Characteristics and Outcomes of Patients in Rehabilitation with Hip Fracture: A Retrospective Chart Review*

Erica Anders,[1] Wendy Laskey,[1] Catherine Milne-Gibson,[1] Brendan Pynenburg,[1] Chelsea Wong,[1] Anna Berall,[2] Nancy Jones,[3] Debbie Mendelson,[2] and Susan Jaglal[1]

RÉSUMÉ

Deux voies de réadaptation sont utilisées dans les cas de fractures de la hanche : la voie de courte durée avec tolérance élevée (CDTÉ) et celle de longue durée avec basse tolérance (LDBT). Cette étude a examiné les caractéristiques et les résultats de patients en CDTÉ et LDBT qui étaient associés avec la durée du séjour à l'hôpital (DSH) et la destination après le congé de l'hôpital (DC). Un examen rétrospectif des dossiers médicaux des patients opérés pour une fracture de la hanche a été réalisé après leur chirurgie. Les données démographiques, fonctionnelles et liées à la santé de ces patients ont été collectées. Des analyses statistiques ont été effectuées afin d'évaluer les différences entre les caractéristiques des patients en CDTÉ (n = 73) et en LDBT (n = 57), et leurs liens avec leur DSH et DC. Les patients en LDBT étaient plus âgés et leur niveau d'autonomie pré-fracture pour le bain et les activités instrumentales de la vie quotidienne était plus faible. Les résultats de ces patients pour la Mesure de l'indépendance fonctionnelle (MIF) à l'admission étaient aussi plus faibles, et leur taux de comorbidités, plus élevé. Des scores MIF plus élevés à l'admission pour les patients en CDTÉ et une évolution plus marquée des scores MIF pour les patients LDBT étaient associés à la destination « maison » après le congé de l'hôpital. Le taux de diabète chez les patients en LDBT et un score MIF plus faible étaient liés à une DSH plus longue.

ABSTRACT

Hip fracture rehabilitation has two streams: high tolerance short duration (HTSD) and low tolerance long duration (LTLD). This study examined patient characteristics and outcomes in HTSD and LTLD associated with length of stay (LOS) and discharge destination. We retrospectively examined patients' medical charts following hip fracture surgery and collected demographic, functional, and health characteristics. A statistical analysis was done to describe the differences between HTSD (n = 73) and LTLD (n = 57) patient characteristics and their relationship with LOS and discharge destination. Those in LTLD were significantly older, less independent with prefracture bathing and instrumental activities of daily living, had lower Functional Independence Measure (FIM) admission scores, and more co-morbidities. Higher FIM motor score on admission in HTSD and greater change in FIM total score in LTLD was significantly correlated with discharge home. Diabetes in LTLD and lower total admission FIM in HTSD was significantly associated with increased LOS.

[1] Department of Physical Therapy, University of Toronto

[2] Baycrest Health Sciences, Toronto

[3] Lakeridge Health Oshawa

* The authors acknowledge Jurgis Karuza for his assistance in this research. This research was completed in partial fulfillment of the requirements for an MScPT degree at the University of Toronto.

Manuscript received: / manuscrit reçu : 14/12/16

Manuscript accepted: / manuscrit accepté : 21/11/17

Mots-clés : vieillissement, fracture de la hanche, réadaptation de longue durée avec faible tolérance, réadaptation de courte durée avec forte tolérance, durée de séjour, destination suivant le congé de l'hôpital

Keywords: aging, hip fracture, low tolerance long duration rehabilitation, high tolerance short duration rehabilitation, length of stay, discharge destination

La correspondance et les demandes de tirés-à-part doivent être adressées à : / Correspondence and requests for offprints should be sent to:
Erica Anders, MScPT
Department of Physical Therapy
University of Toronto
160-500 University Ave
Toronto ON M5G 1V7
<erica.anders@mail.utoronto.ca>

Hip fractures are a major global health care issue, especially for the increasing population of older people (Beaupre et al., 2013). Approximately 30,000 hip fractures are reported in Canada each year and are projected to increase to 88,124 in 2041 (Health Quality Ontario & Ministry of Health and Long-Term Care, 2013; Papadimitropoulos, Coyte, Josse, & Greenwood, 1997). Post-surgical hip fracture rehabilitation is important to minimize negative sequelae such as decreased mobility and quality of life, permanent disability, loss of independence, and increased morbidity, mortality, and burden of care for patients' families and informal caregivers (Health Quality Ontario & Ministry of Health and Long-Term Care, 2013). Baycrest Health Sciences (Toronto, Canada) has two post-acute care inpatient rehabilitation programs: high tolerance short duration rehabilitation (HTSD), usually provided in designated rehabilitation beds, and low tolerance long duration rehabilitation (LTLD, or slow stream rehabilitation), a provincial-specific designation that is commonly provided to patients in complex continuing care (CCC) beds. CCC provides medically complex care, sometimes over an extended period. Patients who are medically stable but cannot tolerate a higher intensity of rehabilitation, or who may need a longer length of stay (LOS) to maximize function and facilitate safe return to the community, are admitted to LTLD rehabilitation (GTA Rehab Network, 2009; O'Neill, McCarthy, & Newton, 1987; Rehabilitative Care Alliance, 2015).

Using a patient-centred, goal-directed approach, care and therapy within each stream of rehabilitation are provided by an inter-professional team whose expertise includes helping patients improve their strength, mobility, balance, and walking; optimizing the activities of daily living; providing equipment recommendations and strategies for managing in the home environment; addressing memory and thinking problems; and managing chronic pain. The inter-professional teams also support patients in enhancing and restoring their functional independence in preparation for discharge, assisting patients and caregivers in returning to their previous living environment to continue with supports or services, and referring the patient for ongoing rehabilitation on an outpatient basis as needed. Patients in HTSD receive physiotherapy 6 days per week, whereas those in LTLD are offered physiotherapy up to 6 days. As there is no standardized method of triaging patients, the allocation of patients with hip fracture into LTLD and HTSD streams is determined on the basis of a set of criteria including the patient's premorbid status, and cognitive and functional status, that utilizes clinical judgement and experience.

The Ministry of Health and Long-Term Care in Ontario has implemented Quality-Based Procedures (QBP) to inform clinical redesign and funding allocation, and to improve quality of care and patient outcomes for high-cost conditions (Health Quality Ontario & Ministry of Health and Long-Term Care, 2013). The QBP for patients with hip fracture indicates a target LOS of 28 days, and general clinical guidelines for LOS in LTLD range up to 90 days (Beaupre, 2011; Health Quality Ontario & Ministry of Health and Long-Term Care, 2013). Studies have identified two primary discharge destinations post-hospital admission: (1) *home* which involves living in the community or a retirement home, and (2) *long-term care* facility or another institution (Health Quality Ontario & Ministry of Health and Long-Term Care, 2013). Post-fracture repair, the QBP considers discharge home a better outcome because patients prefer to return home and doing so is associated with improved quality of life (Health Quality Ontario & Ministry of Health and Long-Term Care, 2013). Furthermore, when a patient is discharged to an institution following admission from home for surgical hip fracture repair (i.e., a change in residence), they are at an increased risk of mortality (Ariza-Vega, Kristensen, Martin-Martin, & Jimenez-Moleon, 2015).

Currently, there is a lack of consensus and literature regarding which factors are associated with increased LOS and discharge home, especially for patients with hip fracture in LTLD. Existing literature does support that a longer time from surgery to beginning rehabilitation (specifically > 6 days post-repair), worse cognition, older age, low prefracture level of function, preoperative ambulation assistance level and gait aid use, living alone, vision or hearing impairment, and pain are associated with worse functional outcomes following a hip fracture (Blackman-Weinberg, Crook,

https://doi.org/10.1017/S0714980818000193 Published online by Cambridge University Press

Roberts, & Weir, 2005; Canadian Institute for Health Information, 2015; Cheng et al., 1989; Health Quality Ontario & Ministry of Health and Long-Term Care, 2013; Hershkovitz, Kalandariov, Hermush, Weiss, & Brill, 2007; Heruti, Lusky, Barell, Ohry, & Adunsky, 1999; Hulsbaek, Larsen, & Troelsen, 2015; Kristensen, Foss, & Kehlet, 2009; Kristensen, 2013; Landi et al., 2002; Lee, Jo, Jung, & Kim, 2014; Semel, Gray, Ahn, Nasr, & Chen, 2010).

Additionally, females are five times more likely to be successful in rehabilitation, while males achieve less gain in Functional Independence Measure (FIM) scores during the rehabilitative stay (Lieberman et al., 1996; Semel et al., 2010). The presence of informal support at home and sufficient support prefracture, younger age, absence of delirium, better cognition, higher FIM motor score, vision in at least one eye, and independence with ADLs on admission to rehabilitation are associated with discharge home or to the community (Blackman-Weinberg et al., 2005; Canadian Institute for Health Information, 2015; Gialanella, Ferlucci, Monguzzi, & Prometti, 2015; Health Quality Ontario & Ministry of Health and Long-Term Care, 2013; Marcantonio, Flacker, Michaels, & Resnick, 2000; Wang et al., 2014).

Factors associated with a longer rehabilitation LOS include older age, male sex, lower physical and cognitive function on admission, diabetes, and higher number of co-morbidities (Arinzon, Fidelman, Zuta, Peisakh, & Berner, 2005; Castelli, Daidone, Jacobs, Kasteridis, & Street, 2015; Health Quality Ontario & Ministry of Health and Long-Term Care, 2013; Hershkovitz et al., 2007; Hershkovitz, Beloosesky, & Brill, 2012; Semel et al., 2010). Being married is associated with better discharge outcomes as well as decreased LOS (Semel et al., 2010). Additionally, the literature supports that cognitive impairment, such as delirium and dementia, is predictive of longer LOS and less successful functional recovery (Hershkovitz et al., 2007; Landi et al., 2002; Lee et al., 2014; Marcantonio et al., 2000). None of the previous studies examined different types of inpatient rehabilitation settings.

The study objective was to describe the patient characteristics and outcomes in LTLD and HTSD that are associated with LOS and discharge destination in order to inform decision-making.

Methods

Study Design and Data Collection

At the outset of our study, we conducted a retrospective chart review to collect data on patients with hip fracture admitted to LTLD and HTSD inpatient rehabilitation units at Baycrest Health Sciences in Toronto from January 1 until December 31, 2015. Approval for this study was granted by the University of Toronto and Baycrest Health Sciences research ethics boards.

We collected data from electronic medical records, the Resource Matching and Referral system (RM&R), and the National Rehabilitation Reporting System (NRS). The RM&R is an application used in parts of Ontario which electronically matches patient referrals with appropriate clinical programs and services (Toronto Central Local Health Integration Network, 2015). Hospital facilities in Ontario are mandated to submit data, including the FIM through the NRS, on all patients admitted to a designated rehabilitation bed to the Canadian Institute for Health Information. The FIM, which is validated in geriatric populations, contains 18 items composed of 13 motor tasks and 5 cognitive tasks rated on a 7-point ordinal scale that ranges from complete dependence to complete independence (Uniform Data System for Medical Rehabilitation, 2016). Scores range from 18 (lowest functioning) to 126 (highest functioning), and assess dimensions including eating, bathing, grooming, upper and lower body dressing, toileting, bladder and bowel management, bed to chair transfer, toilet and shower transfer, stairs ability, and locomotion. Cognitive dimensions include comprehension, expression, social interaction, problem solving, and memory.

A data abstraction form with standardized coding that we created collected variables of interest. There were five data abstractors, and inter-rater reliability was achieved by reviewing the first 10 charts to ensure there was agreement of data sources and coding. We collected sociodemographic, functional, and clinical variables for each patient. Sociodemographic variables included age on admission to rehabilitation, sex, and prefracture living situation (e.g., living alone, with spouse, with family, as per NRS coding). Functional characteristics included premorbid gait aid use, independence with bathing, and independence with instrumental activities of daily living (IADLs) as reported by health care practitioners in the electronic chart, existing home-care Community Care Access Centre support, FIM scores (motor, cognition, and total) at admission to rehabilitation, and change in FIM total score from admission to discharge. Clinical variables included the presence of diabetes, number of co-morbidities, and days from surgery to rehabilitation. Outcome variables were discharge destination and LOS in rehabilitation at Baycrest Health Sciences. Discharge destination was defined as either a return to prefracture residence ("home") or alternative discharge location ("not home"), such as a more supportive living environment or long-term care facility. For example, if a patient resided in their own home prefracture and was discharged to a more

https://doi.org/10.1017/S0714980818000193 Published online by Cambridge University Press

supportive environment such as a retirement home or relative's home, they were grouped into the not home category. LOS was calculated by using the admission and discharge dates from inpatient rehabilitation.

Study Sample and Data Analysis

The inclusion criteria were patients aged 55 years or older admitted and discharged from inpatient rehabilitation between January 1 and December 31, 2015 with femoral neck, pertrochanteric, or subtrochanteric fracture. The exclusion criteria were patients with multi-fracture sites other than the hip and patients who transferred between HTSD and LTLD during their rehabilitation stay.

We analysed the data with IBM SPSS Version 23 software. Any given patient characteristic or outcome variable missing in greater than 20 per cent of sampled patients was excluded from analysis due to insufficient data. An alpha level of 0.05 was used to determine statistical significance.

Descriptive statistics were calculated to describe sociodemographic, functional, and clinical characteristics for each as a function of stream of rehabilitation and discharge destination (home and not home) within each stream of rehabilitation. Following categorization into home and not home, some patients were not included due to missing pre-to-post living environment data or an unexpected discharge to acute care. However, these patients were still included in analyses describing the total HTSD and LTLD populations. We used *t*-tests and chi-square tests to compare differences between rehabilitation streams (HTSD vs. LTLD) and conducted an equivalent nonparametric test, the Mann-Whitney, if the sample was not normally distributed. Within rehabilitation streams, the same tests let us compare the difference between characteristics in those discharged home and not home (e.g., home HTSD vs. not home HTSD).

Multiple linear and simple linear regression analyses were conducted in HTSD and LTLD respectively to describe the relationship between key variables of interest and the outcome variable, LOS in rehabilitation. We identified outliers and eliminated them if they were three standard deviations above or below the mean (Howell, 1998). All variables were entered simultaneously into the initial regression model for each stream of rehabilitation if variables had a significant relationship ($p \leq .05$) with LOS in rehabilitation on bivariate analysis.

Results

Study Sample

We reviewed a total of 139 patient charts and excluded nine patients for transferring between HTSD and LTLD, leaving 130 eligible patients for inclusion in this study (HTSD n = 73 and LTLD n = 57). For the descriptive analyses, when subdividing patients into home and not home, we excluded four patients due to missing pre-to-post living environment data, and six patients due to being discharged to acute care (see Figure 1).

Patient Characteristics by Type of Rehabilitation (HTSD vs. LTLD)

Demographic Characteristics

Among patients in HTSD, the mean age was 83.2 ± 9.0 years and 78.1 per cent (n = 57) of patients were female (see Table 1). Premorbidly, 47.9 per cent (n = 35) of patients lived in an apartment or condominium, 39.7 per cent (n = 29) lived in a house, 11.0 per cent (n = 8)

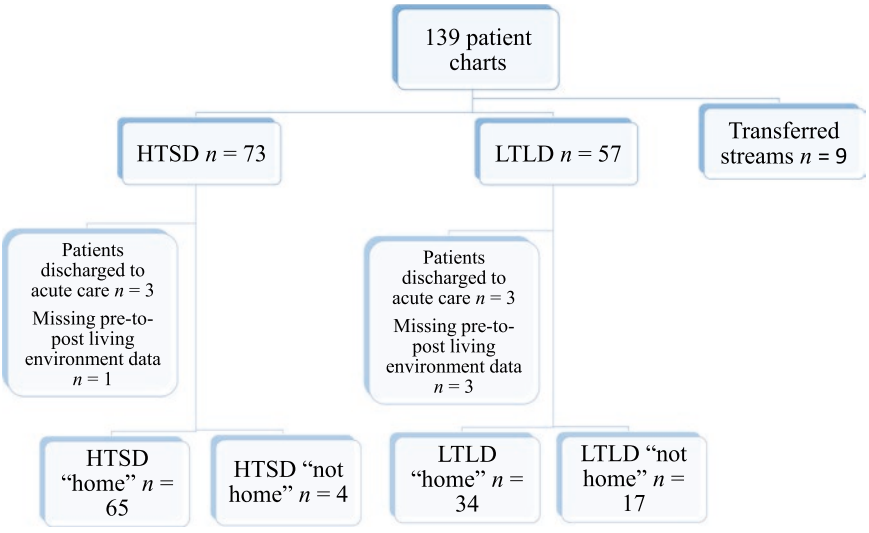

Figure 1: Flowchart depicting study sample and outcome variables by rehabilitation stream

https://doi.org/10.1017/S0714980818000193 Published online by Cambridge University Press

Table 1: Demographic, functional, and clinical characteristics of patients with hip fracture in high tolerance short duration (HTSD) and low tolerance long duration (LTLD) rehabilitation

	TOTAL		
Variables	**HTSD ($n = 73$)**	**LTLD ($n = 57$)**	***p*-value**
Demographic			
Age			
M ± *SD* (Median)	83.2 ± 9.0(86)	86.9 ± 7.3(88)	.021*
Sex[a]			
Male	16 (21.9%)	20 (35.1%)	.096
Female	57 (78.1%)	37 (64.9%)	
Living Alone[a]			
Yes	21 (28.8%)	11 (19.3%)	.214
No	52 (71.2%)	46 (80.7%)	
CCAC Prior[a]			
Yes	19 (26%)	21 (36.8%)	.178
No	53 (72.6%)	35 (61.4%)	
Missing	1 (1.4%)	1 (1.8%)	
Functional			
Premorbid Gait Aid[a]			
Independent	39 (53.4%)	34 (59.6%)	.111
Dependent	32 (43.8%)	15 (26.3%)	
Missing	2 (2.7%)	8 (14%)	
Premorbid Bathing[a]			
Independent	48 (65.8%)	23 (40.4%)	.032*
Dependent	23 (31.5)	25 (43.9%)	
Missing	2 (2.7%)	9 (15.8%)	
Premorbid IADLs[a]			
Independent	25 (34.2%)	8 (14%)	.026*
Dependent	47 (64.4%)	41 (71.9%)	
Missing	1 (1.4%)	8 (14%)	
FIM motor admission			
M ± *SD* (Median)	35.9 ± 9.6	25.1 ± 8.9(23)	< .001*
FIM cognitive admission			
M ± *SD* (Median)	26.4 ± 7.3(28)	20.8 ± 6.5	< .001*
FIM total admission			
M ± *SD* (Median)	62.3 ± 14.7(63)	45.9 ± 13.0(44)	< .001*
FIM change total	$n = 68$	$n = 50$	
M ± *SD* (Median)	32.9 ± 12.1	27.6 ± 13.4	.026*
Clinical			
Number of co-morbidities			
M ± *SD* (Median)	6.0 ± 2.5(6)	7.8 ± 3.0(8)	< .001*
Diabetes			
Yes	7 (9.6%)	9 (15.8%)	.286
No	66 (90.4%)	48 (84.2%)	
Dementia			
Yes	5 (6.8%)	8 (14 %)	.175
No	68 (93.2%)	49 (86%)	
Depression			
Yes	10 (13.7%)	8 (14%)	.956
No	63 (86.3%)	49 (86%)	
Obese (BMI > 30kg/m^2)			
Yes	5 (6.8%)	6 (10.5%)	.280
No	61 (83.6%)	37 (64.9%)	
Missing	7 (9.6%)	14 (24.6%)	
Underweight (BMI < 18.5kg/m^2)			
Yes	8 (11%)	4 (7%)	.646
No	58 (79.5%)	39 (68.4%)	
Missing	7 (9.5%)	14 (24.6%)	
Days from surgery to rehabilitation	$n = 71$	$n = 51$	
M ± *SD* (Median)	7.9 ± 5.4(6)	19.7 ± 30.7(10)	< .001*
Outcomes			
LOS in rehabilitation			
M ± *SD* (Median)	25.4 ± 8.1(28)	55.5 ± 23(62)	< .001*
Discharge destination			
Home	65 (89.0%)	34 (59.6%)	< .001*
Not Home	4 (5.4%)	17 (29.8%)	
Missing pre-to-post living environment	4 (5.4%)	6 (10.5%)	

Note. [a] ***n*(%). CCAC = Community Care Access Centre; FIM = Functional Independence Measure; LOS = length of stay; *M* = mean, *SD* = standard deviation; median presented if data were not normally distributed.**

*** Significant; $p \leq .05$.**

resided in a retirement home, and 1.4 per cent ($n = 1$) of patients resided in convalescent care. For patients in LTLD, the mean age was 86.9 ± 7.3 years and 64.9 per cent ($n = 37$) of patients were female. Premorbidly, 43.9 per cent ($n = 25$) of patients lived in a house, 28.1 per cent ($n = 16$) lived in an apartment or condominium, 24.6 per cent ($n = 14$) lived in a retirement home, and 1.8 per cent ($n = 1$) lived in a facility or assisted living. Data was missing on 1.8 per cent ($n = 1$) of patients for this variable.

Clinical Characteristics

Compared to HTSD, patients in LTLD were statistically significantly less likely to be independent with bathing (40.4% LTLD vs. 65.8% HTSD, $p = .032$) and IADLs (14.0% LTLD vs. 34.2% HTSD, $p = .026$) premorbidly. Patients in LTLD also had lower FIM scores at admission (motor FIM: 25.1 LTLD vs. 35.9 HTSD, $p \leq .001$; cognitive FIM: 20.8 LTLD vs. 26.4 HTSD, $p \leq .001$; total FIM: 45.9 LTLD vs. 62.3 HTSD, $p \leq .001$). They also demonstrated less change in total FIM score during their rehabilitation period (27.6 LTLD vs. 32.9 HTSD, $p = .026$). Lastly, patients in LTLD were older (86.9 LTLD vs. 83.2 HTSD, $p = .021$), had a higher number of co-morbidities (7.8 LTLD vs. 6.0 HTSD, $p \leq .001$) and more days from surgery to rehabilitation (19.7 LTLD vs. 7.9 HTSD, $p \leq .001$) than those in HTSD (see Table 1).

Discharge Destination and Length of Stay

Patients who were missing pre-to-post living environment data or transferred to acute care ($n = 4$ HTSD, $n = 6$ LTLD) were removed from the discharge statistical analysis. Post-discharge from HTSD, 46.4 per cent ($n = 32$) of patients lived in an apartment or condominium, 39.1 per cent ($n = 27$) lived in a house, 11.6 per cent

https://doi.org/10.1017/S0714980818000193 Published online by Cambridge University Press

($n = 8$) resided in a retirement home, 1.4 per cent ($n = 1$) lived in a relative's house, and 1.4 per cent ($n = 1$) were transferred to Baycrest Health Sciences' Alternative Level of Care floor. In HTSD, patients had an average rehabilitation LOS of 25.4 days, 94.2 per cent of patients ($n = 65$) returned to premorbid living environment and were categorized as discharged home, and 60.9 per cent ($n = 42$) were discharged in ≤ 28 days (QBP LOS guidelines).

Post-discharge from LTLD, 37.3 per cent ($n = 19$) of patients lived in a house, 27.5 per cent ($n = 14$) resided in a retirement home, 19.6 per cent ($n = 10$) lived in an apartment or condominium, 9.8 per cent ($n = 5$) were transferred to Baycrest Health Sciences' Alternative Level of Care floor, 2 per cent ($n = 1$) were discharged to a nursing home, 2 per cent ($n = 1$) lived in supportive housing, and 2 per cent ($n = 1$) were sent to palliative care. In LTLD, patients had an average rehabilitation LOS of 55.5 days, 66.7 per cent of patients ($n = 34$) returned to their premorbid living environment and were categorized as discharged home, and 9.8 per cent ($n = 5$) were discharged in ≤ 28 days (QBP LOS guidelines). Compared to patients in HTSD, patients in LTLD were significantly less likely to return home ($p < .001$), meet LOS guidelines ($p < .001$), and had significantly longer LOS in rehabilitation ($p < .001$).

Characteristics Associated with Outcome Variables by Rehabilitation Stream

Characteristics Associated with Returning "Home"

Within HTSD, those who returned home (94.2%) had a statistically significant higher FIM motor score (36.4 ± 9.7) on admission compared to those who were discharged not home (26.3 ± 8.7). Within LTLD, those who returned home (66.7%) had a statistically significant larger FIM change score (29.9 ± 12.5) compared to those who were discharged not home (22.8 ± 14.8) (see Table 2).

Factors Associated with Length of Stay

Factors that were individually associated with rehabilitation LOS within LTLD and HTSD are reported in Table 3. We performed a multiple linear regression analysis for HTSD and a simple linear regression analysis for LTLD to examine factors associated with rehabilitation LOS (see Tables 4 and 5 respectively). All assumptions of multiple and simple linear regression were met. Sex, premorbid independence with bathing, FIM motor score on admission, FIM cognitive score on admission, and total FIM score on admission were chosen for HTSD based on bivariate correlation with LOS in rehabilitation. FIM motor score on admission and FIM cognitive score on admission were excluded from the final models due to collinearity with the included factors. The presence of diabetes, being overweight, and being underweight were entered into the model for LTLD based on bivariate correlation with LOS. Using enter analysis with $p = .05$, only one variable remained predictive for LOS in rehabilitation for each stream.

Results of the regression for variables in HTSD that predict length of stay indicated that only total FIM admission scores were significantly related to LOS once one outlier was removed ($p < .01$). These results were confirmed using backwards, forwards, and stepwise regression. We attempted a multiple linear regression analysis for LTLD using the presence of diabetes, obesity, and underweight as predictive factors; however, multiple linear regression analysis could not be conducted with obesity and underweight included in the model as there was too much missing data (24%). Missing variables were not randomly distributed as patients with high co-morbidities and males were more likely to be missing. As a result, we conducted a simple linear regression using the presence of diabetes as a predictive factor for LOS in rehabilitation for LTLD. In LTLD, the model showed that only diabetes was significantly related to LOS ($p = .039$).

Discussion

Comparison of HTSD and LTLD Populations

The results of this study indicate that patients in HTSD and LTLD differ significantly with regard to age, premorbid independence with bathing and IADLs, number of co-morbidities, admission FIM (motor, cognitive, and total), FIM change (total), days from surgery to rehabilitation, LOS in rehabilitation, and discharge destination. These results confirm that patients in these two streams of rehabilitation are indeed different populations and help support the admission triage criteria and the need for rehabilitation programs of different lengths, intensities, and resources. As there is limited literature defining the LTLD population, describing these patient characteristics may help inform clinical decision-making and encourage research evaluating the effectiveness of the LTLD program or the development of a standardized triaging tool. Furthermore, since individuals who transferred from HTSD to LTLD were excluded from this study, further research should quantify their characteristics. Examination of this subpopulation with a larger sample size may shed light on key characteristics that may not be clinically recognized on admission as indicators of appropriate rehabilitation stream, LOS, and discharge destination.

Functional Characteristics Associated with Discharge Destination

Among LTLD patients with pre-to-post living environment data, 66.7 per cent ($n = 34$) of patients returned to their premorbid living environment, which is similar

https://doi.org/10.1017/S0714980818000193 Published online by Cambridge University Press

Table 2: Characteristics of patients with hip fracture discharged "home" and "not home" in high tolerance short duration (HTSD) and low tolerance long duration (LTLD) rehabilitation

	HTSD			LTLD		
Variables	**"Home" ($n = 65$)**	**"Not Home" ($n = 4$)**	***p*-value**	**"Home" ($n = 34$)**	**"Not Home" ($n = 17$)**	***p*-value**
Demographic						
Age						
M ± *SD* (Median)	83.3 ± 8.2(86)	86.3 ± 11.9	.276	87.1 ± 6.9	85.5 ± 8.3(88)	.682
Sex[a]						
Male	15 (23.1%)	1 (25%)	1	11 (33.3%)	6 (35.3%)	.834
Female	50 (76.9%)	3 (75%)		23 (66.7%)	11 (64.7%)	
Living Alone[a]						
Yes	16 (24.6%)	3 (75%)	.061	5 (14.7%)	5 (29.4%)	.270
No	49 (75.4%)	1 (25%)		29 (85.3%)	12 (70.6%)	
CCAC Prior[a]						
Yes	18 (27.7%)	1 (25%)	1	9 (26.5%)	8 (47.1%)	.141
No	46 (70.8%)	3 (75%)		25 (73.5%)	9 (52.9%)	
Missing	1 (1.5%)					
Functional						
Premorbid Gait Aid[a]						
Independent	37 (56.9%)	0	.197	21 (61.8%)	9 (52.9%)	.502
Dependent	28 (43.1%)	2 (50%)		9 (26.5%)	6 (35.3%)	
Missing		2 (50%)		4 (11.7%)	2 (11.8%)	
Premorbid Bathing[a]						
Independent	43 (66.2%)	2 (50%)	1	16 (47.1%)	6 (35.3%)	.517
Dependent	21 (32.3%)	1 (25%)		14 (41.2%)	8 (47.1%)	
Missing	1 (1.5%)	1 (25%)		4 (11.7%)	3 (17.6%)	
Premorbid IADLs[a]						
Independent	21 (32.3%)	2 (50%)	.599	3 (8.8%)	5 (29.4%)	.095
Dependent	43 (66.2%)	2 (50%)		27 (79.4%)	10 (58.8%)	
Missing	1 (1.5%)			4 (11.8%)	2 (11.8%)	
FIM motor admission						
M ± *SD* (Median)	36.4 ± 9.7	26.3 ± 8.7	.046*	26 ± 7.3	23.4 ± 10.4(20)	.087
FIM cognitive admission						
M ± *SD* (Median)	26.3 ± 7.1(27)	25 ± 11.4	.892	21.4 ± 6.1	20.8 ± 6.9	.781
FIM total admission						
M ± *SD* (Median)	62.6 ± 14.6(63)	51.3 ± 19.7	.194	47.4 ± 11.7	44.2 ± 15.2(38)	.211
FIM change total	$n = 64$			$n = 33$	$n = 16$	
M ± *SD* (Median)	32.3 ± 11.8(56)	42 ± 15.8(35)	.123	29.9 ± 12.5(33)	22.8 ± 14.8	.048*
Clinical						
Number of co-morbidities						
M ± *SD* (Median)	6.1 ± 2.5(6)	5.3 ± 2.6	.511	7.9 ± 2.9(7.5)	7.8 ± 3	.912
Days from surgery to rehabilitation	$n = 63$			$n = 32$	$n = 16$	
M ± *SD* (Median)	7.8 ± 5(6)	6.5 ± 7.4	.404	24 ± 37.9(10)	13.3 ± 7.8(11)	.552
LOS in rehabilitation						
M ± *SD* (Median)	25.7 ± 7.8(28)	29.5 ± 11.7	.194	55.6 ± 18.3(62)	62.7 ± 27.7	.120

Note. [a] ***n*(%). CCAC = Community Care Access Centre; FIM = Functional Independence Measure; LOS = length of stay; *M* = mean, *SD* = standard deviation; median presented if data were not normally distributed.**

*** Significant; $p \leq .05$.**

to research in previous literature that found 61.5 per cent of patients returned home (Leung et al., 2016). Patients in LTLD who did not return home had fewer functional gains, as measured by change in FIM total score. In our study, patients in LTLD who were classified as not home had a mean increase in total FIM of 23 points whereas those in LTLD who returned home had a mean change in total FIM of 30 points which is similar to previous literature (Wang et al., 2014). Our results did not find a significant difference in change in total FIM in an HTSD population between those who went home and those who did not. However, few individuals in HTSD were classified as being discharged not home ($n = 4$). In practice, change in total FIM has limited use as a predictive factor for returning home as it is available only at discharge. FIM motor score on admission may be more clinically useful as this was significantly different between streams.

https://doi.org/10.1017/S0714980818000193 Published online by Cambridge University Press

Table 3: Bivariate analyses of factors associated with rehabilitation LOS in HTSD and LTLD

Stream	Variable[a]	Rehabilitation LOS *M* Days ± *SD*	Correlation Coefficient with Days Rehabilitation LOS
HTSD	Age	83.6 ± 8.3	0.152
	Sex	Male: 23.5 ± 6.8 Female: 26.6 ± 7.7	0.311
	Premorbid independence with bathing	Independent: 24.4 ± 7.6 Not Independent: 28.6 ± 7.2	0.260
	Days from surgery to rehabilitation admission	8.0 ± 5.5	–0.021
	Total # of co-morbidities	6.0 ± 2.5	–0.122
	FIM motor admission	35.8 ± 9.8	–0.471
	FIM cognitive admission	26.1 ± 7.3	–0.278
	FIM total admission	62.0 ± 14.9	–0.466
LTLD	Age	86.6 ± 7.4	–0.178
	Sex	Male: 58.1 ± 27.6 Female: 55.9 ± 19.3	–0.214
	CCAC support prior	Received CCAC prior: 48.6 ± 25.8 Did not receive CCAC prior: 61.3 ± 19.5	0.236
	Presence of diabetes	Had diabetes: 71.6 ± 19.4 Did not have diabetes: 54.1 ± 22.0	0.394
	Presence of dementia	Had dementia: 49.6 ± 20.5 Did not have dementia: 57.4 ± 22.6	–0.107
	Obesity	Obese: 70.7 ± 23.6 Not obese: 56.3 ± 19.6	0.352
	Underweight	Underweight: 82.3 ± 29.0 Not underweight: 55.9 ± 18.1	0.436
	FIM motor admission	25.2 ± 9.0	–0.060
	FIM cognitive admission	20.9 ± 6.6	0.231
	FIM total admission	46.0 ± 13.2	0.113

Note. **[a] *Italic variables*: $p < .05$, bold variables: $p < .01$. CCAC = Community Care Access Centre; FIM = Functional Independence Measure; HTSD = high tolerance short duration; LTLD = low tolerance long duration; LOS = length of stay; *M* = mean; *SD* = standard deviation.**

Functional Characteristics Associated with Length of Stay

Patients in HTSD with a lower FIM total on admission had a longer LOS. This is consistent with a previous study that indicated that patients with lower overall function on admission had longer LOS (Hershkovitz et al., 2007). The FIM is used as a standardized practice to estimate LOS in stroke rehabilitation in Ontario; Baycrest Health Sciences also uses admission FIM scores in the HTSD rehabilitation stream (but not in LTLD) to estimate a target rehabilitation LOS for patients after a hip fracture (Health Quality Ontario and Ministry of Health and Long-Term Care, 2016). The findings in this study support the emerging practice of using FIM scores to estimate LOS in HTSD rehabilitation for patients with hip fracture. For example, FIM total score explained a moderate amount of LOS variability in this study, with LOS and FIM score being inversely correlated in HTSD. These results can assist health care teams upon admission to estimate LOS and to inform discharge planning in an HTSD population.

Other Characteristics Associated with Length of Stay and Discharge Destination

Previous literature has shown that diabetes, dementia, depression, hypertension, weight-bearing status, and Braden score (pressure sore risk) are associated with LOS or discharge destination (Castelli et al., 2015; Hershkovitz et al., 2007; Huusko, Karppi, Avikainen,

Table 4: HTSD Multiple regression results for rehabilitation LOS

Variable	Unstandardized Coefficient β	Standard Error	Standardized Coefficient β	*p*-value
Sex	3.373	1.942	0.195	.087
Premorbid independence with bathing	3.095	1.963	0.201	.120
Total FIM on admission	–0.184	0.068	–0.344	**.009**
*R*2	0.268			
F	7.695			**< .001**

Note. **(*Italics*: $p < .05$, bold: $p < .01$). FIM = Functional Independence Measure; HTSD = high tolerance short duration; LOS = length of stay.**

https://doi.org/10.1017/S0714980818000193 Published online by Cambridge University Press

Table 5: LTLD Linear regression results for rehabilitation LOS

Variable	Unstandardized Coefficient β	Standard Error	Standardized Coefficient β	*p*-value
Presence of diabetes	17.538	8.291	.281	*.039*
*R*2	0.079			
F	4.475			*.039*

Note. (***Italics*: $p < .05$, bold: $p < .01$). LOS = length of stay; LTLD = low tolerance long duration.**

Kautiainen, & Sulkava, 2000; Morghen et al., 2011; Semel et al., 2010). Factors such as dementia and depression may have had an impact on LOS and, thus, on the variance in the regression analysis; however, as this study was a retrospective review, cognitive impairment and depression were not consistently measured in a standardized way and therefore were not included in the data abstraction and analysis. It is not likely that weight-bearing status, pressure sore risk, and hypertension would be associated with LOS in this study as all patients had limited variability for these characteristics. This study found that only diabetes was associated with a longer LOS for patients in LTLD, although the effect size was small in the simple linear regression. With only one variable entered into the regression analysis for LTLD, limited variance could be explained with our model so interpreting these results should be done with caution. The small sample size in this study likely limited the ability to detect other factors that may have contributed to LOS, so these results require confirmation in larger studies.

Study Limitations

Small sample size and the single-site study design are the main limitations of this study. Patients who were discharged to acute care (n = 6) were included in analyses of total HTSD and LTLD so we could achieve a better understanding of the characteristics of each patient population as the number of patient charts we examined was small (n = 139). However, we excluded them from LOS regression analysis to prevent distortion of data (i.e., shorter LOS was due to acute illness) and when subdividing the HTSD and LTLD populations by discharge destination for analysis. Because the sample size of those who did not return home in HTSD was small (n = 4), we were unable to determine factors associated with discharge destination from this unit. In addition, the sample size of those who did not return home in LTLD was also small (n = 17), and therefore it is difficult to draw meaningful conclusions regarding the LTLD population; the findings cannot be generalized.

Sample size may also account for the insignificance of other factors in this study that the literature showed to be related to LOS, such as age and sex (Arinzon et al., 2005; Health Quality Ontario & Ministry of Health and Long-Term Care, 2013b). A larger sample size would allow for greater power and better detection in the regression of factors associated with LOS. Future research would benefit from a greater sample size (more years of data or data from multiple sites) to have a better understanding of the LTLD population. Socioeconomic status and geographical differences could not be accounted for in this single-site study.

Conclusion

This study adds to the literature by further exploring the characteristics of patients following a hip fracture in both HTSD and LTLD rehabilitation streams and highlights that differences exist between these populations. Patients in LTLD were significantly less likely to meet QBP LOS guidelines of ≤ 28 days, less likely to return home, were older, less independent with bathing and IADLs premorbidly, had lower FIM admission scores, more co-morbidities, and more days from surgery to rehabilitation than those in HTSD rehabilitation. A higher FIM motor admission score was significantly associated with discharge home in HTSD, and a greater change in total FIM score was significantly associated with discharge home in LTLD although there was a very small sample size in each stream of those who did not return home. Finally, higher FIM total score on admission was associated with decreased LOS in HTSD, and the presence of diabetes was associated with an increased LOS in LTLD in regression analyses.

The results of this study demonstrate the need for future research to include larger sample sizes in order to further explore the characteristics of LTLD populations, and to identify which factors are most significantly associated with LOS and discharge destination within this stream of rehabilitation. Further research should include prospective studies wherein factors such as duration, type, and frequency of therapy are considered. Information gleaned from further research could then be used to ensure that patients are admitted to a rehabilitation stream with the appropriate level of care, and that they are allowed sufficient time and resources to maximize patient outcomes.

References

Arinzon, Z., Fidelman, Z., Zuta, A., Peisakh, A., & Berner, Y. N. (2005). Functional recovery after hip fracture in old-old elderly patients. *Archives of Gerontology and Geriatrics*, *40*(3), 327–336. doi: S0167-4943(04)00174-8

https://doi.org/10.1017/S0714980818000193 Published online by Cambridge University Press

Ariza-Vega, P., Kristensen, M. T., Martin-Martin, L., & Jimenez-Moleon, J. J. (2015). Predictors of long-term mortality in older people with hip fracture. *Archives of Physical Medicine and Rehabilitation*, *96*(7), 1215–1221. doi: 10.1016/j.apmr.2015.01.023

Beaupre, L. (2011). *Functional recovery of hip fracture patients*. Retrieved from http://boneandjointcanada.com/wp-content/uploads/2014/05/Functional-Recovery_Final.pdf

Beaupre, L. A., Binder, E. F., Cameron, I. D., Jones, C. A., Orwig, D., Sherrington, C., & Magaziner, J. (2013). Maximising functional recovery following hip fracture in frail seniors. *Best Practice & Research. Clinical Rheumatology*, *27*(6), 771–788. doi: 10.1016/j.berh.2014.01.001

Blackman-Weinberg, C., Crook, J., Roberts, J., & Weir, R. (2005). Longitudinal study of inpatients admitted to a general activation service: Variables that predict discharge to a patient's discharge goal location. *Archives of Physical Medicine and Rehabilitation*, *86*(9), 1782–1787. doi: S0003-9993(05)00414-4

Canadian Institute for Health Information. (2015). *Factors predicting return home from inpatient rehabilitation following hip fracture surgery*. Ottawa, ON: Author. Retrieved from https://secure.cihi.ca/free_products/NRS_Hips_2015_EN_web.pdf

Castelli, A., Daidone, S., Jacobs, R., Kasteridis, P., & Street, A. D. (2015). The determinants of costs and length of stay for hip fracture patients. *PloS One*, *10*(7), e0133545. doi: 10.1371/journal.pone.0133545

Cheng, C. L., Lau, S., Hui, P. W., Chow, S. P., Pun, W. K., Ng, J., & Leong, J. C. (1989). Prognostic factors and progress for ambulation in elderly patients after hip fracture. *American Journal of Physical Medicine & Rehabilitation/Association of Academic Physiatrists*, *68*(5), 230–233. Retrieved from https://journals.lww.com/ajpmr/pages/articleviewer.aspx?year=1989&issue=10000&article=00006&type=abstract

Gialanella, B., Ferlucci, C., Monguzzi, V., & Prometti, P. (2015). Determinants of outcome in hip fracture: Role of daily living activities. *European Journal of Physical and Rehabilitation Medicine*, *51*(3), 253–260. Retrieved from https://www.minervamedica.it/en/journals/europa-medicophysica/article.php?cod=R33Y2015N03A0253

GTA Rehab Network. (2009). *Inpatient rehab/LTLD referral guidelines*. Retrieved from http://www.gtarehabnetwork.ca/uploads/File/tools/inpatient-rehab-LTLD-referral-guidelines.pdf

Health Quality Ontario and Ministry of Health and Long-Term Care. (2016). *Quality-based procedures: Clinical handbook for stroke (acute and postacute)*. Toronto, ON: Author. Retrieved from http://health.gov.on.ca/en/pro/programs/ecfa/docs/qbp_stroke.pdf

Health Quality Ontario & Ministry of Health and Long-Term Care. (2013). Quality-based procedures: Clinical handbook for hip fractures. Toronto, ON: Author. Retrieved from http://health.gov.on.ca/en/pro/programs/ecfa/docs/qbp_hipfracture.pdf

Hershkovitz, A., Beloosesky, Y., & Brill, S. (2012). Mobility assessment of hip fracture patients during a post-acute rehabilitation program. *Archives of Gerontology and Geriatrics*, *55*(1), 35–41. doi: 10.1016/j.archger.2011.06.036

Hershkovitz, A., Kalandariov, Z., Hermush, V., Weiss, R., & Brill, S. (2007). Factors affecting short-term rehabilitation outcomes of disabled elderly patients with proximal hip fracture. *Archives of Physical Medicine and Rehabilitation*, *88*(7), 916–921. doi: S0003-9993(07)00257-2

Heruti, R. J., Lusky, A., Barell, V., Ohry, A., & Adunsky, A. (1999). Cognitive status at admission: Does it affect the rehabilitation outcome of elderly patients with hip fracture? *Archives of Physical Medicine and Rehabilitation*, *80*(4), 432–436. doi: S0003-9993(99)90281-2

Howell, D. C. (1998). *Statistical methods in human sciences*. New York, NY: Wadsworth.

Hulsbaek, S., Larsen, R. F., & Troelsen, A. (2015). Predictors of not regaining basic mobility after hip fracture surgery. *Disability and Rehabilitation*, *37*(19), 1739–1744. doi: 10.3109/09638288.2014.974836

Huusko, T. M., Karppi, P., Avikainen, V., Kautiainen, H., & Sulkava, R. (2000). Randomised, clinically controlled trial of intensive geriatric rehabilitation in patients with hip fracture: Subgroup analysis of patients with dementia. *BMJ (Clinical Research Ed.)*, *321*(7269), 1107–1111. doi: http://dx.doi.org/10.1136/bmj.321.7269.1107

Kristensen, M. T. (2013). Hip fracture-related pain strongly influences functional performance of patients with an intertrochanteric fracture upon discharge from the hospital. *PM & R: The Journal of Injury, Function, and Rehabilitation*, *5*(2), 135–141. doi: 10.1016/j.pmrj.2012.10.006

Kristensen, M. T., Foss, N. B., & Kehlet, H. (2009). Factors with independent influence on the 'timed up and go' test in patients with hip fracture. *Physiotherapy Research International: The Journal for Researchers and Clinicians in Physical Therapy*, *14*(1), 30–41. doi: 10.1002/pri.414

Landi, F., Bernabei, R., Russo, A., Zuccala, G., Onder, G., Carosella, L., ... Cocchi, A. (2002). Predictors of rehabilitation outcomes in frail patients treated in a geriatric hospital. *Journal of the American Geriatrics Society*, *50*(4), 679–684. https://www.ncbi.nlm.nih.gov/pubmed/11982668

Lee, D., Jo, J. Y., Jung, J. S., & Kim, S. J. (2014). Prognostic factors predicting early recovery of pre-fracture functional mobility in elderly patients with hip fracture. *Annals of Rehabilitation Medicine*, *38*(6), 827–835. doi: 10.5535/arm.2014.38.6.827

Leung, G., Katz, P. R., Karuza, J., Arling, G. W., Chan, A., Berall, A., … Naglie, G. (2016). Slow stream rehabilitation: A new model of post-acute care. *Journal of the American Medical Directors Association*, *17*(3), 238–243. doi: 10.1016/j.jamda.2015.10.016

Lieberman, D., Fried, V., Castel, H., Weitzmann, S., Lowenthal, M. N., & Galinsky, D. (1996). Factors related to successful rehabilitation after hip fracture: A case-control study. *Disability and Rehabilitation*, *18*(5), 224–230. doi: 10.3109/09638289609166305

Marcantonio, E. R., Flacker, J. M., Michaels, M., & Resnick, N. M. (2000). Delirium is independently associated with poor functional recovery after hip fracture. *Journal of the American Geriatrics Society*, *48*(6), 618–624. doi: 10.1111/j.1532-5415.2000.tb04718.x

Morghen, S., Bellelli, G., Manuele, S., Guerini, F., Frisoni, G. B., & Trabucchi, M. (2011). Moderate to severe depressive symptoms and rehabilitation outcome in older adults with hip fracture. *International Journal of Geriatric Psychiatry*, *26*(11), 1136–1143. doi: 10.1002/gps.2651

O'Neill, T. J., McCarthy, K., & Newton, B. M. (1987). Slow-stream rehabilitation: Is it effective? *The Medical Journal of Australia*, *147*(4), 172–175. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/3657628

Papadimitropoulos, E. A., Coyte, P. C., Josse, R. G., & Greenwood, C. E. (1997). Current and projected rates of hip fracture in Canada. *CMAJ: Canadian Medical Association Journal = Journal De L'Association Medicale Canadienne*, *157*(10), 1357–1363. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1228461/

Rehabilitative Care Alliance. (2015). *Planning considerations for reclassification (PCRC) of Rehab/CCC beds: PCRC toolkit*. Retrieved from http://rehabcarealliance.ca/uploads/File/Toolbox/PCRC/PCRC_Toolkit_FINAL_REVISED_January_2015.pdf

Semel, J., Gray, J. M., Ahn, H. J., Nasr, H., & Chen, J. J. (2010). Predictors of outcome following hip fracture rehabilitation. *PM & R: The Journal of Injury, Function, and Rehabilitation*, *2*(9), 799–805. doi: 10.1016/j.pmrj.2010.04.019

Toronto Central Local Health Integration Network. (2015). *Resource matching & referral – About*. Retrieved from https://resourcematchingandreferral.com/about/

Uniform Data System for Medical Rehabilitation. (2016). *About the FIM system.* Amherst, NY: Author. Retrieved from http://www.udsmr.org/WebModules/FIM/Fim_About.aspx

Wang, C. Y., Graham, J. E., Karmarkar, A. M., Reistetter, T. A., Protas, E. J., & Ottenbacher, K. J. (2014). FIM motor scores for classifying community discharge after inpatient rehabilitation for hip fracture. *PM & R: The Journal of Injury, Function, and Rehabilitation*, *6*(6), 493–497. doi: 10.1016/j.pmrj.2013.12.008