Functional status of community-dwelling older adults after inpatient rehabilitation

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Functional Status of Community-Dwelling Older Adults after Inpatient Rehabilitation

Background: Factors that influence functional ability in older adults after rehabilitation are not well understood.

Aim: To investigate how older people function in their community after discharge from inpatient rehabilitation.

Methods: Cross-sectional study of community-dwelling older adults (n=86, 75±6 years) discharged from rehabilitation in the previous 12 months. Basic functional independence was assessed using the Functional Independence Measure (FIM) and complex functional independence was assessed using the Frenchay Activities Index. Multiple regression analyses were conducted to assess association between predetermined factors and function.

Findings: Discharge FIM and physical activity levels accounted for 50% of the variance in basic function (R^2=.50, F=40.75, p<.001). Discharge FIM, physical activity, age, gender and migrant status accounted for 68% of variance in complex function (R^2=.68, F=29.75, p<.001).

Conclusion: Clinicians are encouraged to implement strategies to improve function at discharge from rehabilitation and to promote physical activity among older people at risk of poor function following rehabilitation.

Keywords: Rehabilitation; Activities of daily living; Aged; Independent Living;

Abbreviations: Frenchay Activities Index = FAI; Functional Independence Measure = FIM; Physical Activity Scale for the Elderly = PASE

INTRODUCTION

Rehabilitation comprises interventions designed to optimise function and reduce disability in people with health conditions (WHO 2017). Older adults make up a large proportion of those who require inpatient rehabilitation (AROC 2018). In efforts to reduce inpatient length of stay, older patients may not have reached their full functional potential at discharge from inpatient rehabilitation. There is an assumption and expectation that following discharge, functional independence will continue to improve on returning to the home environment (Otswald et al. 2009). However, in a 12-month follow-up study of 996 rehabilitation inpatients (mean age 83 years) it was observed they made little improvement in function following discharge (Peiris et al. 2013). Another study found that although younger patients improved three months after discharge from rehabilitation, older adults did not (Gosselin et al. 2008).

The Functional Independence Measure (FIM) (Hamilton and Granger 1994) is commonly used to assess basic motor and cognitive function during rehabilitation and in long-term follow-up (Peiris et al. 2013; Hershkovitz et al. 2012). Although useful in inpatient settings, it has been suggested FIM is not sensitive enough to monitor changes in function that occur in the community (Coster et al. 2006; Passalent et al. 2011). A qualitative study exploring older adults' transition home after hospitalisation identified that 'returning to normal' encompasses much more than basic function (Liebzeit et al. 2020). The Frenchay Activities Index (FAI) (Holbrook and Skilbeck 1983) assesses more complex tasks commonly performed in the community including domestic chores, social functions, outdoor activities, leisure and work and therefore may be a more sensitive measure of community function. FIM, as a measure of basic function, and FAI, as a measure of complex function, have been used together previously to provide a more comprehensive assessment of functional independence (Lin et al 2004).

The complex factors that influence functional status after discharge from inpatient rehabilitation are not well understood. Previous studies have focussed on the prevalence, trajectory

and predictors of functional decline of older adults in acute hospitals (Chen et al. 2008; Hoogerduijn et al. 2005; Huang et al. 2013; Moen et al. 2018; Wu et al. 2006) but little is known about predictors of functional decline nor the trajectory of decline after discharge from rehabilitation. Following inpatient rehabilitation, basic function is usually only measured once or twice by researchers as long-term follow-up of maintenance of intervention effects (Peiris et al. 2013; Hershkovitz et al. 2012). This does not consider the complexities of transition home (Liebzeit et al. 2020) nor complex functional activity, new acute events, hospital admissions or personal factors such as chronic disease or physical activity levels. Identification of predictors of function after rehabilitation would provide rehabilitation clinicians with knowledge that could inform practice. Modifiable positive predictors could be targeted by clinicians to optimise function in the community after discharge. Identification of non-modifiable factors will aid clinicians in detecting those at risk of poor function and putting strategies in place to prevent poor function in the community.

Therefore, our primary aim was to describe the basic and complex functional ability of older adults living in the community within 12 months of being discharged from inpatient rehabilitation. The secondary aims were to: (1) determine factors associated with function in the community after rehabilitation; and (2) compare FIM and FAI as measures of function in the community.

METHOD

Design

A cross-sectional study design used a convenience sample of participants from the admissions register at two rehabilitation facilities in metropolitan Melbourne. To provide a representation of functional recovery we obtained a cross-sectional spread of scores among participants within 12 months of discharge with each participant assessed once. Ethical approval was received from

hospital and university human research ethics committees and the trial was prospectively registered (ACTRN12616000205437).

Participants

Community-dwelling, English-speaking, older adults (≥ 65years) admitted for inpatient rehabilitation for any health condition at the two rehabilitation facilities (60 rehabilitation beds) within the previous 12 months were eligible for inclusion. Older adults who lived independently in the community (including independent living units or retirement villages) after discharge were eligible but those who lived in residential care were excluded as the focus was on functional independence that allowed older adults to remain living independently in the community. People with cognitive impairment (> two errors on the Short Portable Mental Status Questionnaire) (Pfeiffer 1975) were not eligible as they would not have been able to reliably complete the questionnaires. All eligible participants discharged from the rehabilitation facilities in the previous 12 months were contacted regarding participation. Participants were recruited from 2016 to 2017 and provided written informed consent to participate. Each participant completed one assessment in the 12 months post discharge from inpatient rehabilitation. The number of days post discharge that the assessment was conducted on was variable.

Outcomes

The primary outcome was functional independence assessed with the FIM (Hamilton and Granger 1994) and the FAI (Holbrook and Skilbeck 1983).

The FIM consists of 18 items in two domains: motor (13 items of mobility and self-care) and cognitive (5 items). Each item is rated on a 7-point scale where 1 reflects complete dependence and 7 reflects complete independence. The resulting score ranges from 18 to 126 with higher scores indicating more functional independence (Hamilton and Granger 1994). The FIM is a reliable (ICC > .8) measure of functional independence in older adults and in a variety of rehabilitation populations

(Pollack et al. 1996; Stineman et al. 1996) which has demonstrated evidence of internal consistency (ICC > .87) (Stineman et al. 1996) and discriminative validity in older adults and in rehabilitation (Pollack et al. 1996; Hobart et al. 2001).

The FAI is a 15-item self-report scale of a persons' participation in instrumental activities of daily living necessary for living independently in the community (Holbrook and Skilbeck 1983). The scale relies on recollection of activities performed over the previous 3 to 6 months. Each item is rated between 0 (least level of participation) to 3 (most frequent level of participation). The resulting score ranges from 0 to 45 with higher scores indicating higher levels of function. The FAI is a valid measure of activity in the general community including older adults and those with health conditions (Turnbull et al. 2000). It has demonstrated excellent test-retest reliability in older populations (ICC = .94) (McPhail et al. 2009) with evidence of concurrent validity with other measures of activity (r > .54) (Imam and Miller 2012).

Both FIM and FAI rely on patient interview and can be reliably completed via telephone (Petrella et al. 2002; McPhail et al. 2009). Assessments were 1-hour telephone interviews conducted by an experienced physiotherapist. FIM scores at discharge from rehabilitation were collected from participants' medical records.

The following independent variables that are potentially related to functional independence (Hoogerduijn et al. 2007; Chen et al. 2008; Huang et al. 2013) were recorded:

1) Participant factors: age, sex, co-morbidities, country of birth;
2) Rehabilitation factors: diagnosis, basic function on discharge from rehabilitation (discharge FIM), inpatient length of stay, referral for follow-up therapy services;
3) Community factors: days since discharge, falls since discharge, re-admissions since discharge, and reported physical activity levels (Physical Activity Scale for the Elderly) (Washburn et al. 1993) were obtained at the follow-up interview. The Physical Activity Scale

for the Elderly (PASE) is a self-reported 12-item instrument for the assessment of physical activity levels in community-dwelling older adults (Washburn et al. 1993). Questions assess occupational, household and leisure activities completed over the previous week. The scoring algorithm was developed based on comparison with accelerometers and activity diaries with a maximum score of 793 and an average PASE score of 102 units in community-dwelling older adults (Washburn et al. 1993). It has been reported to have excellent retest reliability (ICC = .75) (Washburn et al. 1993) with evidence of construct validity with moderate correlations with step count in the elderly (r > .30) (Ewald et al. 2010).

Data analysis

Data analysis was performed using SPSS (version 24.0). Descriptive data were calculated using means and standard deviations. Change in FIM scores (community FIM score – discharge FIM score) were plotted against time since discharge with a line of best fit to determine the trajectory of change in function.

Separate standard multiple regression analyses assessed the associations between participant, rehabilitation and community factors and basic (FIM) and complex (FAI) functional independence in the community. Variables were removed from the analysis if there was more than a weak correlation (Pearson's r of ≥±0.3) present (collinearity) between independent variables. Factors associated with functional independence (FIM or FAI) were analysed using a backwards elimination process starting with all independent variables expected to contribute (Thompson 1978). The criterion for inclusion of a variable into the model was set at an alpha level of .10. After each of the variable categories were analysed separately (participant factors, rehabilitation factors and community factors), significant independent variables were combined in one analysis.

Percentage of participants obtaining the highest or lowest possible scores on the FIM and FAI was calculated to assess floor and ceiling effects. Floor and/or ceiling effects were considered to be present if 15% of participants scored the lowest or highest possible score (Terwee et al. 2007).

Sample size

Using the equation: n > 50+8m, where m is the number of independent contributing factors (Tabachnick and Fidell 2007), the estimated sample size was n=90 allowing for up to 5 independent factors for each analysis.

RESULTS

Throughout the study period and the preceding 12 months, there were 687 people on the admissions register at the two rehabilitation facilities. Of these, 215 were potentially eligible to participate, 117 were able to be contacted and 86 agreed to participate (figure 1). The most common reason for ineligibility was age less than 65 years (n = 331).

[INSERT FIGURE 1 ABOUT HERE]

Participants

Participants had a mean age of 75 (SD 6) years, 56 (65%) were female and 36 (42%) were born in Australia (table 1). Fifty-four (63%) participants had an orthopaedic diagnosis and 13 (15%) had a neurological diagnosis. Participants' length of stay in inpatient rehabilitation was 19 (SD 12) days and they had a mean increase in FIM score of 22.0 (SD 12.8) between admission and discharge from rehabilitation (table 1). Two participants had missing FIM scores at admission and discharge from rehabilitation. All other data were complete. Most participants (n=78, 91%) were referred for outpatient rehabilitation therapy after discharge. Participants were assessed within one year (min 5,

max 360 days) following discharge from rehabilitation (figure 2). Between discharge and community assessment, participants had a mean increase in FIM score of 10.0 (SD 8.0) units.

[INSERT TABLE 1 ABOUT HERE]

Between discharge from rehabilitation and assessment three falls in the community were reported and 15 participants were readmitted to hospital. Overall, study participants were inactive with a mean PASE score of 72 (SD 53) out of 793. There were no missing data.

Functional Independence

There was no clear trajectory in FIM change according to the time since discharge of each participant (figure 2). The line of best fit appeared to indicate that change in FIM scores increased up until 3 to 4 months post discharge before improvement plateaued or reduced (figure 2). However, the line of best fit only explained a small amount of the variability (R^2 cubic < 7%)

[INSERT FIGURE 2 ABOUT HERE]

Community FIM (basic function) and FAI (complex function) scores were moderately correlated (Pearson's r=.61). No participants scored the maximum or minimal FIM score at admission or on discharge from rehabilitation. Four participants (5%) scored the maximum FIM (126) when living in the community and FIM scores were negatively skewed (skewness = -1.34, SE = .26) meaning the data were not symmetrical and there were outliers with low FIM scores. No participants scored the maximum or minimum on the FAI when assessed in the community and data were not skewed (skewness = -.26, SE = .51).

Multiple regression analyses

There were no violations of collinearity but there were weak, significant correlations between age and physical activity levels (r = -.30); female gender and comorbidity (r = .33); female gender and

FIM score at discharge from rehabilitation (r = -.31); being Australian born and readmission (r = .30); FIM score at discharge from rehabilitation and length of stay (r = -.44); and FIM score at discharge from rehabilitation and physical activity (r = .36).

FIM: The final standard linear regression model accounted for 50% of the variance in community FIM score (R^2 = .50, F=40.75, p<.001) and included FIM score at discharge from rehabilitation (β = .57) and physical activity levels (β = .26) (table 2).

[INSERT TABLE 2 ABOUT HERE]

FAI: The final model accounted for 68% of variance in community FAI score (R^2 =.68, F=29.75, p<.001) with the biggest contributors to the model being FIM score at discharge from rehabilitation (β = .37), physical activity level (β = .34) and being Australian born (β = .29) (table 3). Being older (β = -.19) or female (β = -.23) were negatively associated with community FAI scores.

[INSERT TABLE 3 ABOUT HERE]

DISCUSSION

The main findings of our study were: 1) Participant's basic function improved on the FIM up to 4 months post discharge before plateauing or declining; 2) FAI scores had less ceiling effect, less skew and more variability than FIM scores indicating FAI may be a better choice for measuring function among community-dwelling older adults; and 3) FIM on discharge from rehabilitation and physical activity levels were positively associated with basic and complex functional independence in the community after discharge while being female, older and/or a migrant were negatively associated with complex functional independence.

These results add to the literature by describing the likely trajectory over time after discharge from rehabilitation. These preliminary data suggest recovery may not be linear after discharge from rehabilitation and may include periods of modest improvements and setbacks. The

improvement in functional independence at 3 to 4 months post-discharge from rehabilitation may be due in part to most participants (91%) being referred to follow-up therapy in the community. Follow-up therapy services offered by the health services where the study was conducted were usually funded for 6-weeks and there was often a waiting period before commencing. Therefore, one potential explanation for the observed trajectory is that participants improved until therapy ceased, then their function plateaued or started to decline. However, there was much variability in the data making it difficult to draw strong conclusions. In addition, referral to follow-up therapy was not associated with function after discharge, probably because only 8 participants were not referred to follow-up therapy. Regardless, a clinical implication is that it may be important to monitor decline and implement outpatient therapy services when needed.

The FAI may be a more responsive measure of differences in function in the community than the FIM. Consistent with previous research, the majority of improvement in FIM score is seen between admission and discharge from rehabilitation with maintenance of function seen at follow-up (Passalent at al. 2011; Peiris et al. 2013). This may be because the FIM is a measure of dependence which is relevant in hospital but approaches ceiling once people are discharged (Passalent at al. 2011). There was also more variability in the FAI data than in the FIM data indicating it might be more responsive to change at higher functional levels. Based on these data, and because the FAI includes measures of community participation, FAI appears to be a more appropriate choice of outcome measure to assess function in the community.

Higher function on discharge from rehabilitation was associated with better function in the community after discharge. Therefore, it is important to optimise functional outcomes of rehabilitation prior to discharge home. Optimising functional status during inpatient stay is also important to reduce readmission (Hoyer et al. 2013; Hoyer et al. 2014). Interventions that improve function on discharge from rehabilitation without delaying discharge include providing additional physical therapy services during inpatient rehabilitation (Peiris et al. 2018), providing specific

geriatric rehabilitation for older adults (Bachmann et al. 2010) and providing specific stroke unit care for patients with stroke (Stroke Unit Triallists 2013). Clinicians, health services and researchers should continue to look for cost-efficient ways of improving rehabilitation outcomes as they impact ongoing function in the community after discharge.

Higher levels of physical activity after inpatient rehabilitation are associated with better function. Physical activity levels are also positively associated with functional independence in healthy older adults (Paterson and Warburton 2010) and during inpatient rehabilitation (Peiris et al. 2013b). In addition, being physically active after discharge from hospital is associated with better quality of life in older adults (Brovold et al. 2014). Although association does not indicate causation, being physically active during and after hospitalisation may be important for the improvement and maintenance of function. Therefore, another clinical implication of this study may be that clinicians should promote physical activity to their patients and support them to be physically active during and beyond rehabilitation. Promotion of physical activity and reduction of sedentary behaviour could commence during inpatient rehabilitation. Setting up an environment and activities that promote physical activity during inpatient rehabilitation could be combined with education, goal setting and outdoor mobility practice to prepare patients to be active on discharge. Education provided should be specific to the patient's functional level and diagnosis and should be evidence-based. Research shows it is safe and beneficial for older adults with various diagnoses to be physically active including stroke (Dite et al. 2015), hip fracture (Peiris et al. 2017), and cancer (Dennett et al. 2016). Therapists working in inpatient rehabilitation settings should also refer their patients to outpatient community therapy to further promote and facilitate physical activity where needed. Evidence-based community programs exist in multiple countries such as Fit and Strong!, Enhance Fitness and Active for Life (United States of America), Living Longer, Living Stronger (Australia), Sit Tall, Stand Strong and Care to Move (United Kingdom), FaME (Canada) and the Otago exercise program (New Zealand). Such existing, relatively low cost, evidence-based programs have

been evaluated and found to increase physical activity levels, self-efficacy for exercise and physical function in previously sedentary older adults (Hughes et al. 2009).

Being a migrant, older and/or female were associated with poorer function according to FAI scores. Risk factors for aging specific to migrants include exposure to health issues before and during migration, financial disadvantage, language barriers, low health literacy and psychosocial vulnerability (Kristiansen et al. 2016). These may all be potential contributors to migration status being associated with poorer function in the community. Age, gender and migration status are non-modifiable factors, therefore optimising functional independence on discharge and promoting physical activity is particularly important for these populations. Rehabilitation clinicians should consider putting in place additional strategies to maintain and improve function in these populations in the community through more intensive inpatient therapy and referral to community therapy.

A limitation of this study is that it measured participant functional independence at only one point in time following discharge. However, including participants at various stages post-discharge allowed us to map the trajectory of functional change. Very few participants reported experiencing a fall (n = 3) which limited the ability to detect associations with falls. Other variables potentially related to function were not included as these variables were not routinely recorded in the medical record. For example, there is a negative association between pain intensity and function, although the association is not as strong in older people (Houde et al. 2016). Another important consideration is that although participants who were more physically active had higher function in the community, we cannot conclude physical activity caused or improved functional independence. Additionally, being older, female or migrant was negatively associated with function but may not be the cause of poor function. A strength of this study is that it measured and compared function using two valid and commonly used measures in a mixed older adult rehabilitation population making results generalisable. It is also the first study to consider hospitalisations, physical activity and other important factors that occur in the community after discharge.

CONCLUSION

This research describes the modest improvement in function observed in the 12 months after discharge from inpatient rehabilitation and highlights the positive association between functional independence on discharge from rehabilitation and physical activity levels with basic (FIM) and complex (FAI) function in the community. It is important for rehabilitation clinicians to implement strategies to improve function at discharge from rehabilitation and promote and prescribe physical activity in the community. These strategies are particularly important for people identified as being at risk of poor function in the community following rehabilitation (older age, female gender and migrants). The study also highlights the clinical utility of the FAI for measuring function in the community.

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Figure legend

Figure 1. Flow of participants through the study

Figure 2. Plot of participant's change in FIM scores between discharge and community assessment

Table 1. Participant characteristics

Characteristic	n = 86
Age, mean (SD) years	75 (6)
Gender Male:Female	30:56
Country of birth	
- Australia	36
- Other	50
Charlson Comorbidity Index, mean (SD)	1.2 (1.2)
Diagnosis/Condition	
- Stroke/neuro	13
- Fracture	26
- Hip/knee replacement	28
- Cardiac/pulmonary	5
- Spinal	2
- Other	12
Length of stay in rehabilitation, mean (SD) days	19.2 (12.1)
FIM, mean (SD) score	
- Admission	86.4 (17.2)
- Discharge	108.4 (10.7)
- Community follow-up	118.4 (7.1)
Frenchay Activities Index, mean (SD) score	
- Domestic	9.1 (4.9)
- Leisure	7.2 (2.6)
- Outdoor	7.8 (3.9)
Physical Activity Scale for the Elderly, mean (SD) score	72.3 (53.5)

Number of people who had a fall	3
Number of people who had a readmission	15
Number of people who had follow up therapy	78 (91%)

Table 2. Multiple regression analysis for basic functional independence (FIM) in the community after discharge from inpatient rehabilitation

	B	95%CI for B	β	t	p=
FIM (R^2 .50, F=40.75, p<.001)					
Independent variables included in final model					
FIM on discharge	.38	.27 to .50	.57	6.80	<.001
Physical activity levels	.03	.01 to .06	.26	3.07	.003
Independent variables not included in final model					
Age	0	-.2 to .2	0	0	.997
Female	.52	-2.46 to 3.49	.03	.35	.73
Australian born	1.49	-1.32 to 4.29	.1	1.06	.294
Comorbidity	-.05	-1.12 to 1.01	-.01	-.1	.92
Length of stay	.09	-.03 to .2	.14	1.49	.142
Days since discharge	-.001	-.01 to .01	-.01	-.12	.908
Number of falls	-.49	-7.0 to 6.03	-.01	-.15	.882
Number of readmissions	.54	-1.27 to 2.36	.06	.6	.553
Orthopaedic	-.22	-2.88 to 2.43	-.02	-.17	.867
Follow-up therapy	-2.21	-6.83 to 2.41	-.09	-.95	.344

Table 3. Multiple regression analysis for complex functional independence (FAI) in the community after discharge from inpatient rehabilitation

	B	95%CI for B	β	t	p=
FAI (R^2 .68, F=33.19, p<.001)					
Independent variables included in final model					
FIM on discharge	.32	.19 to .45	.37	4.94	<.001
Physical activity levels	.06	.03 to .08	.34	4.34	<.001
Age	-.28	-.47 to -.08	-.19	-2.81	.006
Female	-4.41	-7.12 to -1.70	-.23	-3.24	.002
Australian born	5.37	2.94 to 7.80	.29	4.40	<.001
Independent variables not included in final model					
Comorbidity	-.28	-1.37 to .81	-.04	-.51	.610
Length of stay	.01	-.11 to .13	.01	.18	.856
Days since discharge	.002	-.01 to .01	.02	.32	.747
Number of readmissions	.05	-1.81 to 1.9	.004	.05	.96
Number of falls	-5.53	-12.2 to 1.14	-.11	-1.66	.1
Follow-up therapy	.37	-4.36 to 5.1	.01	.16	.876
Orthopaedic diagnosis	-1.19	-3.9 to 1.53	-.06	-.87	.387