European Journal of Public Health, Vol. 16, No. 2, 203–208

doi:10.1093/eurpub/cki054 Advance Access published on September 1, 2005

Miscellaneous

Early evaluation of the risk of functional decline following hospitalization of older patients: development of a predictive tool

Pascale Cornette[1], Christian Swine[2], Brigitte Malhomme[3], Jean-Bernard Gillet[4], Philippe Meert[5], William D'Hoore[6]

Objective: To develop a predictive tool that could be used on admission to identify older hospitalized people at risk of functional decline 3 months after discharge. **Methods:** This was a prospective cohort study that included 625 patients aged 70 years and older (mean age 80.0 ± 5.6 years) hospitalized by the way of the emergency room, for at least 48 h, in two academic hospitals. Three months after discharge, 550 patients remained for analysis. On admission, people were assessed for premorbid functional status with the activities of daily living (ADL) scale and instrumental ADL scale. Demographic and medical data, including cognitive function, falls, polypharmacy, comorbidity, continence, mobility and self-rated health, were collected. ADL functioning was re-assessed at discharge and 1 and 3 months later. Functional decline was defined as the loss of at least one point on the ADL scale between the premorbid and 3-month evaluation. Univariate analyses were used to select variables associated with functional decline. A logistic regression model was then constructed to predict functional status 3 months after discharge. **Results:** Three months after discharge, 165 (31.5%) patients had declined. The predictive tool SHERPA includes five factors: age, impairment in premorbid instrumental ADLs, falls in the year before hospitalization, cognitive impairment (Abbreviated Mini Mental State below 15/21) and poor self-rated health. Sensitivity and specificity were 67.9% and 70.8%, respectively. **Conclusions:** Older people are at high risk of functional decline following hospitalization. On admission, a simple instrument can easily identify these patients, even though the performance of this instrument is moderate.

Keywords: activities of daily living, elderly, functional decline, hospital, predictive tool

When older people are admitted to hospital for an acute health problem they are at increased risk of functional decline both during hospitalization and following discharge.[1–3] Three months after discharge, ~30% of older people treated for an acute illness will lose the ability to perform some activities of daily living, as compared with their pre-admission level.[2] This loss is associated with higher health resource use, institutionalization and death.[2,4–7] As functional decline associated with hospitalization begins within 48 h of admission,[8] early intervention to maintain functioning is one of the main goals of care. Therefore, optimal orientation of these patients in acute geriatric units, aimed at minimizing the risk of functional decline and other adverse outcomes,[9] is critical. In acute geriatric units and general internal wards, 62% of people older than 70 years are hospitalized in acute conditions, usually by the way of the emergency room.[10] Moreover, older people visiting the emergency department have three to seven times higher rate of hospitalization than younger people.[11] In our hospitals, 52% of people older than 70 years admitted in the emergency department are hospitalized. Therefore, the emergency room is a key place to assess the functional risk of geriatric patients.[12] Indeed, an early assessment of the functional prognosis of hospitalized elderly may help to target people who will benefit more from geriatric interventions during acute, subacute and rehabilitation phase of their illness. This early targeting may also help with triage and orientation of the patients according to the available number of different geriatric beds in the institution.

Previous studies have developed indices or scores aimed at identifying older hospitalized people at risk of functional decline.[13–15] Their use in our population raised questions because of the exclusion criteria used (nursing homes residents excluded, surgical patients excluded) or their feasibility in emergency (very low prevalence of decubitus ulcer in the emergency room, no albumin determination in routine or in emergency room, difficulty in assessing social activities in some cultural contexts).

The purpose of this work was to study functional decline associated with hospitalization in our population and to develop a scoring system that could be used as soon as possible on admission, even in the emergency room, to identify people according to their risk of losing function in activities of daily living 3 months after their hospitalization.

Methods

Subjects/participants

The study was conducted at two general academic hospitals from March 1998 to December 1998. The two hospitals are

1 Geriatric Unit, St Luc University Hospital, Université catholique de Louvain
2 Geriatric Unit, Mont-Godinne University Hospital, Université catholique de Louvain
3 Mont-Godinne University Hospital, Université catholique de Louvain
4 Emergency Unit, Mont-Godinne University Hospital, Université catholique de Louvain
5 Emergency Unit, St Luc University Hospital, Université catholique de Louvain
6 School of Public Health, Université catholique de Louvain
Correspondence: Dr Pascale Cornette, Internal Medecine, Geriatric Unit, St Luc University Hospital, Av Hippocrate 10, Box 10/50, B-1200 Brussels, Belgium, tel: +32 2 764 10 51, fax: +32 2 764 36 97, e-mail: cornette@hosp.ucl.ac.be

linked to the same university, Université catholique de Louvain, in Belgium. There are differences between the sites: one hospital (hospital 1) is a 900-bed hospital located in an urban area and the other (hospital 2) is located in a rural area and has with 380 beds, including a 27-bed acute geriatric unit. At hospital 1, the majority of elderly patients are admitted in the general internal medicine wards. The patients enrolled were aged 70 years and older and were hospitalized for at least 48 h, by the way of the emergency department. The common criteria for exclusion were terminal illness, admission to the intensive care unit, admission for a stroke, length of stay shorter than 48 h, dependence for the six activities of daily living (based on retrospective reports).

Informed consent was obtained from the patient or from the caregiver for those who were unable to answer. The study protocol was approved by the ethics committees of both hospitals.

Data collection and measurements

On admission, discharge, and at 1- and 3-month follow-up, patients were interviewed by an examiner skilled in patient interviewing in hospital 2 and by a medical researcher in hospital 1. The first interview was performed within 48 h of admission. At that time, recorded information included demographic data, living conditions, previous admission to the hospital and reason for admission in emergency. For the assessment of the premorbid functional status (2 weeks before admission),[16] a retrospective evaluation was made with a modified Katz index for Activities of Daily Living (ADL)[17] and the Lawton scale for instrumental ADL (IADL).[18] For the six ADLs (bathing, dressing, walking, toileting, continence and eating) and the seven IADLs (telephoning, shopping, preparing meals, doing housework, using transportation, managing finances and taking medications) patients were quoted as independent if able to perform these without assistance (score = 6 and score = 7, respectively). Cognitive function was assessed by means of a shorter version (21-point) of the Folstein Mini Mental State Exam (MMSE).[19] This version was chosen for practical reasons; the last nine points were omitted because they require writing, drawing and movements that may be difficult for elderly patients in emergency department to perform. Functional data were collected by direct patient interview in most cases (83%); carers were interviewed for cognitively impaired patients. At this initial interview, a number of other relevant data were also recorded: hearing or visual impairments, alcohol habits, falls in the preceding year, continence, mobility (using or not an assistive device like a cane or rollator) and self-rated health. Comorbidity (number of associated diseases reported by the patient) and daily medications at home were noted. In addition, a single screening question for depression was asked ('do you often feel sad and depressed ?').[20]

At discharge, main diagnosis was recorded according to the International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) codes (1st digit). At that time, the current ability to perform the six ADL was assessed by patient interview confirmed by interview of nurses in charge. One and 3 months after discharge, a follow-up phonecall was performed by the same investigators. Death, current ADLs and IADLs, living arrangements and rehospitalization were determined.

Both investigators were trained and a good interrater reliability was observed. In a pilot study, for the main instruments used, the intraclass correlation coefficients were 0.89 for IADL, 0.86 for ADLs and 0.77 for MMSE.

Definition of functional decline

Functional decline was defined a priori as a loss of at least one point on the ADL scale between premorbid evaluation on admission and 3-month post-discharge evaluation.

Statistical analysis

Data from both hospitals were compiled at the same place by one of the medical researchers: Unité des sciences hospitalières, School of Public Health, Université catholique de Louvain, Brussels. Data were entered using Epi-Info, version 6.04bfr, and analyses were performed using SAS, version 6.12.

Univariate analysis was first performed to identify factors associated with functional decline 3 months after discharge. As data were collected on two different sites, to adjust for this possible confounding factor we used Mantel–Haenszel stratified analyses for dichotomous variables and analysis of covariance (ANCOVA) for continuous variables.

We then used logistic regression analysis to identify independent factors associated with decline (multivariate analysis). The outcome variable was entered as the dependent variable, and variables found to have a statistically significant relationship with the outcome at a level of $P < 0.05$ (univariate analysis) were selected as independent variables. Adjusted odds ratio and 95% confidence intervals were calculated for each independent variable.

In order to develop a score that could help us to best predict the risk of functional decline consecutive to hospitalization, we entered into a new logistic regression model all variables selected by multivariate analysis ($P < 0.05$) and some factors selected by univariate analysis. These latter factors were selected according three criteria: *a priori* clinical relevance in predicting functional decline, possible identification on admission interview and statistical significance in univariate analysis. Continuous variables (age, IADLs) were re-coded into categorical variables. Finally, logistic regression was performed to assess the prognostic effect of the combination of the variables. Model discrimination was

Table 1 Baseline characteristics of population

Demographic characteristics	
Mean age (years)	80.0
Male (%)	43.4
Widowed (%)	49.4
Living alone at home (%)	34.7
Nursing home residents (%)	15.7
Hospitalized in the previous 3 months (%)	25.2
Functional characteristics	
Mean MMSE score (/21)	17.6 ± 3.2
Mean premorbid ADL score (/6)	4.5 ± 1.9
Mean pre-morbid IADL score (/7)	3.9 ± 2.1
Medical characteristics	
Mean number of associated diseases[a]	1.9 ± 1.05
Demented patients[b] (%)	5.6
Mobility difficulties (%)	34.9
Incontinence (%)	32.5
At least one fall in the previous year (%)	36
Visual impairment (%)	18.5
Hearing impairment (%)	24.6
Mean number of different drugs	4.7 ± 2.3
Self-perceived health as poor (%)	205

a: associated diseases reported by patients
b: diagnosis known on admission

assessed using the receiver operating characteristic (ROC) curve. Fit of the model was tested by the Hosmer–Lemeshow[21] goodness of fit test.

Results

Participants characteristics

The majority of patients (552; 88.3%) were assessed within 24 h of admission, of whom 225 (40.8%) were in the emergency room. Direct assessment of patients was possible for the majority (86%); carers were questioned on behalf of those unable to answer. The baseline characteristics of patients enrolled are shown in table 1. Six hundred and twenty-five patients were included. Twenty-nine patients died during index hospitalization and 44 patients died within the 3 months after discharge. Unfortunately, for two patients we could not obtain functional information at 3-month post-discharge contact. The final population left for decline analysis therefore included 550 patients. The mean age of patients was 80.0 ± 5.6 years. Fifty-six per cent were women and 49.4% were widowed. Nursing homes residents represented 15.7% of the population included. One hundred and seven (17.1%) patients were admitted in surgical wards. On admission, 47 (7.5%) patients only were independent for all premorbid IADLs (score = 7). Fifty-seven patients (9.1%) were dependent for all premorbid IADLs (score = 0), the majority of them (73.7%) being nursing home residents. Three months after discharge, mean scores were 3.9 ± 2.1 on ADLs scale, according to the definition of functional decline, 165 (30%) patients declined, 300 (57.5%) stayed at the same level and 57 (10.9%) improved in their ability to perform ADLs.

Development of the scoring system

Twelve variables available on admission interview were found to be associated with functional decline in univariate analysis (table 2). A lower score on IADL pre-admission scale, MMSE score on admission lower than 15/21 and a history of fall in the previous year were independent risk factors for the outcome as selected by stepwise (backward) logistic regression. From this basic model, other variables that were thought to be relevant on a clinical basis were re-tested. Two variables that were significant in univariate analysis were added: age and poor self-perceived health. The logistic regression that best predicted functional decline was built with these five variables. The results of the multivariate analysis are presented in table 3. Goodness of fit test for this model was adequate ($P = 0.91$) and discriminant ability was acceptable (area under ROC curve = 0.73).

For a better characterization of the risk of functional decline following hospitalization, we constructed a score called SHERPA (Score Hospitalier d'Evaluation du Risque de Perte d'Autonomie; see Appendix 1). The idea was to give each risk factor a weight proportional to its odds ratio, with

Table 2 Variables associated with functional decline in univariate analysis

Continuous variables	**Mean for decliners**	***P* value**
Age	81.3	0.0001
Premorbid ADL score (/6)	4.57	0.0001
Premorbid IADL score (/7)	3.39	0.0001
MMSE score (/21)	16.24	0.0001
Dichotomous variables	**% of exposed patients**	**OR (95% CI)**
Widowed	48.28	1.53 (1.06–2.21)[a]
Living alone at home	31.75	0.94 (0.63–1.39)
Male sex	44.37	0.81 (0.56–1.17)
Nursing Homes residents	11.48	3.13 (1.88–5.20)[a]
MMSE score <15/21	20.51	3.59 (2.38–5.43)[a]
Decubitus ulcer	2.34	3.23 (1.06–9.85)[a]
Fall in the previous year	34.96	2.27 (1.56–3.29)[a]
Incontinence	28.28	1.80 (1.22–2.65)[a]
Use of assistive device for mobility	22.9	1.50 (0.98–2.29)
Hearing impairment	24.97	0.94 (0.62–1.45)
Visual impairment	17.72	0.99 (0.62–1.61)
Self-perceived health as poor	18.01	1.60 (1.02–2.51)[a]
Associated diseases[b]		
Parkinson's disease	4.03	2.93 (1.28–6.69)[a]
COPD	19.0	0.78 (0.48–1.28)
Dementia	2.9	2.34 (0.91–6.03)
Stroke (transient or permanent disability)	13.0	1.56 (0.93–2.62)

a: these variables were associated with functional decline in univariate analysis with $P < 0.05$
b: only pathologies associated with functional decline with $p < 0.1$ were reported
OR: odds ratio; CI: confidence interval; COPD: chronic obstructive pulmonary disease

Table 3 Logistic regression analysis for functional decline

Variable	OR	95% CI
History of falls in the previous year	1.86	1.23–2.81
Premorbid IADL score[a]	0.80	0.71–0.90
MMSE <15/21	2.03	1.20–3.41
Self-perceived in poor health	1.67	0.99–2.78
Age[b]	1.28	1.05–1.56
Model performance		
Goodness of fit	$P = 0.91$	
c statistic	0.73	

a: OR shows an inverse relation for IADL score: a higher score decreased the risk of functional decline
b: Three categories: <75 years, 75–84 years and ≥85 years
OR: odds raio; CI: confidence interval

Table 4 Risk of functional decline according to SHERPA

Risk	People without functional decline (*n*)	People with functional decline (*n*)	Total	OR	Score on SHERPA
Low	162	25	187	1	0–3
Mild	92	28	120	1.97	3.5–4.5
Moderate	59	38	97	4.17	5–6
High	46	74	120	10.42	>6
Total	359	165	524		

OR: odds ratio

roundings taken into account (e.g. for falls, the weight was 0 if no fall occurred during the previous year, and 2 otherwise). The resulting score ranged from 0 to 11.5. Then, to simplify clinical use, but also to avoid a large category of intermediate risk patients, we collapsed contiguous rows to construct a 4-category scale. Categorization was obtained using cross tabulation between *decline* and *SHERPA* and a linear analysis for trend in proportions provided the gradient of odds ratio. Odds ratio showed that the risk of functional decline was doubled when switching from one category to the next (table 4).

Testing of SHERPA

A logistic regression using stepwise procedure was performed (SAS proc logistic with backward selection). This regression included SHERPA and the five original predictors. Only SHERPA was included in the final model. Regression parameter was 0.783 with a standard error of 0.091, and odds ratio obtained by this analysis was 2.18. The area under the ROC curve was 0.734, indicating a moderate discrimination. For the 4-point score, the estimates of sensitivity and specificity were 67.9% and 70.8%, respectively, as computed by the SAS LOGISTIC procedure, which provides and unbiased estimate of error count.[22] Table 5 shows the sensitivity and specificity and likelihood ratio at each cut-off of the SHERPA score.

Discussion

The score we developed can be used as a simple scoring system to stratify elderly patients into high, moderate, mild and low risk groups for functional decline in the 3 months following hospitalization in emergency. It is based on five risk factors that are easily assessed on admission. (i) Age, (ii) IADL and (iii) cognitive decline assessed by MMSE are factors associated with functional decline in previous studies[2,3,13,15,23,24] and mentioned in a recent review.[25] (iv) A history of falls in the previous year is also associated with functional decline and institutionalization.[26,27] It is thus an important factor to consider even if its prevalence is probably underestimated when simply based on patients' recall of falls.[28] (v) Studies on self-perceived health and functional decline are less numerous; this association was shown in a study performed in a non-hospitalized population.[29] Our results showed that self-perceived as poor is a predictor of hospital-associated functional decline in multivariate analysis.

Table 5 Performance of SHERPA

Cut-off	Sensitivity (%)	Specificity (%)	SHERPA category	Likelihood ratio[a]
			Low	0.33
Score <3.5	85	45	Mild	0.66
Score <5	68	71	Moderate	1.4
Score ≤6	45	87.2	High	3.5

Prevalence of decline is 31.5%
a: likelihood ratios are computed on the 4-category scale while sensitivity and specificity are calculated on two-by-two tables as indicated by the cut-off

In our study, we defined functional decline as a loss in ability to perform ADLs. Admission in nursing homes was sometimes used as an indirect measure of functional decline,[13,30] but we believed that institutionalization also relies on cultural and socio-demographic factors. Nevertheless, this outcome was tested in a subgroup of patients in our study, and we were able to observe an association between SHERPA score and the rate of nursing home admission 3 months after discharge ($P < 0.001$).

As mentioned, interviewers on admission and after discharge were the same. This could be an advantage for acceptance of telephone call,[31] but also could introduce some bias as these interviewers were not completely blinded to early data. SHERPA has not been validated yet in an independent patient sample, which is a limitation.

SHERPA has a moderate predictive discriminatory ability. This is probably explained by the fact that only patient variables available on admission were used. Our study was not designed to take into account biological variables, such as albumin, process of care or important events during hospitalization (hospital-acquired infections, delirium, deconditioning, etc.). In literature, the predictive ability of scores is also moderate. Sager et al.[14] found a ROC area of 0.65 for the HARP. Wu et al.[15] found a value of 0.81 for their predictive model of functional decline 2 months after discharge, but when that model used interview variables only, the ROC area was 0.77. Their first model included biological variables such as albumin, and medical considerations such as depth of coma, if any, the presence of dementia and depression. The ISAR score, developed on emergency elderly patients who may or not be hospitalized, had a ROC area of 0.70.[32] Our instrument performs at least as well as other instruments developed to screen patients at risk of functional decline after a hospitalization or an admission to emergency. We believe that the ability to predict functional decline with interview data on admission is limited, and that efforts should be made to collect biological and medical information, but also data on adverse events and process of care during the course of hospitalization. In this perspective, assessing the risk of functional decline should be a continuous process for older hospitalized people. SHERPA could be the first step in this process.

Its feasibility in the emergency room will help SHERPA to be well accepted by clinicians and nurses. This score could help clinicians to make explicit their clinical impressions and

facilitate professional communications with colleagues not usually charged with geriatric care. In our opinion, this is one of the main interests of such tool: introducing geriatrics and functional concern in the emergency room and in other medical or surgical wards where increasing number of very old patients are admitted. A prognostic score as SHERPA could provide a basis for discussions with specialists about the future plan of care and therapy, as one piece of information that should be combined with other considerations, such as, for example, availability of rehabilitation resources. Nevertheless, to increase the use of such scores, it seems important that the level of risk should be converted into adequate planning of action. For example, a patient at high risk should be preferably admitted in to an Acute Care for Elders (ACE) unit, a moderate risk could lead to a standardized geriatric evaluation, etc. This could be the focus of future work.

Acknowledgements

P.C. was supported by a grant from the Commission Communautaire Française (CoCoF) of Belgium (Allocation 12.34-D016,1998). There was no conflict of interest involved in the study. An abstract of this study was presented at the 6th French International Congress for Geriatrics and Gerontology in Brussels, Belgium, September 2003.

Key points

- Thirty percents of older people hospitalized in emergency decline in Activities of Daily Living (ADL) functioning 3 months after discharge as compared with their pre-morbid functioning level.
- Five easily identified factors are predictors of functional decline following hospitalization: age, pre-morbid instrumental ADL, low Mini Mental State score, fall in the previous year and poor self-perceived health.
- Based on these factors, we developed a score which stratify elderly patients into 4 categories of risk of functional decline.
- This instrument, named SHERPA, could provide clinicians with useful information in order to plan care and therapy of older patients.

References

1 Creditor M. Hazards of hospitalization in the elderly. *Ann Intern Med* 1993;118:219–23.

2 Sager MA, Francke T, Inouye SK, et al. Functional outcomes of acute medical illness and hospitalization in older persons. *Arch Intern Med* 1996;156:645–52.

3 Hansen K, Mahoney J, Palta M. Risk factors for lack of recovery of ADL independence after hospital discharge. *J Am Geriatr Soc* 1999;47:360–5.

4 Covinsky KE, Justice AC, Rosenthal GE, et al. Measuring prognosis and case-mix in hospitalized elders: the importance of functional status. *J Gen Intern Med* 1997;12:203–8.

5 Fortinsky RH, Covinsky KE, Palmer RM, et al. Effect on functional changes before and during hospitalization on nursing home admission of older adults. *J Gerontol A Biol Sci Med Sci* 1999;54A:M521–6.

6 Walter LC, Brand RJ, Counsell SR, et al. Developement and validation of a prognostic index for 1-year mortality in older adults after hospitalization. *JAMA* 2001;285:2987–97.

7 Incalzi AR, Capparella O, Gemma A, et al. A simple method of recognizing geriatric patients at risk for death and disability. *J Am Geriatr Soc* 1992;40:34–8.

8 Hirsch CH, Sommers L, Olsen A, et al. The natural history of functional morbidity in hospitalized older patients. *J Am Geriatr Soc* 1990;38:1296–303.

9 Covinky KE, Palmer RM, Kresevic DM, et al. Improving functional outcomes in hospitalized elders: lessons from an acute care for elders unit. *Jt Comm J Qual Improv* 1998;24:63–76.

10 Van Pee D, Cornette P, Gillet JB, Swine C. Admission of geriatric patients in the emergency department: the Belgian experience for hospitals provided with a geriatric department. In: Vellas B, editor. *Facts research and intervention in gerontology*. New York: Springer, 1998.

11 Singal BM, Hedges JR, Rousseau EW, et al. Geriatric patient emergency visits. Part I: Comparison of visits by geriatric and younger patients. *Ann Emerg Med* 1992;21:808–13.

12 Rubenstein LZ. The emergency departement: a useful site for CGA? *J Am Geriatr Soc* 1996;44:601–2.

13 Inouye SK, Wagner DR, Acompora D, et al. A predictive index for functional decline in hospitalized elderly medical patients. *J Gen Intern Med* 1993;8:645–52.

14 Sager MA, Rudberg MA, Jalaluddin M, et al. Hospital Admission Risk Profile (HARP): identifying older patients at risk for functional decline following acute medicla illness and hospitalization. *J Am Geriatr Soc* 1996;44:251–7.

15 Wu AW, Yasui Y, Alzola C, et al. Predicting functional status outcomes in hospitalized patients aged 80 years and older. *J Am Geriatr Soc* 2000;48:S6–15.

16 Covinsky KE, Palmer RM, Counsell SR, et al. Functional status before hospitalization in acutely ill older adults: Validity and clinical importance of retrospective reports. *J Am Geriatr Soc* 2000;48:164–9.

17 Katz S, Ford AB, Moskovitz RW, et al. Studies of illness in the aged: the index of ADL: a standardized measure of biological and psychosocial function. *JAMA* 1963;185:914–9.

18 Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist* 1969;9:179–86.

19 Folstein MF, Folstein SE. Mini Mental State: A practical method for grading the cognitive state of patients for the clinican. *J Psychiat Res* 1975;12:189–98.

20 Mahoney J, Drinka TJK, Abler R, et al. Screening for depression: Single question versus GDS. *J Am Geriatr Soc* 1994;42:1006–8.

21 Hosmer DW, Lemeshow S. Applied logistic regression. New York: John Wiley and Sons, Inc., 1989:140–5.

22 SAS institute Inc. SAS/STAT user's guide, version 6, 4th edition, Vol. 2. Cary, NC: SAS Institute Inc., 1989.

23 Hansen K, Mahoney J, Palta M. Risk factors for lack of recovery of ADL independence after hospital discharge. *J Am Geriatr Soc* 1999;47:360–5.

24 Covinsky KE, Palmer RM, Fortinsky RH, et al. Loss of independence in activities of daily living in older adults hospitalized with medical illnesses: increased vulnerability with age. *J Am Geriatr Soc* 2003;51:451–8.

25 McCusker J, Kakuma R, Abrahamowicz M. Predictors of functional decline in hospitalized elderly patients: a systematic review. *J Gerontol* 2002;57A:M569–77.

26 Tinetti ME, Williams CS. The effect of falls and fall injuries on functioning in community-dwelling older persons. *J Gerontol* 1998;53A:M112–9.

27 Tinetti ME, Williams CS. Falls, injuries due to falls, and the risk of admission to a nursing home. *N Engl J Med* 1997;337:1279–84.

28 Cummings SR, Nevitt MC, Kidds S. Forgetting falls: the limited accuracy of recall of falls in the elderly. *J Am Geriatr Soc* 1988;36:613–6.

29 Greiner PA, Snowdon DA, Greiner LH. The relationship of self-rated function and self-rated health to concurrent functional ability, functional decline, and mortality: findings from the Nun Study. *J Gerontol B Psychol Sci Soc Sci* 1996;51:S234–41.

30 Narain P, Rubinstein L, Wieland G, et al. Predictors of immediate and 6-month outcomes in hospitalized elderly patients. The importance of functional status. *J Am Geriatr Soc* 1988;36:775–83.

31 Marcus A, Crane L. Telephone survey in public health research. *Med Care* 1986;24:97–112.

32 McCusker J, Bellavance F, Cardin S, et al. Detection of older people at increased risk of adverse health outcomes after an emergency visit: the ISAR screening tool. *J Am Geriatr Soc* 1999;47:1229–37.

Received 3 February 2004, accepted 6 September 2004

Appendix 1: SHERPA

	Risk score
Fall in the previous year	
No	0
Yes	2
MMSE <15/21	
No	0
Yes	2
Bad self-perceived health	
No	0
Yes	1.5
Age (years)	
<75	0
75–84	1.5
>84	3
Pre-admission IADL score	
6–7	0
5	1
3–4	2
0–1–2	3