
Doing Stairs.	Using stair lift for stairs.
Going out for therapy and grocery.	Not able to do grocery shopping –
Increased distance walking – very	grandson helping.
encouraged.	Not able to do keep up her house
Increased ability with transfer.	not able to do gardening frustrated
	with this.

Table 11

Change in level of community integration from 2-weeks to 6-months after discharge as measured by the RNLI

Participant ID	Change in RNLI scores (6-months minus 2-weeks)	True Change ($\geq MDC_{90}$)	Pattern of change in level of community integration
1.	– 15.9	Yes	Deterioration
2.	13.6	Yes	Improvement
3.	43.2	Yes	Improvement
4.	– 13.6	Yes	Deterioration
5.	20.5	Yes	Improvement
6.	22.7	Yes	Improvement
7.	18.2	Yes	Improvement
8.	– 20.5	Yes	Deterioration
9.	31.8	Yes	Improvement
10.	25.0	Yes	Improvement
11.	15.9	Yes	Improvement
12.	27.3	Yes	Improvement
13.	13.6	Yes	Improvement
14.	0.0	No	No Change
15.	38.6	Yes	Improvement
16.	22.7	Yes	Improvement
17.	4.6	No	No Change
18.	15.9	Yes	Improvement
19.	13.6	Yes	Improvement
20.	– 2.3	No	No Change
21.	13.6	Yes	Improvement

Note. RNLI = Reintegration to Normal Living Index; MDC_{90} = Minimal Detectable Change at 90% confidence interval.

Table 12

Concordance between RNLI scores and patients' comments regarding the change in level of community integration between 2-weeks and 6-months after discharge

Participant ID	Change in level of community integration according to patients comments	Change in level of community integration according to RNLI scores	Concordance between the change
1.	Deterioration	Deterioration	Yes
2.	Improvement	Improvement	Yes
3.	Improvement	Improvement	Yes
4.	Deterioration	Deterioration	Yes
5.	Improvement	Improvement	Yes
6.	Improvement	Improvement	Yes
7.	Improvement	Improvement	Yes
8.	Deterioration	Deterioration	Yes
9.	Improvement	Improvement	Yes
10.	Improvement	Improvement	Yes
11.	Improvement	Improvement	Yes
12.	Improvement	Improvement	Yes
13.	No Change	Improvement	No
14.	Improvement	No Change	No
15.	Improvement	Improvement	Yes
16.	Improvement	Improvement	Yes
17.	Improvement	No Change	No
18.	Improvement	Improvement	Yes
19.	Improvement	Improvement	Yes
20.	Deterioration	No Change	No
21.	Improvement	Improvement	Yes

Note. RNLI = Reintegration to Normal Living Index

Chapter 6: Discussion

The main finding of this prospective pilot study indicates that after discharge from in-patient MSK rehabilitation individual patients follow a wide variety of patterns of change in community integration and functional status. This would not have been identified from analyses of outcome measures at the group level, which has been the method used by most of the previous published studies. In addition, this study highlights that, for this sample, the odds of improvement in community integration were higher than the odds of decline following discharge from in-patient rehabilitation. Furthermore, changes in the level of community integration reported by individual patients during a face-to-face interview were highly concordant with the quantitative measure of community integration (RNLI).

6.1 Community Integration

Group level measurements demonstrated a significant difference in community integration over time after discharge from in-patient rehabilitation. In comparison, the literature in this area showed both agreement and disagreement with this finding. For example, the current study results were generally similar to those reported by Hu et al. (2012), who reported no significant change in the total CHART scores over time among 26 patients with SCI, although significant differences in some of the domains of CHART were noted. Others have reported no significant change in community integration over time after discharge from rehabilitation for patients with TBI (Sander et al., 1996; Sander et al., 2001). Possible reasons for the disagreement between the current study and these study results could be (i) the current study studied a different patient group, (ii) it used a different community integration measure, and (iii) its study design captured data over shorter assessment intervals that were sooner after discharge from rehabilitation.

The results of the individual-level analysis in this thesis complement the group-level findings by revealing the large proportion of patients (76.2%) who followed a mixed pattern of change. One reason for the wide variety of patterns of change found in this study could be the heterogeneous nature of the primary diagnosis at admission. However, even for patients with similar diagnoses, different trajectories of change were

observed over time. The literature review in this thesis highlights a number of factors that affect community reintegration that may also have contributed to the variability in the observed change trajectories. Potential contributors might be different socio-demographic characteristics, different environmental situations or the presence/absence of specific co-morbidities. The wide variation in the RNLI change pattern trajectories over 6-months is consistent with the definition of community integration by Reistetter and Abreu (2005) who defined the construct as "multidimensional, dynamic, personal, and culturally bounded" for the patients with TBI.

Comparison of the results of the individual-level analysis of the current study with the literature is limited because only one publication reported individual patterns of change in community integration over time (Sander et al., 2001). In this study, 24 patients with moderate to severe TBI completed the CIQ at discharge from post-acute rehabilitation, approximately 1-year later and then 5-years after discharge. Patterns of change were generated for the discharge to 1-year and discharge to 5-year mark. The investigators used different follow-up time points, a different measure of community integration and a definition of change equal to any difference in the outcome measure score. However, like the results of the current study (see Figure 1) Sander et al. (2001) showed that improvement in community integration between two time points was more common than decline.

This thesis work also examined the probabilities and odds associated with patterns of change in community integration. Calculation of these values allows relatively simple quantification of complex change patterns that could be used to educate patients and their family about the recovery process after discharge from rehabilitation. Looking at 6-month change trajectories, the odds of at-least one time period of improvement and no periods of decline was 1.63. The odds of some decline was 0.11 and the odds of no change at all was 0.32 (see Figure 5 and associated text in the Results section).The lay translation of these findings could be that there is a 'good' chance that patients will get back to their usual activities a 'small' chance they will struggle to return to these activities; and approximately 1 in 3 patients will make little or no progress in returning to these activities upon their arrival home.

6.2 Functional Status

Similar to the individual patterns of change in community integration over time, the study participants also followed a wide variety of patterns of change in functional status. This finding shows agreement with the results of other studies reported in the literature. For example, the results of the current study were generally similar to a study by Prvu Bettger and colleagues (2008) who identified 27 different trajectories of change in functional status of 419 patients with a variety of health conditions (neurological disorders, lower extremity musculoskeletal disorders, medical complex disorders) after rehabilitation (Prvu Bettger, Coster, Latham, & Keysor, 2008). The current study findings were also similar Young, Xiong, Pruzek, and Brant (2010) and Shaughnessy (1996) who reported heterogeneity in the individual patterns of change in functional status over time for 225 patients with hip fracture and 173 patients with stroke after discharge from rehabilitation, respectively.

Examination of the probabilities of individual patterns of change in functional independence (m- FIM^{TM}) over time can also be used to inform clinicians and patients about the certainty or uncertainty of functional recovery patterns after discharge. For example, the odds of a change trajectory showing some transient declines versus any other trajectory are equal to 0.96 (see Figures 6a & 6b and associated text in the Results section). For patients this means that just about everyone can expect to have some ups and downs in their functional status after discharge (as measured by the m- FIM^{TM}).

The probability of specific community integration change patterns given the probability of change in function (i.e. m-FIM^{TM} scores) soon after discharge, reinforces the value of an m- FIM^{TM} discharge score. For example, the probability of improvement in community integration by 6-months given an improvement in function in the first 2-weeks after discharge was 0.43 (see figure 7a and associated text). Conversely, the probability of an early decline in function after discharge, followed by no change in community integration was 0.10 (see figure 7b and associated text). If this information is of value to clinicians, a follow-up FIM score 2-weeks after rehabilitation should be

captured. This could easily be achieved by telephone interview as the validity of the phone m- FIM™ has been established (Petrella et al., 2002).

6.3 Monitoring Community Integration after Discharge

This study provides other data that supports early follow-up measurements of community integration soon after discharge. According to Stratford, the best assessment interval for any outcome measure is when 50% of one's clientele achieve a change equal to or greater than a MDC (Stratford, 2000). The result of the current study shows that almost half (47.6%) of the study participants had a change score equal to or greater than the calculated MDC value for the RNLI during the assessment interval of two to 6-weeks after discharge (see Figure 1). In accordance with Stratford, these results suggest that a follow-up assessments at two and 6-weeks post-discharge are appropriate for capturing change in community integration as defined by the MDC.

6.4 Patient Comments and Quantitative Measure of Community Integration

The change in patient comments regarding community integration from 2-weeks to 6-months after discharge paralleled the change category assigned to RNLI change scores in 81% of study participants. This supports the content validity of the RNLI to measure community integration for patients with MSK disorders. One reason for this high percentage of raw agreement may be that, as a subjective measure of reintegration, the RNLI statements focus on activities and roles that are important to patients. If interview transcripts document patient-specific discussions about community integration, a valid measure of this construct should yield change scores with at least the same direction of change. Therefore, the results support the use of the RNLI in the current study's target population.

6.5 Strengths of the Study

Strengths of this study include the longitudinal design with follow-up measurements soon after discharge through to 6-months after rehabilitation and the use of the MDC to define the presence and direction of change over time. Furthermore, to the best of our knowledge, this is the first study that has identified individual patterns of

change in community integration and functional status for the target population of interest.

6.6 Limitations of the Study

This study had several limitations. First, it was a secondary analysis of data collected for a pilot study. There was no test-retest reliability component in the study design, resulting in an inability to calculate a study-specific ICC for test-retest reliability. Therefore, in order to calculate the MDC we used ICC values from the literature. As the ICC test-retest reliability of a measure may vary with the population (Weir, 2005), using these values as reported in literature might have under or overestimated the calculated MDC values.

Also, discussion with the research team member who collected the primary data revealed that some study participants had difficulty understanding some of the RNLI statements. Recently, a modified version of RNLI has been developed to improve the readability of the scale and has been validated for community dwelling older adults (Miller, Clemson, & Lanninu, 2011). Using a modified version of the RNLI could have increased the patients' understanding about the items of reintegration being assessed.

Furthermore, the sample was recruited from a single in-patient MSK rehabilitation unit. Therefore, the results are likely generalizeable to this group only. Furthermore, the results cannot be generalized to individuals discharged to a long term care home or to any other supported living environment. The small sample size and pilot study nature of the data mean the results are more useful for informing future work, than for definitive conclusions about community reintegration.

6.7 Future Recommendations

As this is the first study to identify patterns of change in community integration for older adults with a lower extremity MSK disorder, the findings need to be replicated with a larger sample size. In this regard, the numeric results provide preliminary estimates that can inform sample size decisions future studies. As community integration

and functional recovery is a long term and dynamic process, the change in community integration and functional status should be measured until 6-months after discharge.

Future studies could benefit from the inclusion of age-matched peers in the general population in order to establish reasonable expectations about community integration. As the items of the RNLI do not refer to an index event the measure appears to be suitable for the community dwelling persons without ant illness or injury.

Chapter 7: Conclusion

Individual findings demonstrated the inter-individual heterogeneity in recovery pattern, which group data failed to detect. Calculating joint probabilities of patterns of change in community integration may provide a useful approach to monitoring recovery after discharge from rehabilitation because, for example, pathways of early or late responders can be identified. This may assist programming that is designed for patient subgroups who are known to require services either earlier or for longer periods of time. The use of the RNLI to measure community integration for this target population is supported.

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Appendices

Appendix A: Definitions of Community Integration

Author & Year	Definition of Community Integration
Jacob, 1993	"Something to do, somewhere to live, and someone to love"
Willer et al., 1993	Community integration mainly included integration into home, social integration and productive activities.
Corrigan,1994	"Assumption or resumption of culturally and developmentally appropriate social roles"
Dijker,1998	"Acquiring/resuming age-/gender-/culture-appropriate roles/ statuses/activities, including independence/interdependence in decision making, and productive behaviors performed as part of multivaried relationships with family, friends, and others in natural community settings".
McColl et al., 1998	Proposed nine themes classified in the four domains of community integration including: general integration (orientation, conformity and acceptance); independent living (independence and living situation); occupation (productivity and leisure); and social support (close and diffuse relationships).
McColl et al., 2001	Community integration is a multidimensional concept which extends beyond self-care and physical functioning commonly includes three main elements: relationship with others, independence in one's living situation and participation in meaningful activities.
Wong & Solomon, 2002	Community integration consists of three main dimensions including: physical, social, and psychological integration.
Reistetter & Abreu, 2005	"Multidimensional, dynamic, personal and culturally bounded"
Parvaneh & Cocks, 2012	Proposed a community integration framework consisting of seven themes including: community relationships, community access, acceptance, occupation, being at home, picking up life again and heightened risk and vulnerability.
Resnik et al., 2012	"Participation in life roles"

Appendix B: Studies Measuring Community Integration in Various different Patient Populations.

Table of Content

B1. Community Integration Studies on Patients with TBI

Investigator	Study Design	Study Purpose	Community Integration Measure	Assessment Time Point
Sader et al, 1996	Longitudinal	To identify the change in employment status and community integration over time and to investigate relationship between outcomes and sociodemographic & injury related variables	CIQ	1, 2 & 3 or 4 years post injury
Rosenthal et al, 1996	Crossectional	Effect of minority status on short term and one year functional outcome and community integration	CIQ	1 year post injury
Sander et al, 1997	Crossectional	Compare community integration as reported by patients and by family members	CIQ	1 year post injury
Corrigam et al, 1998	Crossectional	Difference in outcomes from TBI as a function of time and to determine if outcomes can be predicted at discharge from in-patients rehabilitation	CHART, CIQ	6 months to 5 years post injury
O'Neill et al, 1998	Crossectional	Effect of employment on perceived QOL, social integration, home and leisure activities	CHART	At least 1 year post injury
Fleming et al, 1999	Crossectional	Predict community integration and vocational outcome by using measures of function, disability, memory and cognition along with demographic and clinical characteristics	CIQ	2 – 5 years after injury
Wagner et al, 2000	Crossectional	To investigate if injury severity alone and in conjugation with premorbid and demographic variables predicts long term outcome after injury	CIQ	1 year post injury
Doig et al, 2001	Crossectional	Patterns of community integration 2 – 5 years post injury and to investigate relationship between community integration and injury severity, functional disability and demographic factors	CIQ	2 – 5 years after injury

Investigator	Study Design	Study Purpose	Community Integration Measure	Assessment Time Point
Sander et al, 2001	Longitudinal	Investigate maintenance of gains in community integration after discharge from post-acute rehabilitation program	CIQ	Admission & discharge from post-acute rehabilitation, in-between 5 to 19 months after discharge and in-between 2 to 5 years after discharge
Rath et al, 2003	Crossectional	Relationship between social problem solving and community integration in higher level post-acute rehabilitation patients	CIQ	No Information
Goranson et al, 2003	Longitudinal	Extent to which participation in multidisciplinary rehabilitation and patient characteristics predict improvement in community integration	CIQ	At intake to rehabilitation program and 6 – 18 months later
Cicerone et al, 2004	Longitudinal	Comparison of effectiveness of intensive cognitive rehabilitation program and standard neuro-rehabilitation program on community integration, satisfaction with community and cognitive functioning	CIQ	Pre-treatment and post treatment
Whiteneck et al, 2004	Crossectional	Environmental barriers reported by patients with TBI and relationship between environmental barriers and components of social participation	CHART	1 year post injury
Dawson et al, 2005	Crossectional	Agreement between patients and proxies on community integration	KAS	4 years post injury
Hart et al, 2005	Longitudinal	Contribution of race and pre-injury status on community outcome	CIQ	As soon as after injury but minimally within 6 months and at 1 year post injury
Linden et al, 2005	Crossectional	Compare community integration of patients with TBI with members of general public	CIM	At least 4 years post injury
Winkler et al, 2006	Crossectional	Factors predicting community integration of people 3 to 15 years after TBI	CIQ, CIM, SPRS	3 to 15 years post injury

Investigator	Study Design	Study Purpose	Community Integration Measure	Assessment Time Points
Rapport et al, 2006	Crossectional	Relationship between driving status and community integration	CIM, CHART	6 months to 10 years post injury
Stalnacke et al, 2007	Crossectional	Relationship between community integration and life satisfaction	CIQ	3 years post injury
Reid- Arndt et al, 2007	Crossectional	Relationship between Frontal system behaviour scale, neuropsychological tests and community integration	CIQ	No Information
Arango-Lasprilla, 2007	Crossectional	Relationship between Hispanic ethnicity and rehabilitation outcomes	CIQ	1 year post injury
Hornich et al, 2008	Longitudinal	Examine the impact of internal locus of control and self-efficacy on community integration over time	CIQ	Baseline and 90 days of follow up
Geurtsen et al, 2008	Longitudinal	Effectiveness of residential community integration programme on emotional well-being, QOL, community integration and employability	CIQ	Pre-treatment, post- treatment and 1 year after end of treatment
Rapport et al, 2008	Crossectional	Driving resumption after TBI and its relation to community integration	CIM, CHART	3 to 15 months post injury
Willemse-van et al, 2009	Longitudinal	Course and determinants of community integration for up to 3 years following moderate to severe injury	CIQ	Hospital admission, 3, 6, 12, 18, 24 & 36 months post injury
Sander et al, 2009	Crossectional	Contribution of race/ethnicity and income on community integration	CIQ. CHART:SF, CIM	6 months after discharge
Mascialino et al, 2009	Crossectional	Objective and subjective community integration difference between ethnic groups beyond one year	POPS	Beyond 2 years of injury

Investigator	Study Design	Study Purpose	Community Integration Measure	Assessment Time Point
Sady et al, 2010	Crossectional	Relationship between pre-injury caregiver and family functioning on community integration	CIQ, CHART	1 to 2 years post injury
Geurtsen et al, 2011	Longitudinal	Effectiveness of residential community integration program on independent living, societal participation, Emotional wellbeing and QOL of patients with Acquired Brain Injury	CIQ	Inclusion to the program (3 months waiting period), start of the treatment, end of the treatment and one year after treatment
Guertsen et al, 2012	Crossectional	Compare independent living, societal participation, emotional well-being and QOL 3 years after discharge from community integration program with previously established effects at 1 year follow up	CIQ	3 years after cessation of residential community integration program
Sander et al, 2012	Longitudinal	Contribution of family functioning and caregiver emotional functioning on community integration after comprehensive post-acute reintegration program	CIQ, CHART	Within 2 weeks of admission to post- acute rehabilitation and 1 month after discharge

B2. Community Integration Studies on Patients with SCI

Investigator	Study Design	Study Purpose	Community Integration Measure	Assessment time points
Rintala et al, 1998	Crossectional	Relationship between race/ethnicity & community integration	CHART	2 to 47 years post injury
Whitneck et al, 1999	Crossectional/Longitudinal	Influence of demographic and injury characteristics on community integration	CHART	1, 2, 5, 10, 15 or 20 years after injury for crossectional design and for longitudinal assessment two assessments 5 years apart
Hanson et al, 2001	Crossectional	Effect of sports participation on community integration	CHART	Mean 13.6 years post injury
Boschen et al, 2003	Crossectional	Factors impacting successful community integration	RNLI	1 to 5 years after discharge from in-patient rehabilitation
Charlifue et al, 2004	Longitudinal	Change in community integration and relationship between change in community integration and demographic variables, psychosocial measures of stress, depression, life satisfaction, psychological well-being and perceived QOL	CHART	20 years after injury – 3 measurement points at 3 years interval
Forchheimer et al, 2004	Crossectional	Relationship between gender, environmental barriers and community integration	CHART:SF	No Information
Forchheimer et al , 2004	Crossectional	Efficacy of community based program on community reintegration	CHART	12 months after discharge from in-patient rehabilitation
Donnelly & Eng, 2005	Crossectional	Relationship between pain and community integration	RNLI	6 months of community living after injury

Investigator	Study Design	Study Purpose	Community Integration Measure	Assessment time points
Boschen et al, 2005	Crossectional	Compare QOL and community integration of support Providers & individuals with SCI also with those non- SCI and non-support providers of general population	The Measure of Community Integration	1 to 6 years post discharge
Lysack et al, 2007	Crossectional	Relationship between environmental barriers and perceived community integration	CIM	Average 11.5 years post injury
McVeigh et al, 2009	Crossectional	Compare community integration and QOL in sports participants & non-sports participants	CIQ	1 year post injury
Sekeran et al , 2010	Crossectional	Factors affecting community integration of patients with SCI living in rural environment	CHART:SF	1 year post injury
Samuelkamaleshkumar et al, 2010	Crossectional	Community integration in rehabilitated South Indian person with SCI and to compare their community integration based on demographic characteristics	CHART	12 months after rehabilitation
Hu et al, 2012	Longitudinal	Compare functional status, QOL and community integration of earthquake survivors with SCI at discharge and one year after return to community	CHART: SF	Discharge from rehabilitation therapy and 1 year post discharge

B3. Community Integration Studies on Patients with Stroke

Investigator	Study Design	Study Purpose	Community Integration Measure	Assessment Time Point
Mayo et al, 2000	Longitudinal	Effectiveness of early discharge combined with rehabilitation on function, community reintegration and QOL	RNLI	1 month assessment (after 4 weeks of intervention) and 3 months assessment (2 months later)
Hoffman et al, 2003	Crossectional	Outcomes of stroke in terms of discharge destination, basic and instrumental ADL's status, community integration and generic health status	RNLI	Mean 18 months after discharge
Ostir et al, 2005	Crossectional	Association between pain and satisfaction with community participation	Questions asking patients about their satisfaction with community participation	Approximately 4 months after discharge from in-patient rehabilitation
Pang et al, 2007	Crossectional	Effect of balance self-efficacy on satisfaction with community integration	RNLI	1 year or more after injury
Beckley, 2007	Crossectional	Role of social support on community integration	RNLI	3 – 6 months after hospital discharge
Brock et al, 2009	Crossectional	Patients perceptive on reintegration and factors associated with successful community reintegration	GAS, LHS	6 months post-discharge
Griffen et al, 2009	Crossectional	Relationship between driving cessation, social support, gender & community integration	CHART, CIM, SIS	No Information

B4. Community Integration Studies on Patients with Mental Illness

Investigator	Study Design	Study Purpose	Community Integration Measure	Assessment Time Points
Abury et al, 1996	Crossectional	Compare community integration and QOL of persons with mental illness in housing program & residents of community	External Integration scale, 12 item sense of community scale by Perkin et al, Expanded version of scale developed by Abury et al	No Information
Malik et al, 1998	Crossectional	Identify barriers to community integration	25 item instrument measuring perceived barrier to community integration	No Information
Prince et al, 2002	Crossectional	Relationship between perceived stigma and community integration	Abury & Myner Scale	No Information
Vine et al, 2005	Crossectional	Identify individual characteristics associated with community integration	Resident Choice Assessment Scale, Comprehensive Quality of Life Scale	4 to 5 years of community living
Lemaire et al, 2005	Crossectional	Examine barriers to community integration after psychiatric rehabilitation	Barriers to community reintegration Scale	No Information
Prince et al, 2005	Crossectional	Relationship between community integration and subjective well being	Abury & Myner Scale	No Information
Yanos et al, 2007	Crossectional	Effect of housing type, neighbourhood characteristics and family life style factors on community integration	External Community Integration Scale, The Sense of Community Index, Rating on descriptors of neighbourhood social interaction	No Information

Investigator	Study Design	Study Purpose	Community Integration Measure	Assessment Time Points
Abdallah et al, 2009	Crossectional	Compare community integration of older adults with schizophrenia with their age matched peers in community and to examine factors associated with community integration	12 item community integration scale – having four domains – independence, psychological, physical & social integration	No Information
Baumgartner et al, 2012	Crossectional	Examine if intervention program to reduce homelessness was associated with community integration	Lehman Quality of Life Interview	18 months after intervention
Yanos et al, 2012	Crossectional	Compare and examine predictors of objective community integration of mental health consumers living in supported housing to other community residents	External Integration Scale, a 12 item social integration scale, The Social Capital Survey: SF	No Information

B5. Community Integration Studies on Patients with MSK problems

Investigator	Study Design	Study Purpose	Community Integration Measure	Assessment Time Points
Bourdeau et al, 2008	Crossectional	Identify predictors of reintegration to normal living after discharge from an in-patient rehabilitation	RNLI	3-months after discharge from in-patient rehabilitation

B6. Community Integration Studies on Patients with Lower Limb Amputation

Investigator	Study Design	Study Purpose	Community Integration Measure	Assessment Time Points
Nissen & Newman, 2008	Crossectional	Explore the factors affecting of reintegration to normal living after lower limb amputation	RNLI	At-least 1 year after amputation

Appendix C: Study Ethics Approval

Table of Content

C1. University of Western Ontario Research Ethics Review Board

Office of Research Ethics
The University of Western Ontario
Room 4180 Support Services Building, London, ON, Canada N6A 5C1
Telephone: (519) 661-3036 Fax: (519) 850-2466 Email: ethics@uwo.ca
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. B.M. Chesworth
Review Number: **16005E** **Review Level:** Expedited
Review Date: March 11, 2009
Protocol Title: Identifying Senior's Rehabilitation Needs to Enhance Community Participation Following Discharge from In-patient Musculoskeletal Rehabilitation
Department and Institution: Physical Therapy, University of Western Ontario
Sponsor: INTERNAL RESEARCH FUND-UWO
Ethics Approval Date: April 28, 2009 **Expiry Date:** March 31, 2010
Documents Reviewed and Approved: UWO Protocol, Letter of Information and Consent
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced study on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the HSREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the HSREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

Chair of HSREB: Dr. Joseph Gilbert

Ethics Officer to Contact for Further Information			
☐ Janice Sutherland (jsuther@uwo.ca)	☐ Elizabeth Wambolt (ewambolt@uwo.ca)	☐ Grace Kelly (grace.kelly@uwo.ca)	☒ Denise Grafton (dgrafton@uwo.ca)

This is an official document. Please retain the original in your files.

cc: ORE File
LHRI

C2. Lawson Health Research Institute

LAWSON HEALTH RESEARCH INSTITUTE

CLINICAL RESEARCH IMPACT COMMITTEE

RESEARCH OFFICE REVIEW NO.: R-09-353

PROJECT TITLE: Identifying Senior's Rehabilitation needs to enhance community participation following discharge from in-patient Musculoskeletal rehabilitation

PRINCIPAL INVESTIGATOR: Dr. B Chesworth

DATE OF REVIEW BY CRIC: August 18, 2009

Health Sciences REB#: 16005E

Please be advised that the above project was reviewed by the Clinical Research Impact Committee and the project:

Was Approved

PLEASE INFORM THE APPROPRIATE NURSING UNITS, LABORATORIES, ETC. BEFORE STARTING THIS PROTOCOL. THE RESEARCH OFFICE NUMBER MUST BE USED WHEN COMMUNICATING WITH THESE AREAS.

Dr. David Hill

V.P. Research

Lawson Health Research Institute

All future correspondence concerning this study should include the Research Office Review Number and should be directed to Sherry Paiva, CRIC Liaison, LHSC, Rm. C210, Nurses Residence, South Street Hospital.

cc: Administration.

Curriculum Vitae

Name	Chandni Chadha
Post-Secondary Education and Degrees	S.B.S Post Graduate Institute of Biomedical Sciences Dehradun, Uttarakhand, India 2004 – 2008 BSc. P.T. The University of Western Ontario London, Ontario, Canada 2010 – 2013 MSc Health and Rehabilitation Sciences
Related Work Experience	Research Assistant The University of Western Ontario Department of Physical Therapy November 2010 – present Teaching Assistant The University of Western Ontario Department of Physical Therapy Winter and Summer 2011, Winter and Summer 2012
Awards	Received Best Poster Award The University of Western Ontario Winter, 2012 Nominated for Ontario Graduate Scholarship The University of Western Ontario Fall 2010, Fall 2011