

## Incidence and main factors associated with early unplanned hospital readmission among French medical inpatients aged 75 and over admitted through emergency units

LANIÈCE, Isabelle, *et al.*

### Abstract

Background: among elderly patients, readmission in the month following hospital discharge is a frequent occurrence which involves a risk of functional decline, particularly among frail subjects. While previous studies have identified risk factors of early readmission, geriatric syndromes, as markers of frailty have not been assessed as potential predictors. Objective: to evaluate the risk of early unplanned readmission, and to identify predictors in inpatients aged 75 and over, admitted to medical wards through emergency departments. Design: prospective multi-centre study. Setting: nine French hospitals. Subjects: one thousand three hundred and six medical inpatients, aged 75 and older admitted through emergency departments (SAFES cohort). Methods: using logistic regressions, factors associated with early unplanned re-hospitalisation (defined as first unplanned readmission in the thirty days after discharge) were identified using data from the first week of hospital index stay obtained by comprehensive geriatric assessment. Results: data from a thousand out of 1,306 inpatients were analysed. Early unplanned readmission [...]

LANIÈCE, Isabelle, *et al.* Incidence and main factors associated with early unplanned hospital readmission among French medical inpatients aged 75 and over admitted through emergency units. *Age and Ageing*, 2008, vol. 37, no. 4, p. 416-422

DOI : 10.1093/ageing/afn093

Available at:

<http://archive-ouverte.unige.ch/unige:100525>

Disclaimer: layout of this document may differ from the published version.



# Incidence and main factors associated with early unplanned hospital readmission among French medical inpatients aged 75 and over admitted through emergency units

ISABELLE LANIÈCE<sup>1</sup>, PASCAL COUTURIER<sup>1</sup>, MOUSTAPHA DRAMÉ<sup>2,3</sup>, GAËTAN GAVAZZI<sup>1</sup>, STÉPHANIE LEHMAN<sup>1</sup>, DAMIEN JOLLY<sup>2,4</sup>, THIERRY VOISIN<sup>5</sup>, PIERRE OLIVIER LANG<sup>6</sup>, NICOLAS JOVENIN<sup>2,4</sup>, JEAN BERNARD GAUVAIN<sup>7</sup>, JEAN-LUC NOVELLA<sup>2,3</sup>, OLIVIER SAINT-JEAN<sup>8</sup>, FRANÇOIS BLANCHARD<sup>2,3</sup>

<sup>1</sup>Clinic of Geriatric Medicine, Hôpital Michallon, University Hospital of Grenoble, Grenoble, France

<sup>2</sup>School of Medicine, University of Reims Champagne-Ardenne, E.A.3797, Reims, France

<sup>3</sup>Internal Medicine Unit and Geriatric Clinic, Hôpital Sébastopol, University Hospital of Reims, Reims, France

<sup>4</sup>Methodological Assistance Unit, Department of Medical Information, Hôpital Maison Blanche, University Hospital of Reims, Reims, France

<sup>5</sup>Internal Medicine Unit and Gerontology Clinic, Hôpital de Rangueil, University Hospital of Toulouse, Toulouse, France

<sup>6</sup>Department of Geriatric and Rehabilitation, Hôpital des Trois-Chênes, University Hospital of Geneva, Thônex-Genève, Switzerland

<sup>7</sup>Center for Geriatric Medicine, Hôpital Porte Madeleine, Hospital Center of Orléans, Orléans, France

<sup>8</sup>Division of Geriatrics, Hôpital Européen G. Pompidou, Assistance Publique-Hôpitaux de Paris, Paris, France

Address correspondence to: Pr. Pascal Couturier. Tel: 00 33 4 76 76 89 07; Fax: 00 33 4 76 76 89 08.  
Email: PCouturier@chu-grenoble.fr

---

## Abstract

**Background:** among elderly patients, readmission in the month following hospital discharge is a frequent occurrence which involves a risk of functional decline, particularly among frail subjects. While previous studies have identified risk factors of early readmission, geriatric syndromes, as markers of frailty have not been assessed as potential predictors.

**Objective:** to evaluate the risk of early unplanned readmission, and to identify predictors in inpatients aged 75 and over, admitted to medical wards through emergency departments.

**Design:** prospective multi-centre study.

**Setting:** nine French hospitals.

**Subjects:** one thousand three hundred and six medical inpatients, aged 75 and older admitted through emergency departments (SAFES cohort).

**Methods:** using logistic regressions, factors associated with early unplanned re-hospitalisation (defined as first unplanned readmission in the thirty days after discharge) were identified using data from the first week of hospital index stay obtained by comprehensive geriatric assessment.

**Results:** data from a thousand out of 1,306 inpatients were analysed. Early unplanned readmission occurred in 14.2% of inpatients and was not related with sociodemographic characteristics, comorbidity burden or cognitive impairment. Pressure sores (OR = 2.05, 95% CI = 1.0–3.9), poor overall condition (OR = 2.01, 95% CI = 1.3–3.0), recent loss of ability for self-feeding (OR = 1.9, 95% CI = 1.2–2.9), prior hospitalisation during the last 3 months (OR = 1.6, 95% CI = 1.1–2.5) were found to be risk factors, while sight disorders appeared as negatively associated (OR = 0.5, 95% CI = 0.3–0.8).

**Conclusions:** markers of frailty (poor overall condition, pressure sores, prior hospitalisation) or severe disability (for self-feeding) were the most important predictors of early readmission among elderly medical inpatients. Early identification could facilitate preventive strategies in risk group.

**Keywords:** *frail, elderly, hospital readmission, risk factors*

---

## Introduction

Episodes of hospitalisation and re-hospitalisation are a particular feature among elderly people. Early readmission is a frequent occurrence, involving between 5 and 35% of patients in the month following discharge [1]. It is an economic marker for consumption of costly care. Unplanned readmissions may be considered with caution as a sentinel event for questioning the quality of care during and after the initial stay. In the context of the French inpatient care financing (a case mix-based hospital prospective payment system), early unplanned readmission rate may be a useful parameter to follow the consequence of an excessive reduction of lengths of stay in the hospital. For frail subjects, functional decline commonly related to acute illnesses may worsen or not recover during hospitalisation which is a critical time to identify needs for rehabilitation care, and renewed need for assistance at home [2–4]. ‘Avoidable’ readmission (between 9 and 50% according to authors) generally occurs in the month following discharge [1, 5, 6].

Several studies have looked at early re-hospitalisation and at its predictors among elderly subjects within different intra-hospital care itineraries [1]. Various combinations of these associated factors have been put forward, related either to intrinsic characteristics of the patient (socio-demographic profile, functional and clinical status) [6–15], or to the patient’s environment (living environment, isolation and support of carers) [5–9], or to modes of health-care provision, at the time of the initial hospitalisation, and in the community [1, 6, 13, 16, 17].

The aims of this work were to assess the incidence of early re-hospitalisation and to identify the associated factors present at the start of the initial hospitalisation among elderly subjects hospitalised in medical ward after being admitted through emergency department (ED). The goal was to enable identification of candidate patients for comprehensive geriatric assessment (CGA), so as to implement preventive strategies in risk groups.

## Methods

### Setting, study design and sample

This study was conducted within a hospital clinical research programme including nine French hospital facilities and an ED. The acronym of the study is [*Sujet Agé Fragile: Evaluation et Suivi* (SAFES)—care and follow-up of frail elderly subjects]. This multi-centre programme looked at the issues of frailty and its consequences in terms of morbidity, mortality, disability and care itinerary. A 24-month follow-up was implemented on a cohort of elderly subjects of 75 and over, hospitalised in any medical specialities (geriatric or not, except intensive care unit), after admission through ED. Patients’ recruitment proceeded through a two-stage randomisation process from a list of consecutive eligible subjects. Some first results on early markers for prolonged hospital stay have recently been published [18]. This study

has already detailed the cohort design. In the course of the first hospital interview, the patient or his representative received information on the study before signing informed consent. The SAFES research programme had the approval of the Champagne-Ardenne (France) Ethics Committee.

### Data collection using an initial geriatric assessment

A CGA was conducted between the fourth and the seventh day of the initial hospital stay by a geriatrician. The information collected concerned socio-demographic data, living environment, health status and hospitalisation data. The data collection instruments used to assess functional, mood and cognitive status, risk of malnutrition and pressure sores, burden of co-morbidities, had all been validated and are detailed further in the supplementary data on the journal’s website <http://www.ageing.oxfordjournals.org>. For each pathology present at the time of admission, disease status was classified according to three levels: acute, chronic unstable or chronic stable. The presence of 15 geriatric syndromes [4, 18] (detailed further in the supplementary data on the journal’s website <http://www.ageing.oxfordjournals.org>) and the occurrence of hospitalisation in the 3 months preceding admission to ED, were recorded. Readmissions occurring during the 24-month follow-up were collected.

### Statistical analyses

A descriptive analysis of the patients’ admission profile was conducted. Early re-hospitalisation was defined as the first episode of unplanned readmission occurring in the 30 days after discharge from the index hospitalisation. Two patient groups were compared for admission profile, in relation to their ‘readmitted early’ versus ‘not readmitted early’ status. The first step of selection was a univariate logistic regression with a threshold level set at  $P = 0.25$ . Then, separate multivariate logistic regressions were conducted in three sub-sets of data (socio-demographic, functional and health characteristics, respectively), using a stepwise descending selection procedure, with an exit threshold at  $P = 0.10$ . The threshold for statistical significance was set at  $P = 0.05$ . Any collinearity among the different independent variables, retained for multivariate analysis, was looked for by calculation of Spearman coefficients  $r$  (variables associated with  $r$  value under 0.4 were considered unlikely to cause instability of regression parameters). Finally, a global multivariate model was conducted including the variables associated with early readmission with a  $P$  value  $\leq 0.05$  in the three separate multivariate models. Age, gender and hospital centre were forced into the multivariate models as adjustment variables. Statistical analyses were conducted using Stata 8.0 (Stat Corp., College Station, TX).

## Results

Among the 1,306 subjects included at the time of the initial CGA, 220 were not retained in the analysis. Among these, 195 died before the 30th day after discharge from

Table 1. Functional characteristics of subjects

| Characteristic           | All subjects ( <i>n</i> = 1,000) |                   |                    |
|--------------------------|----------------------------------|-------------------|--------------------|
|                          | Dependent at D-15%               | Dependent at D 7% | Became dependent % |
| <b>ADL—Katz scale</b>    |                                  |                   |                    |
| Bodily care              | 45.6                             | 80.6              | 35.7               |
| Dressing                 | 39.3                             | 72.5              | 35.4               |
| Using the toilet         | 19.9                             | 55.4              | 36.3               |
| Mobility                 | 22.1                             | 59.5              | 38.1               |
| Feeding                  | 22.7                             | 43.5              | 23.1               |
| For one of the 5 ADLs    | 48.5                             | 82.6              | 60.0               |
| <b>IADL—Lawton scale</b> |                                  |                   |                    |
| Loss of at least 2 IADLs | 86.2                             |                   |                    |

D-15, before admission (assessed retrospectively at inclusion); D 7, at admission; became dependent, subject losing the ability between D-15 and D 7; ADL, activities of daily living; IADL, instrumental activities of daily living.

index hospitalisation without being re-hospitalised, and 25 remained in hospital throughout the follow-up period.

Among the 1,086 remaining eligible patients, 86 (8%) were excluded (45 were lost in follow-up and 41 withdrew). Their main admission characteristics were comparable to those of the remaining 1,000 subjects, considered for subsequent analyses.

### Characteristics at admission

#### *Socio-demographic and environmental characteristics*

Sixty-five per cent of the 1,000 subjects were women; the mean age was 84 years; 32% of the subjects were living with a spouse or partner; 41% were living alone, and 15% in an institution (see Table 1). All the subjects had attended primary school, and 70% had schooling to a higher level. The median for monthly household income was 1,067 euros. Seventy-eight per cent of patients had at least one son/daughter. Sixty-five per cent had an identified main caregiver. Twenty-eight per cent were receiving care in their homes by a visiting nurse prior to admission.

#### *Functional status*

The functional state of patients is presented at two points in time, (before admission, labelled 'D-15' and at admission, labelled 'D 7'), for each of the activities of daily living (ADL) considered, as well as in a more global manner in terms of dependency for at least one ADL or at least two instrumental activities of daily living (IADL) (see Table 1). The loss of an ability to perform any of the ADLs between D-15 and D 7 was also studied, reflecting the functional impact of the acute event leading to hospitalisation. Pre-admission (D-15) dependence for one ADL or two IADLs at least was observed for 48 and 86% of patients, respectively. Sixty per cent of patients had lost autonomy or at least one ADL following the acute event.

Table 2. Geriatric syndromes at inclusion

| Characteristic                           | All subjects<br><i>n</i> = 1,000 |
|--|----------------------------------|
| Number of geriatric syndromes, mean ± SD | 5.2 ± 3.0                        |
| Loss of independence, %                  | 73.2                             |
| Risk of malnutrition (on MNA-sf), %      | 72.3                             |
| Walking difficulties, %                  | 71.0                             |
| Poor overall condition, %                | 48.1                             |
| Sight disorder, %                        | 44.4                             |
| Falls, %                                 | 42.1                             |
| Incontinence, %                          | 39.9                             |
| Mood disorder, %                         | 38.4                             |
| Deafness, %                              | 37.3                             |
| Cognitive impairment, %                  | 30.9                             |
| Delirium, %                              | 19.2                             |
| Bedridden, %                             | 12.9                             |
| Post-fall syndrome, %                    | 7.6                              |
| Failure to thrive, %                     | 6.8                              |
| Pressure sores, %                        | 6.0                              |

SD, standard deviation; MNA-sf, mini nutritional assessment—short form.

#### *Health status*

Geriatric syndromes were frequent with varied prevalence rates (see Table 2). Loss of independence, risk of malnutrition and walking difficulties affected more than 70% of subjects. Overall poor condition was noted in around half the subjects. Sensory impairment, falls, continence problems and mood disorders were present in 40%. Cognitive impairment was noted in 30% and delirium in 19%. Nearly 12% were bedridden, and 6% had pressure sores.

More than 90% of the subjects had at least one acute pathology at inclusion. Thirty-one per cent presented moderately severe co-morbidity, and 2.6% very severe co-morbidity. The number of prescribed drugs at the time of admission was high (median 6, interquartile range 4–8).

#### *Care itinerary before inclusion*

Twenty-seven per cent had been hospitalised in the 3 months preceding admission to ED. At the time of the index hospitalisation, 44% of patients were admitted into the geriatric department.

### Early unplanned re-hospitalisation: incidence and relationship to mortality

The incidence of early re-hospitalisation was 14% with a 95% confidence interval (95% CI) from 12.0 to 16.7%. It ranged from 9.8 to 17.5% depending on the hospital facility.

Early re-hospitalisation was related to increased vulnerability. The mortality was 6 times higher among early readmitted patients than among others (26.0 versus 3.9%) during the 3 months after index admission, and was 1.7 times higher over the 2-year follow-up period.

### Univariate and multivariate analyses

The comparison between the ‘readmitted early’ group and the ‘not readmitted early’ group conducted in the three separate datasets identified five variables with a  $P$  value  $\leq 0.05$  in multivariate analysis. These five variables and the three forced variables (age, gender and hospital centre) were retained for the global multivariate analysis. This final logistic regression model comprised five main effects, alongside the non-significant effects of forced variables (see Table 3). No significant interaction was noted between forced variables and predictive variables. The Hosmer–Lemeshow test (chi-square = 6.0 with  $P = 0.647$ ) was in favour of satisfactory model fit.

Only one functional characteristic, the loss of the ability of the subject to feed himself/herself between D-15 and D 7 was associated with re-hospitalisation with an adjusted operational research odds ratio (OR) at 1.9 (95% CI 1.2–2.9). For clinical status, among the variables, only geriatric syndromes were retained in univariate analysis. In multivariate analysis, the presence of pressure sores and poor overall condition were factors associated with readmission, with ORs of 2.05 (95% CI 1.0–3.9) and 2.01 (95% CI 1.3–3.0) respectively, while sight disorders showed a reverse association, with an OR at 0.5 (95% CI 0.3–0.8). Hospitalisation in the 3 months preceding admission to ED was also a risk factor for re-hospitalisation with an OR at 1.6 (95% CI 1.1–2.5).

### Discussion

This study found that unplanned readmission within 30 days is associated with pressure sores, poor overall condition, recent loss of the ability to feed oneself, prior hospitalisation within 3 months, and is negatively related to visual impairment.

This study was based on a multi-centre cohort of substantial size, and took account of all episodes of re-hospitalisation, whether or not they occurred in the hospital facility where the initial stay took place (around 22% of early re-hospitalisations have been observed to occur in facilities that were not the facility of the index hospitalisation) [16]. However, although this cohort had a considerable sample size, lack of power to identify mild to moderate effects of some variables cannot be excluded.

Early re-hospitalisation concerns about one patient in six. The proportion shown by the present study (14.2%) is comparable to that reported in France (varying from 10.8 to 17%) [19–21] and abroad (12%) [22], for those studies that considered subjects of the same minimum age of 75 years, hospitalised in any hospital ward or in a medical or geriatric ward, with unplanned readmission in an interval of 30 days from the day of discharge.

With regard to the factors associated with early re-hospitalisation, a first result is the absence of any impact of socio-demographic or living environment factors. Earlier multivariate analyses had pinpointed male gender [7, 8], advanced age [7], isolation [5, 9], problematic social environment [9], and low income [10] as risk factors.

In this cohort, caregiver characteristics such as age, health condition and burnout, which may contribute to explain readmission, were not studied, and should be considered in subsequent research.

From a functional viewpoint, the recent loss of the ability for self-feeding is retained as a risk factor, while dependency status at baseline or at admission appears less important as such. Earlier studies had shown that the level of dependency for ADL (global or mobility) at discharge was linked to early re-hospitalisation [6, 11]. Carlson *et al.* noted that a change in functional status was more predictive than the level of dependency at discharge [11]. The loss of the ‘self-feeding’ ADL and its association with early re-hospitalisation could be explained by sustained or severe anorexia related to the pathological state or by the loss of the ability to swallow, very frequent among elderly people after an acute episode. Need for feeding at home reflects an extreme state of frailty, requiring a considerable caregiver implication, and may not be met because of problems of isolation or continuity of care [23].

Among clinical features, none of the risk factors identified previously, such as the severity of clinical status on admission [8, 9, 12, 13], the severity of co-morbidity [7, 14], and neuro-psychological condition (cognitive impairment [9], depression [8, 15]) appears to be associated with early readmission in the present work, even in univariate analysis. To our knowledge, no previous study has included the main geriatric syndromes as potential risk factors for early re-hospitalisation. Winograd *et al.* showed that in prediction of mortality and institutionalisation, geriatric syndromes played a more important part than age or morbidity profile [4]. The study by Satish *et al.* confirmed the significant effect of certain geriatric syndromes in presence of variables describing functional and clinical status in predicting survival or admission to an institution, but no geriatric syndrome was reported to be associated with duration of re-hospitalisation [24]. In the present sample, among the three geriatric syndromes predictive in multivariate analysis, poor overall condition and the presence of pressure sores can reflect diagnostic difficulties among poly-pathological patients and the direct consequences of acute immobilisation. For these highly frail patients, the issue is all about how far the amount of care required at discharge and the resources available in the home are matched.

In contrast, patients with sight problems that have repercussions on basic daily living appear less likely to be readmitted early. Previously, McCusker *et al.* identified sight disorders as one of the six risk factors making up the Identification of Seniors at Risk (ISAR) score, which is a screening instrument predicting risk of hospitalisation (rather than re-hospitalisation) in patients of 65 years and over who had visited the ED [25]. In the SAFES cohort, the proportion of re-hospitalisations is lower among patients with sight disorders than among other subjects, independently from their living environment. Their admission profile is characterised by a higher burden of geriatric syndromes but a not different one in terms of main pathologies and co-morbidity. Considering hospital accessibility *a priori* to be

Table 3. Factors predictive of early re-hospitalisation

|  |           | Univariate analysis<br>Odds-ratio<br>(95% CI) | Multivariate analysis<br>by sub-sets of data |                      | Final analysis<br><i>n</i> = 944 |                      |
|--|-----------|---|--|----------------------|----------------------------------|----------------------|
|  |           |   | Odds-ratio<br>(95% CI)                       | Value<br>of <i>P</i> | Odds-ratio<br>(95% CI)           | Value<br>of <i>P</i> |
| Patients characteristics                               |           |   |  |                      |                                  |                      |
| Socio-demographic characteristics                      |           |   |  |                      |                                  |                      |
| Assistance of nurse at D-15                            | yes vs no | 1.5 (1.0–2.3)**                               | 1.6 (1.0–2.5)                                | 0.037                |                                  |                      |
| Living in an institution                               | yes vs no | 1.3 (0.8–2.1)*                                |  |                      |                                  |                      |
| Functional characteristics                             |           |   |  |                      |                                  |                      |
| ADL—Katz scale   |           |   |  |                      |                                  |                      |
| Bodily care  |           |   |  |                      |                                  |                      |
| Dependent at D-15                                      | yes vs no | 1.3 (0.9–1.9)*                                | 1.3 (0.9–2.0)                                | 0.113                |                                  |                      |
| Dependent at D 7                                       | yes vs no | 1.7 (1.0–2.9)**                               |  |                      |                                  |                      |
| Dressing   |           |   |  |                      |                                  |                      |
| Dependent at D-15                                      | yes vs no | 1.3 (0.9–1.9)*                                |  |                      |                                  |                      |
| Dependent at D 7                                       | yes vs no | 1.5 (0.9–2.3)*                                |  |                      |                                  |                      |
| Using the toilet                                       |           |   |  |                      |                                  |                      |
| Dependent at D 7                                       | yes vs no | 1.3 (0.9–1.9)*                                |  |                      |                                  |                      |
| Mobility   |           |   |  |                      |                                  |                      |
| Dependent at D 7                                       | yes vs no | 1.3 (0.9–1.9)*                                |  |                      |                                  |                      |
| Feeding  |           |   |  |                      |                                  |                      |
| Dependent at D 7                                       | yes vs no | 1.4 (1.0–2.1)**                               |  |                      |                                  |                      |
| Became dependent                                       | yes vs no | 1.7 (1.2–2.6)***                              | 1.8 (1.2–2.7)                                | 0.003                | 1.9 (1.2–2.9)                    | 0.002                |
| For one of the 5 ADLs:                                 |           |   |  |                      |                                  |                      |
| Dependent at D-15                                      | yes vs no | 1.3 (0.9–1.8)*                                |  |                      |                                  |                      |
| Dependent at D 7                                       | yes vs no | 1.7 (0.9–2.9)*                                |  |                      |                                  |                      |
| Became dependent                                       | yes vs no | 1.3 (0.9–2.0)*                                | 1.4 (0.8–2.3)                                | 0.182                |                                  |                      |
| IADL—Lawton scale                                      |           |   |  |                      |                                  |                      |
| Loss of at least 2 IADLs at D 15                       | yes vs no | 1.5 (0.9–2.5)*                                |  |                      |                                  |                      |
| Health characteristics                                 |           |   |  |                      |                                  |                      |
| Pressure sores   | yes vs no | 2.1 (1.1–4.0)**                               | 1.8 (1.09–3.6)                               | 0.077                | 2.0 (1.0–3.9)                    | 0.031                |
| Poor overall condition                                 | yes vs no | 2.2 (1.5–3.2)***                              | 2.1 (1.4–3.2)                                | 0.000                | 2.0 (1.3–3.0)                    | 0.001                |
| Hospitalisation in the 3 months before admission to EU | yes vs no | 1.7 (1.2–2.5)***                              | 1.5 (1.0–2.3)                                | 0.021                | 1.6 (1.1–2.5)                    | 0.011                |
| Sight disorder   | yes vs no | 0.6 (0.4–0.9)**                               | 0.5 (0.3–0.8)                                | 0.006                | 0.5 (0.3–0.8)                    | 0.006                |
| Number of geriatric syndromes >5                       |           | 1.5 (1.0–2.2)**                               |  |                      |                                  |                      |
| Loss of independence                                   | yes vs no | 1.7 (1.1–2.8)**                               |  |                      |                                  |                      |
| Risk of malnutrition                                   | yes vs no | 1.8 (1.1–2.9)*                                |  |                      |                                  |                      |
| Walking difficulties                                   | yes vs no | 1.5 (0.9–2.3)*                                |  |                      |                                  |                      |
| Falls  | yes vs no | 1.2 (0.8–1.8)*                                | 1.3 (0.8–1.9)                                | 0.167                |                                  |                      |
| Incontinence   | yes vs no | 1.3 (0.9–1.9)*                                |  |                      |                                  |                      |
| Failure to thrive                                      | yes vs no | 1.7 (0.9–3.1)*                                |  |                      |                                  |                      |

Only variables associated with early readmission with  $P \leq 0.25$  in uni- or multivariate analysis of sub datasets are presented; vs, versus.

\* Wald test with  $0.05 < P \leq 0.25$ ;

\*\* Wald test with  $0.01 < P \leq 0.05$ ;

\*\*\* Wald test with  $P \leq 0.01$ . D-15, before admission; D 7, at inclusion. ADL, activities of daily living; IADL, instrumental activities of daily living.

identical, we presume that for these patients with a long-standing severe disability, the living environment is more likely to be adapted to the deficit, thus facilitating ambulatory medical care provision, which is also preferred because of fears of the more damaging effects of hospitalisation.

Regarding health care specialities, geriatric departments do not appear to be associated with a readmission rate different from that of other medical departments. A previous recent hospitalisation is a risk factor for re-hospitalisation that has frequently been put forward [7, 10, 13, 14, 17]. It most often reflects the clinical instability of frail patients, and also the inadequacy of assistance provision in the home.

Characteristics of hospital care provision (care process [1, 16, 17, 26], duration of initial stay [6, 13]) and of post-discharge ambulatory care [17] were not studied here, since the objective was to identify risk factors present at the start of the index hospitalisation. These factors merit specific attention in any strategies aiming to prevent unplanned re-hospitalisation, since they are at least in part modifiable [16, 26].

In the SAFES cohort, if at least two risk factors are present among the four (poor overall condition, pressure sores, recent loss of self-feeding or prior admission in the past 3 months), risk of early readmission is greater than 20%. Prompt

identification of these risk factors may allow to pinpoint at-risk individuals. Among those, a CGA could be conducted by mobile geriatric teams aiming to optimise care provision both in hospital and afterwards. This type of assessment is more likely to be effective in randomised intervention studies for prevention of re-hospitalisation, in situations where particular sub-populations (in particular, frail) are targeted and where post-discharge provision of geriatric care and follow-up of recommendations are implemented [27–30]. The impact of such interventions (identification on the basis of a few simple criteria, and then targeted geriatric assessments) needs to be explored.

### Conclusion

These results show that among patients admitted through emergency unit to medical wards, risk factors for early re-hospitalisation are identifiable at the start of their hospital stay. These are connected with significant deterioration of functional status or with the overall frailty of patients, rather than with the acute episode or any associated co-morbidity *per se*. From an operational viewpoint, early identification of patients at risk for early re-hospitalisation appears to require consideration of (1) the impact of severe loss of autonomy in feeding abilities implying a considerable degree of assistance in the home or in the institution, (2) the presence of pressure sores requiring a lot of direct care and (3) deterioration in overall condition justifying prolonged care, in the form of intermediate or long-term care or institutionalisation.

### Key points

- Early unplanned readmission occurred in one out of six medical inpatients aged 75 years and over admitted through emergency departments (EDs).
- The main risk factors for early readmission identified at initial admission were associated with recent severe disability for self-feeding and presence of markers of frailty (poor overall condition, presence of pressure sore and prior hospitalisation).
- Early identification could facilitate preventive strategies in risk groups.

### Acknowledgements

This study was designed and conducted by the SAFES cohort study group which includes: Joël Ankri, François Blanchard, Pascal Couturier, Benoit De Wazière, Moustapha Dramé, Jean Bernard Gauvain, Régis Gonthier, Damien Heitz, Claude Jeandel, Damien Jolly, Nicolas Jovenin, Jean-Luc Novella, Olivier Saint-Jean, Dominique Somme, Thierry Voisin.

### Conflicts of interest

None.

### Funding

We are grateful to the Ministère de la Santé (France), the Caisse Nationale d'Assurance Maladie des Travailleurs Salariés and the Institut de la Longévité et du Vieillessement (INSERM, France) for their financial support.

### Supplementary data

Supplementary data for this article are available online at <http://ageing.oxfordjournals.org>.

### References

1. Benbassat J, Taragin M. Hospital readmissions as a measure of quality of health care: advantages and limitations. *Arch Intern Med* 2000; 160: 1074–81.
2. 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.
3. Fried LP, Ferrucci L, Darer J *et al*. Untangling the concepts of disability, frailty, and comorbidity: implications for improved targeting and care. *J Gerontol A Biol Sci Med Sci* 2004; 59: 255–63.
4. Winograd CH, Gerety MB, Chung M *et al*. Screening for frailty: criteria and predictors of outcomes. *J Am Geriatr Soc* 1991; 39: 778–84.
5. Tierney AJ, Worth A. Review: readmission of elderly patients to hospital. *Age Ageing* 1995; 24: 163–6.
6. Peres K, Rainfray M, Perrie N *et al*. Incidence, facteurs de risque and adéquation des réhospitalisations à court terme de personnes âgées. *Rev Epidemiol Sante Publique* 2002; 50: 109–19.
7. Boulton C, Dowd B, McCaffrey D *et al*. Screening elders for risk of hospital admission. *J Am Geriatr Soc* 1993; 41: 811–7.
8. Fethke CC, Smith IM, Johnson N. “Risk” factors affecting readmission of the elderly into the health care system. *Med Care* 1986; 24: 429–37.
9. Di Iorio A, Longo AL, Mitidieri Costanza A *et al*. Characteristics of geriatric patients related to early and late readmissions to hospital. *Aging (Milano)* 1998; 10: 339–46.
10. Williams EI, Fitton F. Factors affecting early unplanned readmission of elderly patients to hospital. *BMJ* 1988; 297: 784–7.
11. Carlson JE, Zocchi KA, Bettencourt DM *et al*. Measuring frailty in the hospitalized elderly: concept of functional homeostasis. *Am J Phys Med Rehabil* 1998; 77: 252–7.
12. Narain P, Rubenstein LZ, Wieland GD *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.
13. Comette P, D’Hoore W, Malhomme B *et al*. Differential risk factors for early and later hospital readmission of older patients. *Aging Clin Exp Res* 2005; 17: 322–8.
14. Burns B, Nichols LO. Factors predicting readmission of older general medicine patients. *J Gen Intern Med* 1991; 6: 389–93.
15. Bula CJ, Wietlisbach V, Burnand B *et al*. Depressive symptoms as a predictor of 6-month outcomes and services utilization in elderly medical inpatients. *Arch Intern Med* 2001; 161: 2609–15.

16. Ashton CM, Kuykendall DH, Johnson ML *et al.* The association between the quality of inpatient care and early readmission. *Ann Intern Med* 1995; 122: 415–21.
17. Reed RL, Pearlman RA, Buchner DM. Risk factors for early unplanned hospital readmission in the elderly. *J Gen Intern Med* 1991; 6: 223–8.
18. Lang PO, Heitz D, Hedelin G *et al.* Early markers of prolonged hospital stays in older people: a prospective, multicenter study of 908 inpatients in French acute hospitals. *J Am Geriatr Soc* 2006; 54: 1031–9.
19. Pichot-Duclos B, Alix E, Thomas O. Facteurs de risque de réhospitalisation des personnes âgées de 75 ans et plus dans un centre hospitalier général: étude transversale de prévalence d'indicateurs et validation de la prédiction de réhospitalisation par une étude longitudinale de type cas exposés versus cas non exposés. *L'Année Gérologique* 2002; 16: 42–58.
20. Pichot-Duclos B, Alix E, Thomas O *et al.* Conditions de validité d'un score de risque de réhospitalisation non programmée chez la personne âgée: étude longitudinale prospective réalisée dans un centre hospitalier général, et propositions pour améliorer la prise en charge des personnes âgées admises à l'hôpital. *L'Année Gérologique* 2004; 18: 313–29.
21. Barberger-Gateau P, Dabis F, Moise A *et al.* Facteurs liés à la durée d'hospitalisation des personnes âgées en court séjour. *Rev Epidemiol Sante Publique* 1987; 35: 463–73.
22. Townsend J, Dyer S, Cooper J *et al.* Emergency hospital admissions and readmissions of patients aged over 75 years and the effects of a community-based discharge scheme. *Health Trends* 1992; 24: 136–9.
23. Sands LP, Wang Y, McCabe GP *et al.* Rates of acute care admissions for frail older people living with met versus unmet activity of daily living needs. *J Am Geriatr Soc* 2006; 54: 339–44.
24. Satish S, Winograd CH, Chavez C *et al.* Geriatric targeting criteria as predictors of survival and health care utilization. *J Am Geriatr Soc* 1996; 44: 914–21.
25. McCusker J, Bellavance F, Cardin S *et al.* Prediction of hospital utilization among elderly patients during the 6 months after an emergency department visit. *Ann Emerg Med* 2000; 36: 438–45.
26. Gonseth J, Guallar-Castillon P, Banegas JR *et al.* The effectiveness of disease management programmes in reducing hospital re-admission in older patients with heart failure: a systematic review and meta-analysis of published reports. *Eur Heart J* 2004; 25: 1570–95.
27. Stuck AE, Siu AL, Wieland GD *et al.* Comprehensive geriatric assessment: a meta-analysis of controlled trials. *Lancet* 2003; 342: 1032–6.
28. Caplan GA, Williams AJ, Daly B *et al.* A randomized, controlled trial of comprehensive geriatric assessment and multidisciplinary intervention after discharge of elderly from the emergency department—the DEED II study. *J Am Geriatr Soc* 2004; 52: 1417–23.
29. Rubenstein LZ, Joseph T, Freeman T. Freeman award lecture: comprehensive geriatric assessment: from miracle to reality. *J Gerontol A Biol Sci Med Sci* 2004; 59: 473–7.
30. Kircher TTJ, Wormstall H, Muller PH *et al.* A randomised trial of a geriatric evaluation and management consultation services in frail hospitalised patients. *Age Ageing* 2007; 36: 36–42.

Received 21 May 2007; accepted in revised form 20 December 2007