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Research

A randomised controlled trial of an exercise intervention to reduce functional decline and health service utilisation in the hospitalised elderly

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Objective: *Functional decline is experienced by up to 50% of older hospitalised patients and is associated with increased institutionalisation, mortality and length of stay (LOS). We aimed to determine the effectiveness of an exercise program in reducing functional decline and health service utilisation in older inpatients.*
Methods: *A single-blinded randomised controlled trial was conducted in a tertiary metropolitan hospital involving 180 acute general medical patients aged ≥ 65 years. In addition to usual physiotherapy care, the intervention group performed an exercise program for 30 minutes, twice daily, with supervision and assistance. Change in physical function was measured by the modified Barthel index (mBI). Analysis was done on an intention-to-treat basis.*
Results: *When admission mBI scores were low, there was a greater improvement in mBI scores in the intervention group compared with the control group. The intervention group had a shorter total LOS (Hazard ratio (HR) 1.46 (95%CI 1.04–2.05);* P = *0.026).*

Key words: *activities of daily living, aged, exercise, inpatients, length of stay.*

Introduction

The profile of the acute public hospital is changing. Half of all acute hospital beds are occupied by people over 65 years of age [1]. Older patients are especially at risk in an acute hospital because they are susceptible to the detrimental effects of hospitalisation such as functional decline (defined as '*reduced ability to perform tasks of everyday living because of a decrement in physical and/or cognitive functioning*' [2]), which can occur as early as day 2 of hospitalisation [3].

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Observational studies have shown that poor functional outcomes reduce the quality of life of many older people and increase health costs and demands on the health system. Between 34 and 50% of older hospitalised patients experience functional decline [3,4], and it has been described as a leading complication of hospitalisation for older patients [2]. It has been found that almost one-third of older adults hospitalised for medical illness declined in their ability to perform activities of daily living, and only half had recovered by 3 months post-discharge [5]. Mahoney (1998) reported that one in six older adults became newly dependent in walking with hospitalisation and nearly one-third continued to be dependent 3 months later [6].

Maintenance of strength through exercise is an important factor in preventing functional decline and maintaining independence. The rate of loss of muscle strength may be as high as 5% per day with inactivity and is greater in the lower limbs than in the upper limbs [7]. If strength can be maintained through exercise, above the threshold required to perform an activity then independence can be maintained [8,9].

Interventional studies that have investigated the effects of exercise programs on community dwelling and institutionalised older people have demonstrated improved outcomes in muscle strength and functional measures [10–12].

Interventional studies in the rehabilitation and subacute hospital setting that have investigated the effects of targeted multicomponent falls prevention programs – with an exercise program component – in addition to usual care, have had mixed results [13,14]; however, one study demonstrated a reduced incidence in falls and fewer falls related injuries in the intervention group [14]. A study in the acute hospital setting demonstrated improved functional outcomes following an exercise program implemented in hospital and continued at home, but failed to show any reduction in length of stay [15].

Enforced bed rest is a function of hospital design because of the bed-based model of care in most acute hospitals. Functional status and well-being are highly valued by patients, therefore they should be essential outcomes of medical care [16].

Objectives

The objectives of this study were to implement an exercise program in addition to usual care (which may have included physiotherapy intervention), in the acute setting with elderly general medical patients and to determine if such a program

improves functional outcomes and reduces health service utilisation using a randomised controlled trial design.

Methods

Participants

The study assessor screened all general medical admissions to the general medical wards at Royal Melbourne Hospital, Australia, between May 2003 and March 2004. All patients who were aged 65 years and over and gave informed consent were eligible for inclusion into the study. We excluded patients who were: admitted from a nursing home or who were receiving nursing home level of care at home; medically unstable or where mobilisation was contraindicated by the treating medical team; admitted to the delirium management unit; non-weight bearing; not assessed within 48 hours of admission; assessed as requiring palliative care; admitted to hospital with a diagnosis known to cause functional impairment (for example a lower limb fracture or a stroke); or who had an expected length of stay less than 24 hours as documented in the patient's medical record.

Ethics approval

The protocol was approved by the Melbourne Health research ethics committee.

Recruitment

The study assessor (a physiotherapist) collected baseline measurements on all patients recruited into the trial via an interview and physical assessment. Baseline measurements included: age, sex, marital status, primary language, residence prior to admission, nutritional status using the Mini Nutritional Assessment – Short Form (MNA-SF) [14], length of time spent in the emergency department, Charleson comorbidity score [15], 15-item geriatric depression score (GDS) [16], abbreviated mental test score (AMTS) [17], self-rated health score, smoking status and functional measures (described below).

Randomisation and allocation concealment

The allied health assistant (AHA), individually randomly allocated each patient to receive either the exercise intervention or the usual care. While the random number sequence was not concealed, the AHA was not able to influence the allocation of patients as they had no knowledge of the outcomes of the baseline assessment and had no clinical contact with the patient prior to randomisation. To ensure approximately equal numbers of patients in each group, a block randomisation sequence was generated using a computer-generated random numbers table with block sizes of 10. Allocation was concealed from the study assessor who was blind to participants' group allocation for the duration of the study. While discharge measures were conducted on the ward and therefore there was a possibility that the study assessor would see the AHA providing the intervention to patients (thus unblinding the assessor to that patient's group allocation), this was unlikely to occur as the AHA would page the study assessor to the ward only when a discharge assessment was required. The study assessor did not have clinical contact with the patients outside of the admission and discharge assessments.

The intervention

Patients randomised to the intervention group were assigned to one of four levels of an exercise program depending on their functional status as assessed at baseline (Table 1). The exercise program was carried out twice daily by the patient with the supervision and assistance of the AHA. The exercise programs were tailored to the individual's ability, consisted predominantly of strengthening and mobility exercises and were designed to be carried out in a hospital setting, that is, they did not require a large space or expensive or specialised equipment. A brief outline of the content of each of the four levels of the exercise program is provided in Table 1. Full details of the exercise programs can be provided by the authors on request. The amount of time (in minutes) spent by the patient participating in the program was recorded.

Patients randomised to the control group received 'usual care' which included medical, nursing and allied health intervention and discharge planning consistent with the patient's diagnosis and resources available on the acute general medical wards. Both groups continued to receive 'usual' physiotherapy interventions. The exercise intervention was provided in addition to the physiotherapy the patient may have received. The exercise intervention differed to 'usual' physiotherapy intervention in both the frequency and the duration of the therapy sessions

Table 1: Criteria for assignment to and description of each of the four levels of the exercise program

Functional level as assessed by the study assessor (physiotherapist)	Exercise program
1 Patient is unable to transfer out of bed without moderate to maximum assistance and has poor static and dynamic sitting balance (unable to sit independently).	Level 1. Bed exercise program includes targeted lower limb, upper limb and abdominal strengthening exercises in supine position and sitting balance exercises.
2 Patient can transfer out of bed with minimal assistance, has independent sitting balance and poor static and dynamic standing balance (unable to stand independently). Patient is unable to walk without assistance.	Level 2. Sitting exercise program includes targeted lower limb, upper limb and abdominal strengthening exercises in sitting position, sit to stand exercises, marching on the spot and standing balance exercises.
3 Patient can transfer independently or with supervision. Patient has independent standing balance, can walk with supervision or is independent but has poor endurance. Unable to ascend/descend flight of stairs.	Level 3. Standing exercise program includes targeted lower limb, upper limb and abdominal strengthening exercises in standing position, sit to stand exercises, step up exercises, standing balance exercises and ambulation.
4 Patient is independent with transfers and gait and has high level balance skills. Patient can do stairs with minimal assistance/supervision.	Level 4. Stairs exercise program includes targeted lower limb, upper limb and abdominal strengthening exercises in standing position, step up exercises and walking up flight of stairs, standing balance exercises and ambulation.

(the specific role of the AHA was the provision of exercise to the study patients and therefore they had more time to dedicate to each patient than a physiotherapist) but also in the content of the therapy sessions (the exercise intervention focused on targeted strength, balance and functional exercises whereas usual care physiotherapy in an acute medical ward is weighted more heavily towards assessment and planning for discharge).

Outcomes

The primary outcome was the change in the modified Barthel index (mBI) [18]. The mBI is a validated and reliable modified version of the Barthel index which is measured on a 5-point rather than a 3-point scale which has been shown to improve the sensitivity of the scale. The mBI measures an individual's performance in 10 self-maintenance tasks that are relevant to the older population; personal hygiene, bathing, feeding, toileting, stair climbing, dressing, bowel and bladder control, ambulation or wheelchair mobility and chair/bed transfers. Each task is assigned a value according to the amount of assistance required. The maximum score is 100 and the minimum score is zero with a higher score indicating greater function/less dependency.

The timed up and go (TUG) test is a validated and reliable measure of functional capacity incorporating aspects of mobility, strength and balance and involves measuring the time taken (in seconds) for the patient to rise from a chair, walk a distance of 3 m, turn and walk back to the chair [19]. If the patient is unable to complete the test they are rated as 'unable' and do not receive a score.

Both the mBI and the TUG were measured by the study assessor within 48 hours of admission and 24 hours of discharge from the ward.

Other outcome measures assessed at discharge were: discharge destination and length of stay (LOS), measured using hospital administration data and adverse events (defined as a fall, death or deterioration) collected from the patient's medical record.

Statistical methods

Sample size calculations were performed based on randomisation at the level of individual patients. It was estimated that the required sample size was 126 participants for the study to have 90% power to detect a 10-point improvement (considered clinically significant) in the mBI score, assuming a standard deviation of 17.3 based on pilot study data, with an alpha level of 0.05.

The results were analysed using an 'intention-to-treat' analysis. The primary outcome was improvement in mBI from admission to discharge, where high scores indicate greater improvement while a score of zero indicates no change. Similarly, change in TUG times was calculated for each patient, and again higher scores indicated greater improvement (reduction in time to complete TUG). The majority of outcome data did not meet the assumption of normality, as defined by visual inspection of their distribution and the Shapiro–Wilk test. The non-parametric Mann–Whitney *U*-test was used to perform univariate comparisons between groups, with the exception of total LOS where Cox regression was used. The effect of group on change in mBI was analysed using multiple linear regression techniques. Potential confounding variables (admission mBI, age, sex, marital status, English as primary language, residence prior to admission, Charleson comorbidity score, GDS and AMTS) were entered into the initial model if they had a univariate *P*-value of 0.20 or less. A manual backwards elimination process was applied until all variables with a *P*-value of greater than 0.05 were removed to obtain a preliminary model. If there was evidence of confounding with the group allocation (greater than 15% variation in the coefficient for group) the variable was retained. All variables were given a final opportunity to enter the model, and were retained if they had a *P*-value of less than 0.05 in the adjusted model.

Because of potential floor and ceiling effects associated with mBI (maximum score of 100 and minimum of 0), it was planned to test if the effect of the intervention was influenced by the admission mBI (interaction between group and admission mBI). Because of marked heteroscadasticity in the change in mBI scores (large variation at low baseline mBI scores, with little variation at high baseline mBI scores) robust regression techniques were used. The effect of group on total LOS (acute and subacute LOS) was analysed using Cox regression. The covariates mentioned above were also considered in this model, as well as admission TUG scores. Stata release 8 was used for all data analysis.

Results

To achieve the required 126 patients with complete data at discharge, a total of 160 patients were recruited into the trial. Withdrawal as a result deterioration in medical status and admission to the intensive care unit (ICU) occurred in 6.3% of patients in the intervention group (5/80) and 1.3% of the control group (1/80) ($P = 0.096$); 5.0% of the intervention group (4/80) and 2.5% of the control group (2/80) died ($P = 0.405$); and 10.0% of the intervention group (8/80) and 17.5% of the control group (14/80) were lost to follow-up, that is, they were discharged from hospital before the follow-up assessment was completed ($P = 0.168$). Of the intervention group, 6.3% (5/80) were non-compliant, that is, they participated in the intervention less than half of the time because they either declined or were unable to participate. A total of 121 patients completed the trial as planned and a total of 160 patients were included in the analysis. Figure 1 shows the trial profile.

Baseline factors were equivalent between the two groups with a number of important exceptions (Table 2). Patients in the intervention group were less likely to live in some form of supported accommodation, had a greater median admission mBI and were more often able to complete the TUG test. These results suggest that at baseline, the intervention group was more highly functioning than the control.

Figure 1: Trial profile – CONSORT diagram showing the flow of participants through each stage of the trial.

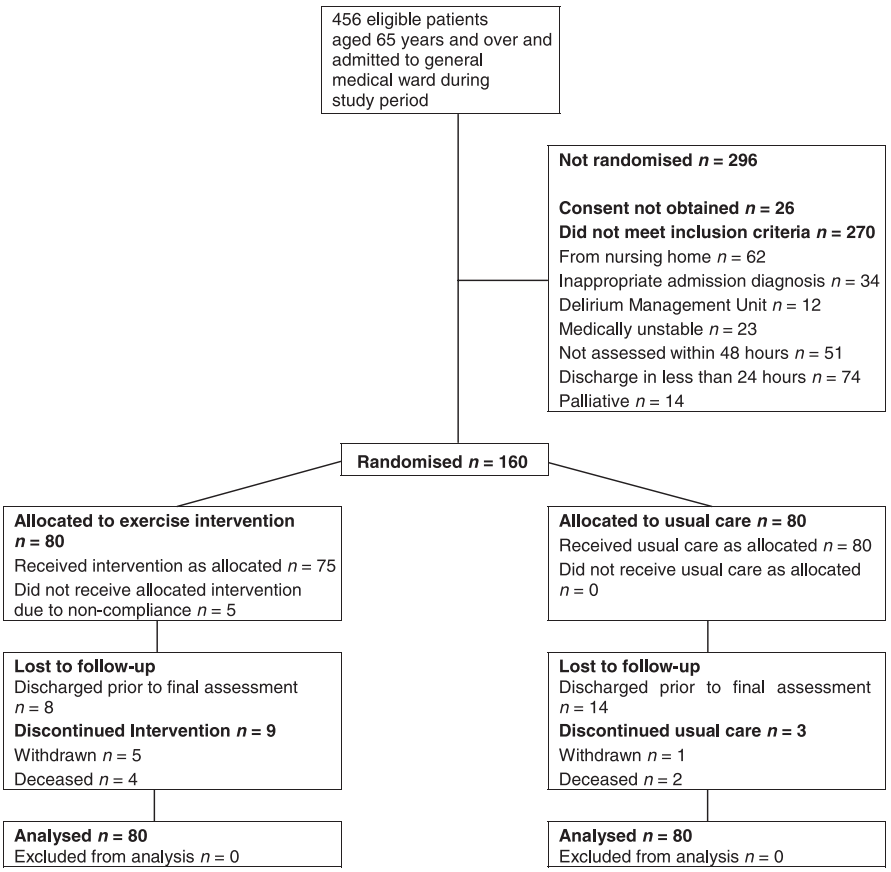


Table 2: Comparison between the control and intervention groups at baseline

Characteristic	Control ($n = 80$)	Intervention ($n = 80$)
Mean age (SD)	82.9 (7.6)	81.9 (8.0)
Sex (% female)	61.3	53.8
Marital status (% married)	77.5	71.3
% English speaking	85.0	87.5
Previous accommodation		
% Home	76.3	88.8
% Other (hostel, supported accommodation, rehabilitation facility or other hospital)	23.8	11.3
Nutritional status (% possible malnutrition)	95.0	96.3
LOS in emergency department		
% who spent 0 day	65.0	57.5
1 day	32.5	33.8
2 days	2.5	8.8
Median Charelson score (IQR)	2 (1–3)	2 (1–3)
Cognition (% ≤ 6 on AMTS)	37.5	30.0
Median AMTS (IQR)	7 (5.5–8.0)	8 (6.0–9.0)
Depression (% ≥ 6 on GDS)	66.3	65.0
Mean GDS (SD)	6.8 (3.0)	6.5 (2.9)
Median self-rated health from 1 to 5 (IQR)	3 (2–4)	3 (2–3)
Smoker		
Current (%)	43.8	38.8
Previous (%)	47.5	55.0
Never (%)	8.8	6.3
Median modified Barthel index (IQR)	61 (40.5–82.5)	71 (51.5–83.0)
Median time to complete TUG in seconds [n = number completing TUG] (IQR)	21.50 [$n = 34$] (16.9–25.9)	24.20 [$n = 47$] (15.8–37.3)

AMTS, abbreviated mental test score; GDS, 15-item geriatric depression score; IQR, interquartile range; LOS, length of stay; TUG, timed up and go.

Table 3: Univariate analysis of outcomes

Outcome	Control	*n*	Intervention	*n*	*P*-value
Change in modified Barthel index – median (IQR)	9 (2,22)	63	11 (3,22)	63	0.548
Change in TUG (decrease in seconds) – median (IQR)	1.2 (–0.9,4.3)	24	5.4 (1.0,12.4)	39	0.012*
LOS in acute care – median (IQR)	8 (5,11)	77	8 (4,12)	71	0.575
LOS in subacute care – median (IQR)	14 (11,19)	32	13 (8.5,17)	20	0.266
Total LOS* (acute plus subacute) – median (IQR)	11 (6,21)	77	9 (4,16)	71	0.097
Total LOS* (acute plus subacute) – HR (95%CI)	1.32 (0.95–1.84)				0.094
Discharge destination *n* (%)					
Home alone	7 (9.1%)	77	11 (15.5%)	71	
Home with other	26 (33.8%)	77	32 (45.1%)	71	
Subacute care	32 (41.6%)	77	20 (28.2%)	71	
Nursing home/wait nursing home bed	1 (1.3%)	77	1 (1.4%)	71	
Hostel or supported accommodation	8 (10.4%)	77	5 (7.0)	71	
Other	3 (3.9%)	77	2 (2.8%)	71	

*$P < 0.05$.
HR, hazard ratio; IQR, interquartile range; LOS, length of stay; TUG, timed up and go.

Usual care and time spent in the intervention

The control group received a median of 90 minutes (interquartile range (IQR) 42.5–232.5 minutes) of 'usual care' physiotherapy intervention during their acute LOS and the intervention group received a median of 100 minutes (IQR 37.5–225 minutes) ($P = 0.903$). In addition, the intervention group spent a median of 160 minutes (IQR 120–360 minutes) participating in the exercise intervention.

Functional outcome measures

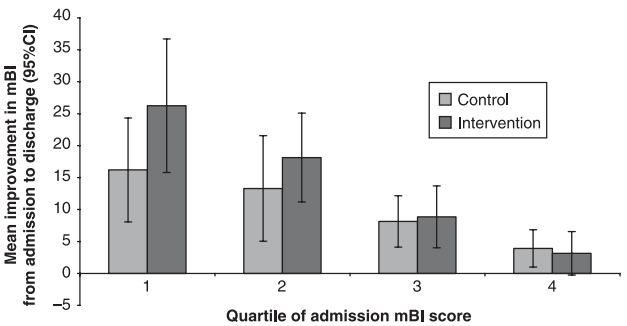
Both admission and discharge mBI scores were available for 78.8% of patients (126/160). The remaining 21.3% (34/160) had missing discharge mBI scores because of withdrawal, loss to follow-up or death (Figure 1). Univariate results show that there was no evidence that the exercise intervention was associated with a greater improvement in mBI than usual care (median difference = 2, $P = 0.548$) (Table 3). However, multivariate analysis of change in mBI (after adjusting for confounders outlined in Table 4), demonstrated a significant interaction effect between group and admission mBI ($P = 0.024$), that is, when admission mBI scores were low, there was a greater improvement in mBI scores in the intervention group compared with the control group. This effect diminished with increasing admission mBI score. This effect has been visualised by plotting the improvement in mBI associated with each group, according to quartiles of admission mBI as follows; ≤ 48, 49–69, 70–83 and > 83 (Figure 2).

Table 4: Multivariate predictors of change in modified Barthel index

Variable	Coefficient	SE	*P*-value	95% confidence interval	
Group	19.08	6.27	0.003*	6.68	31.49
Admission Barthel†	0.44	1.38	0.747	−2.29	3.18
Interaction	−0.23	0.09	0.014*	−0.41	−0.05
Constant	22.50	3.77	0.000*	15.04	29.95

*$P < 0.05$.
†Odds ratios for admission Barthel score have been rescaled to represent the change in odds for a 10-unit change.

Figure 2: Effect of an exercise intervention on improvement in modified Barthel index (mBI) score, according to quartile of admission (mBI) score.



Quartile 1 = mBI (modified Barthel index) ≤ 48, Quartile 2 = mBI 49–69, Quartile 3 = mBI 70–83, Quartile 4 = mBI > 83.

Both admission and discharge TUG scores were available for only 39.4% of patients (63/160). Discharge TUG scores were missing in 21.3% (34/160) because of withdrawal, loss to follow-up, or death and the remaining 39.4% (63/160) were unable to complete the TUG either on admission or on discharge and therefore a change score could not be calculated.

In the limited number of patients who were able to perform the TUG at both admission and discharge, univariate analysis revealed that the intervention was associated with a greater reduction in time to complete the task; median difference = 4.2 seconds, $P = 0.012$ (Table 3). After adjusting for confounders the intervention was only associated with a trend towards improving TUG score by 2.01 seconds (95%CI −0.26, −4.29, $P = 0.081$) (Table 5).

Health-care utilisation outcomes

Health-care utilisation data were not included in the analysis for 3.8% (3/80) of the control group and 11.3% of the intervention group (9/80) because they had died or were withdrawn.

Table 5: Multivariate predictors of change in 'timed up and go' (TUG) score

Variable	Coefficient	SE	*P*-value	95% confidence interval	
Group	2.01	1.14	0.081	−0.26	4.29
Admission TUG	0.56	0.03	0.000*	0.49	0.63
Gender	2.46	1.10	0.029*	0.26	4.66
Constant	−14.68	2.43	0.000*	−19.55	−9.81

*$P < 0.05$.

Table 6: Multivariate predictors of need for geriatric rehabilitation

Variable	OR	SE	*P*-value	95% confidence interval	
Group	0.55	0.25	0.19	0.22	1.35
Admission Barthel†	0.62	0.07	0.00*	0.50	0.78
Age†	3.20	1.08	0.00*	1.66	6.19
Home with other vs home alone	0.15	0.08	0.00*	0.05	0.43
Hostel vs home alone	0.14	0.10	0.01*	0.04	0.55

*$P < 0.05$.
†Odds ratios (OR) for admission Barthel score and age have been rescaled to represent the change in odds for a 10-unit change in each measure.

Discharge to subacute care, an indication that the patient required a period of geriatric rehabilitation prior to returning to their previous residence, occurred in 41.6% (32/77) of the control group and in 28.2% (20/71) of the intervention group (Table 3). After adjusting for confounders there was no clear evidence that the intervention altered the odds of being discharged to subacute care (OR = 0.55 (95%CI 0.22, 1.35), $P = 0.191$) (Table 6).

There was a trend for the intervention to be associated with a reduced total LOS (median difference = 2 days; $P = 0.097$) (Table 3). This effect became stronger after adjusting for confounding factors (HR = 1.46 (95%CI 1.05–2.05); $P = 0.026$) (Figure 3), indicating that at any point in time, patients in the intervention group had a greater likelihood of being discharged (shorter total admission time) than the control group (Table 7).

Adverse events

There were no adverse events attributable to the intervention. However, 2.6% of the control group (2/77) and 5.6% of the intervention group (4/71) had a fall ($P = 0.437$) and as previously reported, 6.3% of the intervention group and 1.3% of the control group were withdrawn because of deterioration in medical status and admission to ICU and 5.0% of the intervention group and 2.5% of the control group died.

Discussion

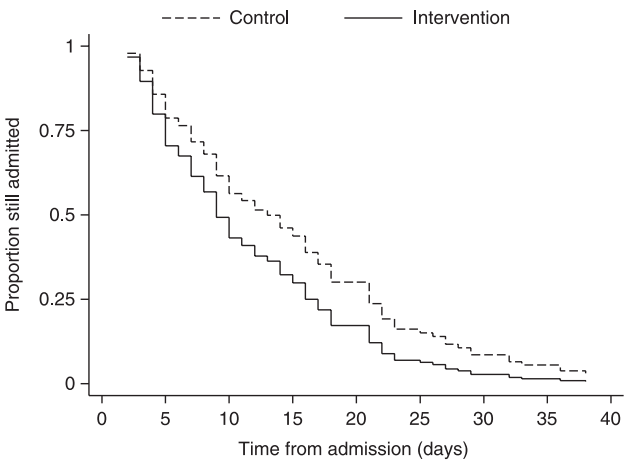
The current study found that an exercise program implemented early in an older patient's hospital stay and sustained throughout their LOS appeared to improve functional outcomes as measured by the mBI, but only in those patients with poor

Table 7: Multivariate predictors of length of stay

Variable	HR	SE	*P*-value	95% confidence interval	
Group	1.46	0.25	0.026*	1.05	2.05
Home alone or with other	2.05	0.40	0.000*	1.40	3.00
Hostel vs home alone	1.81	0.45	0.016*	1.12	2.94
Admission Barthel†	1.26	0.05	0.000*	1.16	1.37
Gender (male vs female)	0.57	0.11	0.003*	0.40	0.83

*$P < 0.05$.
†Odds ratios for admission Barthel score have been rescaled to represent the change in odds for a 10-unit change.
HR, Hazard ratio.

Figure 3: Length of stay.



Adjusted time to discharge for intervention and control groups (adjusted to median admission modified Barthel score of 69, living home alone, and female gender). The adjusted median time to discharge for the control group was 13 days, compared with 9 days for the intervention group.

functional ability at admission. This resulted in the simple univariate analysis failing to identify an improvement in functional outcomes, while the multivariate analysis indicated that the exercise program was effective in patients with low admission mBI scores, that is, those who were more functionally impaired at admission. This suggests that for optimal results, the exercise intervention may need to be more carefully targeted to those patients who are most likely to be able to benefit from the intervention.

The twice daily exercise program in this study was designed to be easily implemented in the hospital setting. It did not require a large space or any specialised equipment. However, while the program was tailored to the individual needs of each patient, five patients declined participation in the exercise program. A number of other patients were unable to complete the exercise program either twice a day or for the allocated time of 30 minutes. In these cases, the patient only completed one session per day instead of two or the program was broken down into shorter more frequent sessions, that is, 15 minutes four times per day. Despite the fact that some patients did not

participate in the full program, our intention-to-treat analysis indicates that any additional exercise is beneficial at improving functional outcomes.

The exercise intervention also appeared to reduced health-care utilisation with a reduced total LOS of 2 days (acute and subacute combined) and there was a trend towards reduced rates of admission to subacute care; however, this did not reach statistical significance. The implications of this study are significant when consideration is given to the physical, social and possible economic benefits of such an intervention. While there are some statistical considerations (limited power to demonstrate a significant difference in subacute transfers) these trends may be clinically important for health service utilisation. In addition, the potential impact of this intervention on the acute health-care workforce needs exploration. If an AHA was available to provide daily preventative exercise interventions, many secondary functional complications may be avoided, thus reducing the impact on health professionals responding to the demands caused by the effects of functional decline.

One of the limitations of the study is the difficulty inherent in measuring functional outcomes. This study has highlighted the paucity of validated functional measures sensitive enough to measure functional change over short periods of time. The Barthel index includes items that are not responsive to changes in strength such as personal hygiene, feeding and bowel and bladder control – and therefore, the exercise intervention is unlikely to directly influence these items. While the TUG is better suited to measure change in strength and mobility, the study was not adequately powered to detect changes in TUG scores and the sample size was further eroded by a high proportion of patients who were unable to complete the TUG (around 40% of patients were unable to complete the TUG either on admission or on discharge). Given the poor completion rate, it does not appear to be a suitable outcome measure for this patient population.

Another limitation is that the upper limit of improvement of the Barthel index is determined by the Barthel index score at admission – this ceiling effect has been previously established [20,21]. Figure 2 indicates that there was no longer a difference in the improvement in Barthel scores between the groups once an admission Barthel score of about 75–80 was reached. Because of baseline differences between the control and the intervention groups (despite adequate randomisation), patients in the intervention group had higher baseline Barthel scores than those in the control group (median mBI score 71 and 61, respectively), so the observed treatment effect may be an underestimate of the true benefit of the intervention.

Complete follow-up of all patients proved difficult despite a number of strategies being implemented to avoid patients being discharged prior to completion of a discharge assessment (including the ward clerks notifying the AHA of all patient discharges and daily contact with the Nurse Unit Manager regarding planned discharges). Decisions regarding patient discharge were often made at short notice, precluding the assessor from collecting discharge measures. Additionally, patients discharged over the weekend without prior notice were also lost to follow-up as the assessor was not within the hospital on weekends. Future studies would benefit from a 7-day-a-week approach to avoid this.

Further research in this area is warranted, as the potential benefits for both patients and health services are significant. In particular, an analysis of the effect of a more targeted intervention may provide insight into the group of patients most likely to benefit from this type of intervention. In addition, further studies could examine the effect of a similar intervention on other patient populations such as post-surgical patients or patients in sub-acute care.

Key points

The intervention was effective at improving the function of hospitalised elderly general medical patients, but only in patients with poor functional ability at admission. The intervention may have contributed to reduced health-care utilisation through reduced LOS and reduced rates of admission to subacute care. Further research is needed to identify the group of patients most likely to benefit from an exercise intervention. The intervention is easy and safe to implement in a tertiary health-care setting.

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Key Points

- The intervention was effective at improving the function of hospitalised elderly general medical patients, but this improvement declined with increasing functional ability at the time of admission.
- The intervention may have contributed to reduced health-care utilisation through reduced length of stay and reduced rates of admission to subacute care.
- Further research is needed to identify the group of patients most likely to benefit from an exercise intervention.
- The intervention is easy and safe to implement in a tertiary health-care setting.

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