Original Article

Factors Associated With Functional Decline of Hospitalised Older Persons Following Discharge From an Acute Geriatric Unit

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Abstract

Introduction: Older persons are likely to develop functional impairment following hospitalisation. Several studies in the West have examined the factors associated with functional decline following the older person's discharge from hospital but there are little data on Asian populations. This study aims to look at the associated risk factors in our local population, following admission to an acute geriatric unit. Materials and Methods: This is a retrospective, cohort study. Patients who were discharged from an inpatient geriatric unit over a 3-month period were recruited. Data including their demographic information, functional status prior to admission and at the time of discharge, and medical conditions were obtained from the inpatient medical notes. A follow-up telephone interview was conducted at 3 months to determine the functional status of these patients at that point in time. Results: Following hospitalisation, 40.4% of patients developed functional decline. Of those discharged, 29.6% showed functional decline at 3 months. The principal diagnosis, hypoalbuminaemia, tendency to fall, premorbid functional independence and the length of hospitalisation were associated with functional decline during hospitalisation, while hypoalbuminaemia, the presence of bedsores, institutionalisation, the length of hospitalisation and premorbid functional dependence were important factors associated with functional decline between the time of discharge and 3 months after. In the multivariable predictive model, independent predictors of functional decline at the time of discharge included patient's tendency to fall, premorbid functional independence and the length of hospitalisation, while the presence of bedsores was the only significant predictor of functional decline 3 months post-discharge. Conclusions: Many elderly patients developed new functional impairment following hospitalisation. Several factors were found to be associated with this functional decline, though no single predictive model similar to the other published studies was identified.

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Key words: Admission, Functional impairment, Risk factors

Introduction

Hospitalisation is a stressful event for the older person. The physiological changes associated with ageing, such as decreased muscle strength and aerobic activity, reduced bone density, altered appetite and tendency towards urinary incontinence, predispose older patients to complications during hospitalisation. Studies[1,2] have shown that about one-third of older persons develop functional decline following hospitalisation. The effects of the acute illness itself, the medical or surgical therapies initiated, and deconditioning associated with bedrest are the major reasons for functional decline.[3-6]

Many associated factors have been reported in studies that look at functional decline in the older persons during hospitalisation. In the HARP study,[7] advanced age, lower scores on the abbreviated Mini Mental State Examination (MMSE), and the presence of 2 or more Instrumental Activities of Daily Living (IADL) disabilities before admission were identified as risk factors of functional decline. In the study conducted at Yale-New Haven Hospital,[8] 4 risk factors were identified: the presence of pressure sores, scores on MMSE of less than 20, impairment in carrying out 1 or more basic Activities of Daily Living (ADL) before admission, and low social activity.

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As a result of the lack of a standardised way to measure functional decline and the heterogeneity of the study populations, the factors identified have been quite different among the various studies. Although many of these are "patient" factors which cannot be changed (e.g., advanced age), there are still a considerable number of "environmental" factors which can potentially be modified in the acute hospital setting such as avoiding prolonged bedrest.

Even though there has been much research looking at functional decline in hospitalised older persons in the West, no studies have examined this topic among the Asian population. This study thus aimed to look into the effects of hospitalisation on the functional status of our local elderly inpatient population at the time of discharge and 3 months after.

Materials and Methods

This retrospective, cohort study was conducted from January 2002 to April 2002. The subjects of this study consisted of elderly patients (65 years and above) who were consecutively discharged from the Geriatric Unit in our 1200-bed acute hospital between 15 October 2001 and 14 January 2002. Patients who died during the hospitalisation or were diagnosed with terminal cancer were excluded from the study. Subjects who were fully dependent functionally prior to the hospital admission were also excluded in the analysis as it was not possible to document any further functional decline using the criteria adopted.

The casenotes of the subjects were traced from the Medical Records Office within 3 months of their discharge dates and from therein, relevant information was gathered with the use of a structured protocol. During the same study period, a follow-up telephone interview was made to a patient's co-residing family member 3 months post-discharge. This non-interventional study was conducted with the approval of the Ethics Committee of the hospital, as well as with the informed consent of the patient or his/her family member.

The data obtained from the medical records included gender, age, the principal medical diagnosis, serum albumin level, the length of hospitalisation and the patient's premorbid functional status and functional status at the time of discharge. Patients' cognitive function, tendency to fall and the presence of bedsores were also documented.

The median age of the subjects studied was 82 years and this was used to categorise the patients into 2 groups for analysis: those below 82 years and those 82 years and above. The principal diagnosis for the admission was also categorised into life-threatening (severe congestive cardiac failure, ischaemic heart disease, pneumonia, pulmonary embolism, acute exacerbation of chronic obstructive airway disease, gastrointestinal tract haemorrhage, hyperosmolar coma, liver failure, abdominal abscess, acute renal failure and septicaemia) and non-life-threatening conditions; this disease classification was adopted from Jarrett et al's study.[9] The lowest documented serum albumin level during the admission was used in the analysis. Using the 50th percentile as the cut-off, half of the subjects had albumin levels of less than 34 g/dL (labelled as hypoalbuminaemia) and this was used to dichotomise the group. The median length of stay (LOS) in our study was 11 days and this was used to categorise the subjects into those with an LOS of fewer than 11 days and those with an LOS of 11 days or more (defined as a prolonged stay).

The functional status variable was defined using the 5 ADL, namely, ambulation, feeding, toileting, bathing and dressing. Patients who were independent in all the 5 areas were considered to be fully independent while those who required assistance in any of these 5 areas were considered partially dependent. Patients who required assistance in all areas of ADL and were chairbound or bedbound were termed fully dependent. The premorbid functional status was obtained from the clerking notes at the time of admission. This was defined as the patient's functional status 2 weeks prior to hospitalisation. The functional status at the end of the hospitalisation was based on the input from the therapists just before the patient's discharge.

A simple scoring system was used to quantify functional status in our study. This was partially adapted from Saliba et al's[10] vulnerable elders survey. A single point was awarded for independence in each of the 4 areas (feeding, bathing, dressing and toileting) while no points were awarded if assistance was required in each of the same areas. For ambulation, 2 points were allocated to subjects who were able to walk independently, 1 point for those requiring assistance, and zero for those who were chair/bedbound. With this scale, a subject who was fully dependent in his/her functional status would have a functional score of zero.

The functional scores were measured at each of the 3 phases, i.e., the premorbid phase, at the time of discharge, and 3 months post-discharge. In our study, functional decline during hospitalisation was defined as a 1-point (or more) decline in the functional score between the premorbid phase and at the time of discharge. Similarly, functional decline at 3 months post-discharge was defined as a 1-point (or more) decline in the functional score between the time of discharge and 3 months after discharge. Subjects who passed away within 3 months of discharge were included in the analysis (and considered to have declined functionally).

Patients with a known history of dementia or memory impairment, according to the feedback from their family members or based on documentation in the casenotes, were

labelled as cognitively impaired. From the clerking notes, patients with documented history of falls over the past 6 months were considered to have falling tendencies.

Three months post-discharge, data concerning patients' functional status and place of stay (institution versus home) were collected through telephone interviews. Nursing home residents who were admitted and subsequently discharged during the study period were also included under "discharged to nursing home". Referrals made to the therapist(s) as an outpatient were obtained from the patients' discharge plans in the casenotes. A subject was considered "lost to follow-up" if the family could not be reached by phone on 3 separate occasions.

The main outcome variables of this study were (a) functional decline at the time of discharge, and (b) functional decline between discharge and 3 months after discharge. Bivariate analysis was first performed to determine the factors associated with each of the functional declines. This was followed by multivariate analysis using the model building method where factors with a *P* value of <0.25 at the bivariate analysis stage were included in the final logistics regression model.[11] Possible collinearity between the independent variables was excluded using Pearson's correlation test.

The following variables were included in the bivariate analysis of functional decline during hospitalisation: a) age, b) sex, c) principal diagnosis, d) serum albumin level, e) tendency to fall, f) cognitive impairment, g) presence of bedsores, h) premorbid functional status, and i) length of hospitalisation.

For the analysis of functional decline between time of discharge and 3 months after hospitalisation, patients lost to follow-up were excluded. The independent variables studied for the bivariate analysis were: a) age, b) sex, c) principal diagnosis, d) serum albumin level, e) tendency to fall, f) cognitive impairment, g) presence of bedsores, h) premorbid functional status, i) length of hospitalisation, j) referral to therapists as an outpatient, and k) discharge to nursing home/institutionalisation.

Results

Table 1 shows the characteristics of the study population, their functional outcome at the time of discharge and 3 months later.

There were a total of 199 discharges during the 3-month study period, with a female-to-male ratio of 3:2. The mean age of the study population was 82 years (range, 65 to 98 years). About one-third (36%) of the patients were independent in their ADL prior to the hospitalisation while 1 in 5 were fully dependent. At the time of discharge, the proportion of functionally independent patients had dropped to about 16%. Three months post-discharge, 31% of the patients were functionally independent.

Table 1. Characteristics of the Study Population

Gender	80 male (40.2%) 119 female (59.8%)
Age	Mean: 82 years 65-81 years: 98 (49.2%) ≥82 years: 101 (50.8%)
Place of stay before admission	Home: 177 (88.9%) Nursing home: 19 (9.5%) Others: 3 (1.5%)
Place discharged to	Home: 153 (77%) Community hospital: 15 (7.5%) Nursing home: 30 (15%) Others (Hospice): 1 (0.5%)
Principal diagnosis	Non-life-threatening: 121 (60.8%) Life-threatening: 78 (39.2%)
Serum albumin level	Mean: 33.4 g/dL <34 g/dL: 86 (49.7%) ≥34 g/dL: 113 (56.8%)
Length of hospitalisation	Mean: 14 days Less than 11 days: 99 (49.7%) 11 days or more: 100 (50.3%)
Bedsores	Present: 30 (15.1%) Absent: 169 (84.9%)
Tendency to fall	Yes: 99 (49.7%) No: 100 (50.3%)
Cognitive impairment	Yes: 93 (46.7%) No: 106 (53.3%)
Premorbid functional status	Independent: 72 (36.2%) Partially dependent: 84 (42.2%) Fully dependent: 43 (21.6%)
Functional status at discharge	Independent: 32 (16.1%) Partially dependent: 107 (53.8%) Fully dependent: 57 (28.6%) Not documented: 3 (1.5%)
Status 3 months after discharge	Independent: 42 (21.1%) Partially dependent: 95 (47.7%) Fully dependent: 26 (13.1%) Dead: 22 (11.1%) Not sure: 14 (7%)
Referral for outpatient rehabilitation	Referred: 20 (10.1%) Not referred: 179 (89.9%)

The average length of hospitalisation was 14 days. Three in 4 patients were discharged back to their own homes, while the remainder were either institutionalised or transferred to community hospitals for further rehabilitation. Twenty-two patients (11%) died within 3 months of discharge from hospital and 14 (7%) were lost to follow-up. A breakdown of the patients who died within 3 months of their discharge from hospital showed that 3 patients were fully independent prior to discharge, 7 were partially dependent, and 12 were fully dependent in their ADL.

For analysis of factors associated with functional status between premorbid and at the time of discharge, only 156

Table 2a. Bivariate Analysis of Variables in Association with Decline in Functional Status at Time of Discharge from Hospital (n = 156)

Independent variables	Odds ratio (OR)	95% Confidence interval (CI)	*P* value
Age (y)			
<82	Reference		
82 or more	1.31	0.69-2.49	0.41
Gender			
Female	Reference		
Male	1.32	0.69-2.51	0.40
Principal diagnosis*			
Non-life-threatening	Reference		
Life-threatening	2.22	1.14-4.33	0.02
Serum albumin level*			
34 g/dL or more	Reference		
<34 g/dL	2.18	1.11-4.28	0.02
Tendency to fall*			
No	Reference		
Yes	1.99	1.03-3.84	0.04
Cognitive impairment			
No	Reference		
Yes	1.23	0.63-2.40	0.54
Bedsores			
No	Reference		
Yes	1.85	0.54-6.36	0.33
Premorbid functional status*			
Independent	Reference		
Partially dependent	0.38	0.20-0.73	0.00
Length of hospitalisation*			
<11 days	Reference		
11 days or more	2.41	1.25-4.63	0.01

*$P \leq 0.05$

Table 2b. Multivariate Analysis of Functional Decline at Time of Discharge Using Model-building Method (n = 156)

Independent variables	Adjusted odds ratio (OR)	95% Confidence interval (CI)	*P* value
Principal diagnosis			
Non-life-threatening	Reference		
Life-threatening	1.96	0.90-4.26	0.09
Serum albumin level			
34 g/dL or more	Reference		
<34 g/dL	2.11	0.95-4.69	0.07
Tendency to fall*			
No	Reference		
Yes	2.90	1.35-6.23	0.01
Premorbid functional status*			
Independent	Reference		
Partially dependent	0.21	0.09-0.47	0.00
Length of hospitalisation*			
<11 days	Reference		
11 days or more	2.24	1.05-4.78	0.04

*$P \leq 0.05$

patients were studied, after excluding 43 patients who had a premorbid functional score of zero. Of the 156 patients analysed, 63 (40.4%) showed a decline in their ADL function at the time of discharge as compared to their premorbid status while 93 (59.6%) showed no decline. When the 63 patients who declined at the time of discharge were followed up, 31 actually reported functional improvement 3 months later.

Only 142 patients were included in the final analysis to determine functional decline 3 months post-discharge as 14 out of the 156 patients were lost to follow-up. There were no differences in the characteristics of the group that was lost to follow-up as compared to the rest of the patients.

Comparing the functional status between time of discharge and 3 months after, 42 patients (29.6%) showed decline in their ADL function while the remaining 100 (70.4%) patients did not show any decline.

Bivariate analyses showed that life-threatening conditions, hypoalbuminaemia, tendency to fall, premorbid functional independence and prolonged hospitalisation were significantly associated with functional decline during hospitalisation (Table 2a). Hypoalbuminaemia, the presence of bedsores, institutionalisation, prolonged hospitalisation and premorbid functional dependence were important factors associated with functional decline between discharge and 3 months after (Table 3a).

In the multivariate analyses to determine the predictors for functional decline during hospitalisation however, only tendency to fall, premorbid functional independence and prolonged hospitalisation turned out to be significant at $P < 0.05$ (Table 2b). On the other hand, the presence of bedsores was the only significant factor associated with functional decline between discharge and 3 months after (Table 3b). It was interesting to note that patients who were premorbidly independent in their ADL appeared more likely to develop functional decline during hospitalisation as compared to those who were partially dependent; the latter group, however, had a greater tendency to decline after discharge from hospital.

Discussion

For elderly persons, hospitalisation following an acute illness may lead to permanent functional decline or at times, even death. In our study, 40.4% and 29.6% of the patients developed functional decline following hospitalisation and at 3 months post-discharge respectively. These figures were fairly consistent with those reported in the HOPE study,[12] which showed that 1 in 3 elderly patients developed functional impairment after being hospitalised for acute illnesses and about 1 in 5 showed further functional decline 3 months later.

Decline in functional status during hospitalisation is not

Table 3a. Bivariate Analysis of Variables in Association with Decline in Functional Status from Time of Discharge to Three Months after Discharge (n = 143)

Independent variables	Odds ratio (OR)	95% Confidence interval (CI)	*P* value
Age (y)			
<82	Reference		
82 or more	1.13	0.55-2.32	0.74
Gender			
Female	Reference		
Male	1.13	0.54-2.34	0.75
Principal diagnosis			
Non-life-threatening	Reference		
Life-threatening	1.22	0.59-2.55	0.59
Serum albumin level*			
34 g/dL or more	Reference		
<34 g/dL	2.23	1.06-4.68	0.04
Tendency to fall			
No	Reference		
Yes	0.79	0.38-1.62	0.51
Cognitive impairment			
No	Reference		
Yes	1.25	0.59-2.64	0.56
Bedsores*			
No	Reference		
Yes	6.47	1.58-26.40	0.01
Premorbid functional status*			
Independent	Reference		
Partially dependent	2.16	1.02-4.58	0.04
Length of hospitalisation*			
<11 days	Reference		
11 days or more	3.08	1.43-6.62	0.00
Discharged to nursing home*			
No	Reference		
Yes	4.08	1.50-11.07	0.01
Outpatient referral to therapists			
Nil	Reference		
Yes	1.02	0.36-2.87	0.96

*$P \leq 0.05$

Table 3b. Multivariate Analysis of Functional Decline from Time of Discharge and Three Months after Using Model-building Method (n = 143)

Independent variables	Adjusted odds ratio (OR)	95% Confidence interval (CI)	*P* value
Serum albumin level			
34 g/dL or more	Reference		
<34 g/dL	1.38	0.60-3.14	0.45
Bedsores*			
No	Reference		
Yes	4.51	1.02-19.84	0.05
Premorbid functional status			
Independent	Reference		
Partially dependent	1.92	0.85-4.34	0.12
Length of hospitalisation			
<11 days	Reference		
11 days or more	1.91	0.82-4.44	0.13
Discharged to nursing home			
No	Reference		
Yes	0.43	0.15-1.23	0.12

*$P \leq 0.05$

always permanent and gradual functional recovery after discharge has been reported in several studies.[2,7,13] Elderly patients who experienced a burden of new and worsened functional impairment during hospitalisation have been found to have delayed functional recovery. The return of functional status to the pre-hospitalisation stage may lag behind the recovery from the acute illness. This pattern of functional recovery was also observed in our study, where 49.2% of the patients with functional decline during hospitalisation actually showed improvement 3 months after discharge.

Most studies that examined functional outcome of hospitalised older patients did not look at fall tendency as a possible factor associated with functional decline. The tendency to fall is an indicator of frailty. It may be the result of poor vision, postural hypotension, poor balance, diminished mobility, weakness or neurological diseases. A frail elderly patient has limited physiological reserves, and when hospitalised for an acute illness, is at high risk of developing complications from prolonged bed rest. De-conditioning in this group of patients predispose them to problems such as weakness, immobility, pressure sores and infection. Our study indicates that patients with falling tendency actually had an increased risk of functional decline during hospitalisation. It is therefore important to target this group of patients for early physical therapy once they are out of their acute illness[4] so as to minimise prolonged bedrest and de-conditioning which may result in new problems contributing to functional decline.

It has been shown that patients with increased LOS are more likely to report decline in their functional status[7,14,15] at the time of discharge. The LOS acts as a proxy for severity of illness, potential de-conditioning effects of bed rest, as well as iatrogenic complications.[4,6,16] In the present study, patients with a longer hospital stay (of 11 days or more) were 2 to 3 times more likely to develop functional decline as compared to those hospitalised for less than 11 days. Our study also revealed that in this group of patients, the functional decline continued further till 3 months post-discharge, though this association was not significant in the multivariate analysis.

An interesting finding to highlight is that patients who were premorbidly independent in function appeared to have a higher tendency to develop functional decline during hospitalisation as compared to those who were

partially dependent. This is contrary to Inouye et al's study[8] and the HARP study,[7] which concluded that an elderly patient's premorbid ADL dependence and premorbid IADL dependence, respectively, were associated with functional decline at the time of discharge. A possible explanation is the difference in the characteristics of the patients in our study and the latter 2 studies.

Firstly, there were a larger proportion of "old-old" subjects in our study, with 38.7% of the study cohort being above the age of 84 years, as compared to 18% in the HARP study and 5% in Inouye's study. In addition, more than a third (39%) of our functional independent subjects were above the age of 84 years. We believe that in this category of the "old-old", even premorbidly independent subjects are at a higher risk of developing functional decline following hospitalisation.

Secondly, our study subjects were generally more frail than those from Inouye's study and the HARP study. Thus 24% to 35% of the subjects in Inouye's study required assistance with at least one area of their ADL, as compared to 54% in our study. In the HARP study, the pre-admission function of their subjects was higher, with a mean ADL score of 5.6 out of a total score of 6, while the mean ADL score for our subjects was only 3.4 out of a total score of 5. Although the denominator in our study was slightly different (as we did not include the ability to transfer as one of the ADL), it is possible to conclude that the subjects in the HARP study were physiologically more robust. Similarly, as a surrogate marker of increased frailty, the average LOS of our study subjects was much higher (median of 11 days; mean of 14 days) as compared to those in Inouye's study (median of 7 days) and the HARP study (mean of 8.6 days).

We believe it is likely that the measures of functional decline adopted in our study would generally show a greater floor effect amongst those already more frail at baseline. This fact coupled with the greater vulnerability towards functional decline amongst our premorbidly independent group (because of their significantly older age) are plausible explanations for why, unlike similar studies done elsewhere, premorbid functional independence turned out to be a significant risk factor for functional decline at the time of discharge.

The presence of bedsores is a marker of reduced mobility and, hence, functional dependence. Bedbound patients are usually at an increased risk of complications such as pneumonia, urinary tract infections and aspiration. In our study, this group of patients appeared to have a higher tendency for functional decline after discharge from hospital, though we were not able to demonstrate a similar association at the time of discharge. Patients who died during hospitalisation were excluded from our study and we believe that pressure sores could have been significantly associated with this group. The exclusion might then explain why bedsores did not turn out to be a significant factor for functional decline at discharge. Overall, however, there is a need to be cautious in interpreting this finding since the number of patients with bedsores in the study was small.

Older persons diagnosed with life-threatening illnesses appeared to fare worse than those with non-life-threatening conditions at the time of discharge. This was, however, not significant in the multivariate analysis. The role of acute illness in causing functional decline was demonstrated in a prospective, population-based study using data from the Established Populations for Epidemiologic Studies of the Elderly (EPESE).[3] Many patients who developed disabilities in that study had serious medical conditions such as stroke, hip fracture, congestive cardiac failure, pneumonia, coronary heart disease and cancer. On the other hand, several studies[2,7,14,17] have shown that medical diagnosis alone is a poor predictor of functional decline. It is likely therefore that Jarrett et al's classification of life-threatening conditions – which was employed in our work – is inadequately capturing the important dimensions of the severity of illness concept. Perhaps, an additional measure that focuses upon the varying severities of each medical condition may better predict discharge-related outcomes.[18,19]

Institutionalisation is an indirect indicator of patients' need for assistance in their ADL. There are several reasons for admission to nursing homes in our local setting, the commonest being the lack of caregivers. Some cognitively impaired elderly patients may have behavioural problems, resulting in carer stress and hence institutionalisation. Patients discharged to nursing homes seemed to experience functional decline (3 months post-discharge) more than those discharged home.

Serum albumin often reflects the chronic nutritional state of a person, although it can also be reduced in patients who are acutely ill. Like the tendency to fall, it is a potential marker of frailty. Protein-energy nutritional status has been shown to play an important role in determining the morbidity and mortality of geriatric rehabilitation patients.[20,21] In our study, patients with serum albumin levels of less than 34 g/dL showed a higher tendency for functional decline both during and after hospitalisation, though this association did not achieve statistical significance in the multivariate analysis. The low serum albumin level may be associated with the disease severity or the frail state of the patient, which could have accounted for the higher likelihood of functional decline.

We were not able to demonstrate any association between functional decline and patients' age, gender, cognition and referral to outpatient rehabilitation. Sager et al showed in 2 different studies[2,7] that a cognitively impaired elderly person was at risk for functional decline. In the HARP study,[7]

patients' MMSE scores were significantly associated with functional decline following hospitalisation. Unlike the HARP study, the definition of cognitive impairment in our study was not as precise and was only based on the feedback from the caregivers or previous known history. This may explain the differences in the findings of our study and the HARP study.

Although this study revealed many interesting points, it has several limitations; one of which is the relatively small sample size of the study population. Delirium, which may contribute to functional decline during hospitalisation, was not studied as an independent factor because this information could not be consistently captured in a retrospective study like ours. The reliance on self-report of ADL function and mobility at the time of admission as well as during the telephone interview with the patients' carers may have resulted in reporting bias, leading to the inaccurate estimation of functional declines. In addition, the definition of pre-morbid functional status using patients' functional status 2 weeks prior to hospitalisation may not truly reflect the pre-morbid functional status of every subject in this study as some may have developed the acute illness even before that. However, this was the most objective information on patients' pre-morbid functional status available in our study. Patients who died during hospitalisation were excluded because we felt that certain information such as their length of hospitalisation could not be meaningfully captured and analysed; this exclusion may, however, have distorted the predictive role of premorbid functional status toward the eventual functional decline during hospitalisation.

Conclusion

Based on the results of this study, it can be concluded that a large proportion of hospitalised elderly patients in our local setting suffer functional decline, both at the time of, and after, discharge. The tendency to fall, increased length of hospitalisation and premorbid functional independence were significantly associated with functional decline at the time of discharge, while the presence of bedsores was associated with decline 3 months post-discharge. It is difficult to use a common predictive model or instrument recommended in the other published studies[7,8] to identify local elderly patients at risk of functional decline in the acute geriatric unit setting, given the different characteristics of the patients encountered.

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REFERENCES

1. McVey LJ, Becker PM, Saltz CC, Feussner JR, Cohen HJ. Effect of a geriatric consultation team on functional status of elderly hospitalised patients. A randomised, controlled clinical trial. Ann Intern Med 1989;110:79-84.
2. Sager MA, Franke T, Inouye SK, Landefeld CS, Morgan TM, Rudberg MA, et al. Functional outcomes of acute medical illness and hospitalisation in older persons. Arch Intern Med 1996;156:645-52.
3. Ferruci L, Guralnik JM, Pahor M, Corti MC, Havlik RJ. Hospital diagnoses, Medicare charges, and nursing home admissions in the year when older persons become severely disabled. JAMA 1997;277:728-34.
4. Creditor MC. Hazards of hospitalization of the elderly. Ann Intern Med 1993;118:219-23.
5. Steel K, Gertman PM, Crescenzi B, Anderson J. Iatrogenic illness on a general medical service at a university hospital. N Engl J Med 1981;304:638-42.
6. Hoenig HM, Rubenstein LZ. Hospital-associated deconditioning and dysfunction. J Am Geriatr Soc 1991;39:220-2.
7. Sager MA, Rudberg MA, Jalaluddin M, Franke T, Inouye SK, Landefeld CS, et al. Hospital admission risk profile (HARP): identifying older patients at risk for functional decline following acute medical illness and hospitalization. J Am Geriatr Soc 1996;44:251-7.
8. Inouye SK, Wagner DR, Acampora D, Horwitz RI, Cooney LM Jr, Hurst LD, et al. A predictive index for functional decline in hospitalized elderly medical patients. J Gen Intern Med 1993;8:645-52.
9. Jarrett PG, Rockwood K, Carver D, Stolee P, Cosway S. Illness presentation in elderly patients. Arch Intern Med 1995;155:1060-4.
10. Saliba D, Elliot M, Rubenstein LZ, Solomon DH, Young RT, Kamberg CJ, et al. The Vulnerable Elders Survey: a tool for identifying vulnerable older people in the community. J Am Geriatr Soc 2001;49:1691-9.
11. Hosmer DW, Lemeshow S. Applied Logistic Regression. 2nd ed. New Jersey, USA: John Wiley & Sons, 1989:92-142.
12. Margitic SE, Inouye SK, Thomas JL, Cassel CK, Regenstreif DI, Kowal J. Hospitalised Outcomes Project for the Elderly (HOPE): rationale and design for a prospective pooled analysis. J Am Geriatr Soc 1993;41: 258-67.
13. Hirsch CH, Sommers L, Olsen A, Mullen L, Winograd CH. The natural history of functional morbidity in hospitalized older patients. J Am Geriatr Soc 1990;38:1296-303.
14. Sahadevan S, Earnest A, Koh YL, Lee KM, Soh CH, Ding YY. Improving the diagnosis related grouping model's ability to explain length of stay of elderly medical inpatients by incorporating function-linked variables. Ann Acad Med Singapore 2004;33:614-22.
15. Chin JJ, Sahadevan S, Tan CY, Ho SC, Choo PW. Critical role of functional decline in delayed discharge from an acute geriatric unit. Ann Acad Med Singapore 2001;30:593-9.
16. Harper CH, Lyles YM. Physiology and complications of bed rest. J Am Geriatr Soc 1988;36:1047-54.
17. Landefeld CS, Palmer RM, Kresevic DM, Fortinsky RH, Kowal J. A randomised trial of care in a hospital medical unit especially designed to improve the functional outcomes of acutely ill older patients. N Engl J Med 1995;332:1338-44.
18. Horn SD, Sharkey PD, Chambers AF, Horn RA. Severity of illness within DRGs: impact on prospective payment. Am J Public Health 1985;75: 1195-9.
19. Horn SD, Sharkey PD, Buckle JM, Backofen JE, Averill RF, Horn RA. The relationship between severity of illness and hospital length of stay and mortality. Med Care 1991;29:305-17.
20. Sullivan DH, Patch GA, Walls RC, Lipschitz DA. Impact of nutrition status on morbidity and mortality in a select population of geriatric rehabilitation patients. Am J Clin Nutr 1990;51:749-58.
21. Sullivan DH, Walls RC. Impact of nutritional status on morbidity in a population of geriatric rehabilitation patients. J Am Geriatr Soc 1994;42:471-7.