Home modifications and carer status are important factors influencing outcomes of Rehabilitation in the Home programs for non-condition specific populations

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Abstract

Background: Current Rehabilitation in the Home (RITH) programs provide rehabilitation for people with a variety of conditions, yet little evidence is available to guide admission criteria. The primary aim of this cross-sectional study was to profile patients admitted to a non-condition specific RITH program. The secondary aim was to explore factors influencing program outcomes.

Methods: This retrospective audit utilised a two-year dataset collected from patients, aged ≥60 years, admitted under a RITH program. Clinical information such as age, sex, hospital utilisation, past medical history, functional and social status were collected to profile the patients. Outcomes such as length of stay, FIM change and hospital representations were used to determine success in the program. A regression analysis was conducted to determined variables that were independently related to the outcome.

Results: Among the 202 patients included, patients were on average 78 years of age, living with three comorbid conditions, and have an average stay of 29 days in hospital prior to rehabilitation. The presence of home modifications was found to be an independent factor that correlated with RITH length of stay, FIM change scores and hospital readmissions. In addition, factors such as age, comorbidities, acute hospital length of stay and carer status were shown to correlate with at least two out of three of the outcomes.

Conclusions: This study suggest that commonly collected information such as age, acute hospital length of stay, presence of home modifications and carer status may be used to better identify suitable patients for a non-condition specific RITH program.

Trial registration: This study was approved through SWSLHD's Human Research Ethics Committee (approval number: CT06_2019).

Introduction

With an ageing population and improved survival rates among acute conditions, there has been an increased healthcare burden occurring across developed countries [1]. In Australia, the ageing population has resulted in increased acute hospital presentations and demand for inpatient rehabilitation services, with an annual expenditure of $2.93 billion [2]. Rehabilitation in the Home (RITH) services provide an alternative to inpatient rehabilitation, whereby a typical model of RITH involves patient-centred occupational therapy and physiotherapy interventions delivered at home, with nursing, medical, and social work support [3]. This model allows medically stable patients to return home without compromising their access to coordinated multidisciplinary rehabilitation. Such services are proposed to improve flow through the hospital system and reduce waiting times for rehabilitation as well as improving patient satisfaction and quality of life [4].

Emerging evidence on RITH services supports equivalent or improved patient outcomes for function, and health service use, when it is applied in a homogenous cohort of patients [5, 6]. For example, in post-stroke patients, or those undergoing joint arthroplasty or fracture rehabilitation, RITH leads to equivalent improvements in functioning compared to inpatient rehabilitation [5, 7–10]. Health service benefits of homogenous RITH programs include reduced length of acute hospital admission in both stroke [11–13] and orthopaedic populations [5–10], which has been shown to translate into reduced economic costs of treatment [14, 15]. Studies including patients in non-condition specific RITH programs found equivalent functional outcomes compared to inpatient rehabilitation [16, 17]. However, research is sparse compared to studies investigating homogenous populations. Whilst patients in non-condition specific RITH programs spent on average nine days less in hospital, this finding was to be expected with patients discharged earlier to receive rehabilitation at home [16]. The length of stay in home rehabilitation has not been reported, yet may provide insight into the efficiency of RITH compared to inpatient rehabilitation in non-condition specific populations.

Previous studies evaluating RITH in non-condition specific populations captured a broad range of patients, with inclusion criteria limited to age, medical stability, and a lack of availability of other appropriate outpatient services [16–18]. Without understanding the patient profile of RITH services, it is unclear who should be targeted for RITH admission and which factors influence successful RITH outcomes, limiting the ability to determine the most suitable referral pathway for patients. It is plausible that routinely collected variables such as demographic characteristics, comorbidities, carer status and functional levels may influence functional and health service outcomes of heterogenous RITH programs. The Functional Independence Measure (FIM) score of patients at time of admission to rehabilitation services has previously been shown to be a strong predictor of functional improvement and discharge destination [19], and comorbidity measures such as the Charlson Comorbidity Index (CCI) have been shown to predict both mortality risk and the likelihood of hospital re-presentation [20]. However, no study to date has investigated whether these routinely collected variables influence outcomes of non-condition specific RITH programs.

The primary aim of this study was to profile patients admitted to a non-condition specific RITH program. The secondary aim was to explore factors influencing outcomes of a non-condition specific RITH program.

Methods

Study Design and Setting

This study was a retrospective cross-sectional study of patients admitted to non-condition specific RITH program at a metropolitan hospital located in xxxx between May 2017 and March 2019. The RITH program comprised of a multidisciplinary team who provide services to people who have rehabilitation goals residing within the community following initial hospital discharge. This study received ethical approval from the South Western Local Health District's Human Research Ethics Committee (CT06_2019). Informed consent from the patients were not sought due to the retrospective nature of the study.

Patients

Patients who were aged 60 years and older and managed by the RITH team during the period of the study were included in the current study. Patients were deemed eligible for RITH if they were i) deemed medically stable by the rehabilitation clinician, ii) had a safe home environment to conduct rehabilitation sessions including support and equipment, iii) had adequate physical and cognitive function for care in the home as deemed by the medical and occupational therapy teams, iv) resided within the community in the local catchment area and v) had identifiable and achievable rehabilitation goals. Patients who had more than 50% of required data missing from their medical histories were excluded from the study.

Possible explanatory variables

In order to address the aims of the study, a list of routinely collected variables was collated by clinicians within the RITH team (Table 1). These variables included demographic characteristics of patients, health status, the level of social support that patients were receiving prior to hospital admission, functional status at time of admission to rehabilitation and health service related outcomes. The CCI: a risk stratification tool designed to quantify an individual's burden of disease by assigning weighted scores to comorbid conditions was also chosen as one of the possible explanatory variables. The index is associated with mortality risk and is valid, with a good interrater reliability (κ = 0.7, 95%CI = 0.6–0.7) [21, 22]. The Functional Independence Measure (FIM) was also collected at the time of admission to RITH and used as a predictor for rehabilitation outcomes. The FIM is a common functional outcome measure where the level of independence is scored from 1–7 across 18 items covering functional domains such as self-care, transfers, mobility, communication and cognition [23]. The FIM has been validated in different populations who require rehabilitation and has high inter-rater reliability (ICC = 0.89 to 1.00) [23]. The FIM was separated into FIM motor and cognition sub-scores, as these have been found to predict rehabilitation outcomes previously [24–26].

Table 1
List of independent variables

Categories of variables	Types of variables
Demographic characteristics	Age
	Sex
Health status	Charlson Co-morbidity index
	Impairment category as per admission diagnosis
Social support	Living alone (yes/no)
	Have stairs at home (yes/no)
	Previous home modifications (yes/no)
	Carer status (does not require a carer, needs carer but no live-in carer and needs carer and have a live-in carer)
Functional status	Mobility status prior to admission
	• Indoor
	• Outdoor
	• Community mobility
	FIM on admission
	• Motor sub total
	• Cognitive sub total
	• Total
Health service utilisation	Length of stay in acute hospital
	Previous hospital admission within the last 12 months (yes/no)

FIM-Functional Independence Measure

[Insert Table 1]

Outcome variables

The outcomes of RITH were determined by the following three outcomes: i) length of stay in RITH, ii) FIM change, iii) unplanned returns to ED and hospital within 30 days of discharge from RITH. Length of stay and FIM change are outcomes commonly used to benchmark the effectiveness of rehabilitation programs [27]. FIM change is measured by calculating the differences in FIM admission scores and discharge scores [27]. In addition, based on the National Health Performance Framework, hospital performance is also determined by the number of unplanned returns to Emergency Departments (ED) within 30 days of hospital discharge [28].

Data Collection

Data collection was completed using a study-specific data extraction sheet in Microsoft Excel 2016. Prior to commencement of data collection, the data extraction sheet was first piloted by two of the research members to ensure that the extracted data accurately captured the variables included in the study. Following refinement of the data extraction sheet, data collection was completed by the various research members. To ensure that the data was extracted in an accurate and consistent manner, a member of the team audited 20% of the total eligible patients' histories to ensure accuracy of the data extracted [29]. In an instance where a discrepancy was found in the data extraction, a third member of the research team was consulted to resolve the discrepancy. Data related to FIM score and length of stay in rehabilitation were also cross checked against the information extracted from the internal RITH database to ensure accuracy of the outcome variables.

Statistical Analysis

All analyses were performed using IBM SPSS Statistics version 24 [30]. Descriptive statistics were used to analyse the baseline characteristics of patients. The mean and standard deviation were used to describe continuous variables and categorical variables were expressed as a percentage based on frequency.

Statistical analysis began with a univariate regression analysis to identify dependent variables that had a significant correlation to each of the predetermined RITH outcome. In addition, a Kolmogorov-Smirnov test was used to test the normality of the continuous data on outcome variables. In the instance when the data is skewed, a Log transformation will be conducted. Then, all the possible explanatory variables identified were entered into a backwards stepwise regression analysis (linear or logistic, according to the type of outcome variable), to select only those independently related to outcomes. For the purpose of this study, a variable that was deemed independently related to the outcome was defined when the p-value was less than 0.2 [31]. Results for the linear regression were expressed as regression coefficients with 95% confidence intervals while results for the logistic regression were expressed as odds ratio with 95% confidence intervals. Advice from a biostatistician was sought for both the univariate and multivariate regression analyses to ensure that the analyses conducted were robust.

Results

Patient Demographics

A total of 279 patients were treated by the RITH service between May 2017 and May 2019. 49 patients were excluded from the study due to being below 60 years of age and an additional 28 were excluded due to incomplete datasets despite best effort to extract information from electronic medical records. This left a total of 202 patients included for analysis. Baseline characteristics of included patients are presented in Table 2. The mean age of patients was 77.6 years (SD 9.2). There were slightly more female patients as compared to males. In general, most of the patients were admitted to hospital under an orthopaedic related ICD code (41.6%, n = 84), with an average length of stay of 28.6 days in the acute hospital prior to RITH commencement. The mean CCI score was 4.7 with as many as 63.4% of the patients (n = 128) having at least three comorbidities as listed on the CCI. Half of the included patients had at least one hospital admission in the 12 months prior to the current hospital admission. From the social demographics, most of the patients were living at home alone (73%) and many (60%) did not require any assistance from a carer pre-admission. Functionally, the majority of the patients were able to ambulate independently indoors and outdoors, with 50% of patients able to participate in activities such as shopping in the community independently.

Table 2
Demographic Characteristics of RITH Patients

Patients	N = 202
Age (years), mean (SD)	77.6 (9.2)
Gender, n(%)	
Males	85 (42.1)
Females	117 (57.9)
Impairment Code, n(%)	
Neurological	35 (17.3)
Musculoskeletal	84 (41.6)
Deconditioning	65 (32.2)
Other	17 (8.4)
Acute LOS (days), mean (SD)	28.6 (33.1)
CCI, mean (SD)	4.7 (1.9)
Lives alone, n(%)	
Yes	147 (72.8)
No	51 (25.2)
Carer Status, n(%)	
No Carer	120 (59.4)
Carer (not live in)	13 (6.4)
Carer (live in)	69 (34.2)
Previous home modifications, n(%)	
Yes	71 (35.1)
No	127 (62.9)
Missing data	4 (2.0)
Stairs at home, n(%)	
Yes	144 (71.3)
No	54 (26.7)
Missing data	4 (2.0)
Indoor mobility status, n(%)	
Require assistance	17 (8.8)
Independent with gait aid	71 (36.6)
Independent with no aid	104 (53.6)
Missing data	5 (2.5)
Outdoor mobility status, n(%)	
Require assistance	21 (10.4)
Independent with gait aid	68 (33.7)
Independent with no aid	108 (63.5)
Missing data	5 (2.5)

SD = Standard Deviation, Impairment codes based on Australian health standards impairment codes, LOS = length of stay, CCI = Charlson Comorbidity Index, FIM = Functional Independence Measure

Patients	N = 202
FIM scores on admission, mean (SD)	
Motor	69.5 ± 12.9
Cognitive	32.8 ± 3.9
Total	101.9 ± 15.6
Previous hospital admission, n(%)	
Yes	94 (48.5)
No	96 (49.5)

SD = Standard Deviation, Impairment codes based on Australian health standards impairment codes, LOS = length of stay, CCI = Charlson Comorbidity Index, FIM = Functional Independence Measure

[Insert Table 2]

Length of stay in RITH

The average length of stay (LOS) in RITH was 11.75 days (SD = 6.09). Due to the fact that the LOS in RITH was not normally distributed (D(df) = 0.14(275, $p < 0.01$), the regression analysis was performed using a Log transformation of RITH LOS data to reduce skewness. In the univariate analysis, factors such as CCI and acute hospital LOS had a significant correlation ($p < 0.05$) with length of stay in RITH (Table 3). Age, CCI, acute hospital LOS and home modifications were independent factors that correlated significantly ($p < 0.05$) to length of stay in the multivariate-regression analysis (Table 3), when analysis was adjusted in accordance to age, CCI, acute hospital LOS, FIM motor score on admission, previous home modifications and indoor mobility status.

Table 3
Factors influencing RITH LOS in regression analysis

Unadjusted					Adjusted		
Variables		**Regression coefficient**	**P-value**	**95%CI**	**Regression coefficient**	**p-value**	**95%CI**
Age		1.002	0.644	-1.006 to 1.011	*1.014	0.006	1.005 to 1.026
CCI		-1.071	*0.004	-1.124 to 1.023	*-1.086	< 0.001	-1.140 to -1.035
Acute Hospital LOS		1.005	*0.005	1.002 to 1.006	*1.005	< 0.001	1.002 to 1.007
FIM motor admission		-1.0046	0.285	-1.012 to 1.002	-1.007	0.060	-1.014 to 0.000
FIM total admission		-1.002	0.328	-1.009 to 1.002			
Sex	Male ref Female	-1.127	0.188	-1.349 to 1.062			
Lives alone		1.096	0.938	-1.216 to 1.236			
Stairs		-1.021	0.837	-1.247 to 1.197			
Home modifications		-1.197	0.056	-1.442 to 1.005	*-1.262	0.015	-1.521 to -1.047
Indoor mobility status	Indep with gait aid ref unable	-1.358	0.231	-2.242 to 1.216	-1.285	0.356	-2.188 to 1.324
	Indep with nil aid ref unable	-1.271	0.337	-2.065 to 1.282	-1.057	0.840	-1.807 to 1.618
Outdoor mobility status	Assist by 1 ref unable	-1.042	0.882	-1.807 to 1.663			
	Indep with aid ref unable	1.067	0.770	-1.435 to 1.629			
	Indep with nil aid ref unable	1.086	0.700	-1.396 to 1.644			
Community mobility	Assist by 1 ref unable	1.069	0.607	-1.208 to 1.384			
	Indep with aid ref unable	1.045	0.778	-1.300 to 1.422			
	Indep with nil aid ref unable	1.042	0.719	-1.205 to 1.309			
Previous hospital admission		1.002	0.980	-1.191 to 1.196			
Impairment codes	Neuro ref Others	1.084	0.67	-1.337 to 1.567			
	Ortho ref Others	1.300	0.123	-1.074 to 1.811			
	Re-conditioning ref Others	1.076	0.67	-1.306 to 1.514			
Carer status	Do not need carer vs Needs carer, not living together	1.321	0.137	-1.091 to 1.905			

LOS = length of stay, CCI = Charlson Comorbidity Index, FIM = Functional Independence Measure, denote significant independent factor where p < 0.05*

Unadjusted					Adjusted
	Do not need carer vs carer lives in	1.023	0.805	-1.180 to 1.239	

LOS = length of stay, CCI = Charlson Comorbidity Index, FIM = Functional Independence Measure, denote significant independent factor where p < 0.05*

[Insert Table 3]

Fim Change

The mean FIM change among patients was 10.5(SD = 9.2). In the univariate analysis, factors such as CCI, FIM motor score on admission, and FIM total admission scores were independently correlated to FIM change (Table 4). Age, CCI, the presence of home modifications, outdoor mobility status and carer status were found to have significant associations with FIM change in the multivariate analysis when adjusted in accordance to age, CCI, the presence of home modifications, outdoor mobility status and carer status (Table 4).

Table 4
Factors influencing FIM change in regression analysis

Unadjusted					Adjusted			
Variables		Regression coefficient	P-value	95%CI	Regression coefficient	p-value	95%CI	
Age		0.027	0.703	-0.112 to 0.166	*0.142	0.035	0.010 to 0.274	
CCI		-0.714	*0.038	-1.388 to -0.04	*-0.936	0.003	-1.561 to -0.312	
Acute Hospital LOS		-0.010	0.607	-0.050 to 0.029				
FIM motor admission		-0.270	*<0.001	-0.361 to -0.18				
FIM total admission		-0.207	*<0.001	-0.288 to -0.126				
Sex	Male ref Female	-1.154	0.375	-3.703 to 1.395				
Lives alone		-1.707	0.252	-4.628 to 1.214				
Stairs		1.195	0.415	-1.678 to 4.069				
Home modifications		-1.328	0.331	-4.004 to 1.348	*-2.871	0.015	-5.177 to -0.566	
Indoor mobility status	Indep with gait aid ref unable	3.787	0.302	-3.409 to 10.983				
	Indep with nil aid ref unable	4.766	0.180	-2.203 to 11.735				
Outdoor mobility status	Assist by 1 ref unable	1.40	0.732	-6.602 to 9.402	*8.762	0.012	1.892 to 15.633	
	Indep with aid ref unable	5.079	0.100	-0.981 to 11.14	*12.120	< 0.01	6.698 to 17.542	
	Indep with nil aid ref unable	4.393	0.145	-1.522 to 10.307	*13.432	< 0.01	7.890 to 18.974	
Community mobility status	Assist by 1 ref unable	0.871	0.645	-2.838 to 4.580				
	Indep with aid ref unable	0.800	0.723	-3.621 to 5.221				
	Indep with nil aid ref unable	0.289	0.863	-2.988 to 3.576				
Previous hospital admission		-1.121	0.385	-3.651 to 1.409				
Impairment codes	Neuro ref Others	-5.471	0.045	-10.808 to -0.133				
	Ortho ref Others	-3.296	0.175	-8.074 to 1.483				

LOS = length of stay, CCI = Charlson Comorbidity Index, FIM = Functional Independence Measure, denote significant independent factor where p < 0.05*

Unadjusted					Adjusted		
	Re-conditioning ref Others	-4.10	0.10	-8.994 to 0.795			
Carer status	Do not need carer vs Needs carer, not living together	-4.721	0.074	-9.903 to 0.461	*-5.990	0.010	-10.555 to -1.425
	Do not need carer vs carer lives in	-0.272	0.843	-2.966 to 2.422	-1.661	0.218	-4.301 to 0.979

LOS = length of stay, CCI = Charlson Comorbidity Index, FIM = Functional Independence Measure, denote significant independent factor where p < 0.05*

[Insert Table 4]

Ed Re-presentation Within 30 Days Of Discharge From Rith

Nineteen percent of the patients (n = 39) discharged from the RITH program re-presented to the ED within 30 days of discharge from RITH. Length of stay in the acute hospital, the presence of home modifications and carer status were independent variables that significantly correlated to ED presentations in the univariate analysis (Table 5). When adjusted for CCI, acute hospital LOS, FIM motor scores on admission, gender, the presence of home modifications, community mobility status, impairment code and carer status in the multivariate analysis, variables such as acute hospital LOS, presence of home modification and carer status were shown to have a significant association with ED re-presentations (Table 5). Patients who needed a carer but did not have one living together with them were 11.5 times (95% CI = 2.488 to 53.1) more likely to present to ED within 30 days of discharge as compared to patients who did not need a carer.

Table 5
Factors influencing ED presentations following discharge from RITH in regression analysis

Unadjusted					Adjusted		
Variables		**Regression coefficient**	**p-value**	**95%CI**	**Regression coefficient**	**p-value**	**95%CI**
Age		1.014	0.469	0.976 to 1.055			
CCI		1.142	0.136	0.959 to 1.359	1.163	0.190	0.928 to 1.459
Acute Hospital LOS		0.973	*0.024	0.949 to 0.996	*0.951	0.001	0.923 to 0.980
FIM motor admission		0.981	0.150	0.956 to 1.007	0.965	0.060	0.930 to 1.001
FIM total admission		0.980	0.051	0.960 to 1.00			
Sex		0.756	0.440	0.372 to 1.537	0.478	0.110	0.194 to 1.181
Lives alone		0.923	0.845	0.411 to 2.069			
Stairs		1.36	0.436	0.628 to 2.946			
Home modifications		0.452	*0.032	0.219 to 0.933	*3.273	0.013	1.285 to 8.335
Indoor mobility status			0.264				
	Assist by 1 ref indep with no aid	0.881	0.909	0.101 to 7.698			
	Indep with aid ref Indep with no aid	1.844	0.110	0.871 to 3.905			
Outdoor mobility status			0.891				
	Unable to do ref indep with nil aid	1.171	0.849	0.230 to 5.957			
	Assist by 1 ref indep with nil aid	1.757	0.436	0.426 to 7.241			
	Indep with aid ref indep with nil aid	1.107	0.798	0.507 to 2.419			
Community mobility			0.144				
	Asst by 1 ref unable to do	0.365	0.079	0.119 to 1.123	0.829	0.801	0.192 to 3.578
	Indep with aid ref unable to do	0.254	0.089	0.053 to 1.229	0.175	0.075	0.026 to 1.195
	Unable to do ref indep with nil aid	0.842	0.685	0.368 to 1.930	1.652	0.416	0.492 to 5.542
Previous hospital admission		2.606	0.012	1.231 to 5.518	2.025	0.135	0.803 to 5.106
Impairment codes			0.317				
	Neuro ref Others	0.306	0.091	0.077 to 1.206			

LOS = length of stay, CCI = Charlson Comorbidity Index, FIM = Functional Independence Measure, denotes significant independent factor where p < 0.05*

Unadjusted					Adjusted		
	Ortho ref Others	0.372	0.092	0.118 to 1.173			
	Re-conditioning ref Others	0.458	0.190	0.143 to 1.470			
Carer status			*0.011				
	Needs carer,not living together vs do not need carer	5.775	*0.004	1.754 to 19.013	*11.497	0.002	2.488 to 53.120
	Carer lives in vs do not need carer	0.939	0.878	0.420 to 2.908	0.648	0.464	0.202 to 2.073

LOS = length of stay, CCI = Charlson Comorbidity Index, FIM = Functional Independence Measure, denotes significant independent factor where p < 0.05*

[Insert Table 5]

Discussion

The results from this study suggest that the typical older adult undergoing rehabilitation in a non-condition specific RITH program is 78 years of age with at least three co-morbidities and one previous hospital admission within the preceding 12 months. In addition, patients undergoing rehabilitation via RITH had generally high levels of function and cognition, and tended to live alone. Patients in the RITH program had an average of 12 days LOS and achieved an average of 10-point improvement in their FIM motor scores. Approximately one in five patients undergoing RITH had an unplanned ED representation within 30 days of hospital discharge. The need to have previous home modifications and the CCI were two factors that were associated with all three rehabilitation outcomes. These findings suggest that such routinely collected variables may be used to identify patients who are best suited for RITH and in return improve the efficacy of the service.

One of the most surprising findings from our study is the importance of carer status and home environment in influencing outcomes in RITH. The use of these factors may improve patient selection to improve the efficacy of RITH, as has been shown in other rehabilitation settings [32]. While previous studies evaluating the effectiveness of rehabilitation did find living arrangements, such as live-in social supports, to be an independent predictor of rehabilitation outcomes [25, 33], these studies did not breakdown which aspects of living arrangements and home environment impacted on rehabilitation outcomes. As shown in the results from the current study, both social and living environments played an integral role in influencing outcomes of RITH, suggesting that the patient's social and living environment may be a more sensitive measure than other previously thought factors such as FIM scores. FIM motor scores on admission are frequently identified as an independent factor in influencing length of stay and discharge destination following rehabilitation [24–26, 34, 35]. Contrary to current literature, where FIM motor scores have been found to be associated with length of stay and ED representations following RITH, they were not a significant predictor for these outcomes in the current study. High average FIM scores on admission among patients included in this study may have limited the potential of improving FIM scores on discharge and the impact on length of stay and ED representations, which in turn may suggest that FIM admission scores may not be the most important factor in influencing rehabilitation outcomes for programs like RITH that are already targeting people with high levels of independence in their daily activity. Future studies may evaluate the association of caring arrangements and previous home modifications on rehabilitation outcomes for inpatient rehabilitation services where there is a lower functional baseline of admitted patients.

There are a number of previous studies which have identified that age, CCI and acute hospital LOS were found to be independent predictors of rehabilitation outcomes for people following hip fractures, strokes and traumatic brain injuries [33, 36]. Conversely, our study found that patients with a lower CCI had a longer stay in rehabilitation as compared with patients with higher CCI scores. Patients with a better health status may have stayed longer in rehabilitation in the current study due to having more rehabilitation goals to achieve in order to return back to pre-morbid function. The emergence of such findings also highlights the relevance of length of stay as a measure of outcome for rehabilitation. While length of stay of rehabilitation has been often deemed as an important indicator of the efficiency of a service [38], having a shorter length of stay in rehabilitation may be counterintuitive to the aim of rehabilitation, which is to assist people to regain pre-morbid function. Apart from focusing on length of stay, health executives should also pay attention to patient's functional gain as measured using objective outcome measures like FIM when evaluating the effectiveness of rehabilitation, even though this can be challenging for many health services.

Other than suggesting the importance of assessing care arrangements and previous home modifications when ascertaining suitability of patients to participate in RITH, the results have also highlighted the importance of supporting an individual at home following rehabilitation. While as many as one in five people who completed RITH had an unexpected ED re-presentation, the reasons for these ED re-presentations were mostly associated with the lack of support available at home. Appropriate case management offered after the conclusion of rehabilitation may reduce the rate of ED re-presentations and the overall health service burden, as supported by the findings of a recently published systematic

review which found that community-based case management reduces the likelihood of an ED presentation among older people living in the community [39].

Study Limitations

The large sample size of the study enabled sufficient statistical power for statistical analyses, however, the distribution of data for some of the variables such as FIM cognition subscore at time of admission limited the possibility of adding it to the analysis. This was likely due to the nature of the RITH program where it tends to take on patients of higher level of function, meaning less variances in scores. Further, the heterogeneity of admitted patients improves the external validity to other non-condition specific RITH services. The retrospective nature of this study may also impact on the accuracy of the data extracted from the histories, as it is plausible that missing data from the medical histories were actually collected by the clinician but not documented in the medical history. Lastly, the findings from this study was limited to only one RITH service. Future research should consider including more study sites to evaluate if the findings can be generalised to a wider population.

Conclusion

Factors such as age, acute hospital LOS, function on admission to RITH and previous home modifications influence outcomes of non-condition specific RITH programs. A knowledge of these factors may assist rehabilitation clinicians when choosing patients to admit to RITH services, and how to highlight areas of focus and provide further guidance for goal setting and intervention. Further research may seek to determine whether these results are generalisable to other rehabilitation and healthcare settings with varied patient populations.

Abbreviations

RITH- Rehabilitation In The Home

ED- Emergency Department

CCI- Charlson Comorbidity Index

FIM- Functional Independence Measure

LOS- Length of Stay

Declarations

Ethics approval and consent to participate

This study was reviewed by the South Western Sydney Local Health District Human Ethics Committee and determined to be of a “low-risk ethics project” (CT06_2019). Written informed consent from the study population was waived because of the retrospective nature of this study. The reporting of this study is in accordance to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

Consent for publication

Not applicable.

Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files].

Competing interest

The Authors declare that they have no competing interests.

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Author contributions

All authors were involved in the design of the study. LS, TN, CC, CT and JM oversaw patients in the clinical setting including collecting and collating patient data, MD, CT, DT analysed the data and interpreted the findings, and MD, DT, CT contributed to writing of the manuscript, with

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