

ORIGINAL ARTICLES

Characteristics associated with inappropriate hospital use in elderly patients admitted to a general internal medicine service¹

B.B. Ingold^{1,2} B. Yersin² V. Wietlisbach³, P. Burckhardt², B. Burnand³, and C.J. Büla^{1,2}

¹Division of Geriatric Medicine, and ²Department of Internal Medicine, Centre Hospitalier Universitaire Vaudois (CHUV), Lausanne, ³Institute of Social and Preventive Medicine, University of Lausanne, Lausanne, Switzerland

ABSTRACT. Our objective was to identify patient characteristics associated with inappropriate hospital days in a cohort of elderly medical inpatients. This prospective cohort study included a total of 196 patients aged 75 years and older, who were consecutively admitted over eight months to the internal medicine service of a regional, non-academic public hospital located in a rural area of Western Switzerland. Patients with severe cognitive impairment, terminal disease, or previously living in a nursing home were excluded. Data on demographics, medical, physical, social and mental status were collected at admission. A blinded hospitalization review was performed concurrently using a modified version of the Appropriateness Evaluation Protocol (AEP). Subjects' mean age was 82.4 years; 63.3% were women. Median length of stay was 8 days. Overall, 68 patients (34.7%) had at least one inappropriate day during their stay, including 18 patients (9.2%) whose hospital admission and entire stay were considered inappropriate. Most inappropriate days were due to discharge delays (87.1%), primarily to nursing homes (59.3%). Univariate analysis showed that subjects with inappropriate days were more likely to be living alone (69.1 vs 48.4%, $p=0.006$), and receiving formal in-home help (48.5 vs 32.8%, $p=0.031$). In addition, they were more impaired in basic and

instrumental activities of daily living (BADLs, and IADLs, $p<0.001$ and $p=0.015$, respectively), and more frequently had a depressed mood [29.4 vs 10.9%, $p=0.001$ with a score ≥ 6 at the Geriatric Depression Scale (GDS), short form]. Using multivariate analysis, independent associations remained for patients living alone (OR 2.6, 95%CI 1.2-5.8, $p=0.016$), those with a depressed mood (OR 2.8, 95%CI 1.1-7.3, $p=0.032$), with BADL dependencies (OR 1.5, 95%CI 1.2-1.8, $p=0.001$), and IADL dependencies (OR 1.3, 95%CI 1.0-1.6, $p=0.032$). Cardiovascular (OR 0.2, 95%CI 0.1-0.7, $p=0.008$) and pulmonary admission diagnoses (OR 0.1, 95%CI 0.0-0.7, $p=0.022$) were inversely associated with inappropriate hospital days. In conclusion, patients living alone, functionally impaired and showing depressive symptoms were at increased risk for inappropriate hospital days. These characteristics might permit better targeting for early discharge planning in these at-risk subjects, and contribute to avoiding premature discharge of other vulnerable elderly patients. Whether these interventions for at-risk patients will also result in prevention of hospitalization hazards, such as deconditioning and related functional decline, will require further study.

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Correspondence: C.J. Büla, M.D., CUTR Sylvania, Ch. de Sylvania # 10, 1066 Epalinges., Switzerland.

E-mail: Christophe.Bula@chuv.hospvd.ch

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INTRODUCTION

Several studies of elderly hospitalized persons have found an association between long hospital stays and adverse outcomes such as functional decline, in-hospital mortality, and nursing home admission (1-4). Studies of the appropriateness of hospital use have also shown that long hospital stays are associated with the occurrence of inappropriate hospital days (5-7). Inappropriate hospital days were defined by Gertmann and Restuccia (8) as days from which patients get no significant benefit, or get services that could have been provided at a lower level of care than the acute hospital setting. Utilization review instruments using explicit criteria such as the Appropriateness Evaluation Protocol (AEP) (8), or the Delay Tool (9) have been developed to identify inappropriate hospital days, and determine reasons for inappropriate hospital use (9-25). In most studies, delay due to discharge to places other than home (rehabilitation facilities or nursing homes) was the most frequent cause of inappropriate days (9-16). While the characteristics of elderly inpatients that predict length of stay, functional decline, nursing home admission, rehospitalizations or short-term mortality have been examined extensively (1-3, 26-33), few studies have addressed patients' characteristics associated with inappropriate hospital days (6, 14, 15, 20, 34), and none have specifically considered elderly patients. Moreover, the interpretation of the results of these studies is limited by methodological problems. For example, advanced age has been associated with an increased risk for inappropriate hospital days in several studies (5, 6, 14, 15, 20, 24, 34), but it is not clear whether age would remain an independent risk factor after controlling for confounding factors such as functional status or comorbidities. In addition, little information is available about other important factors such as the living situation, socioeconomic, affective or cognitive status, as well as the presence of comorbidities.

Some of the patient characteristics associated with the occurrence of inappropriate days might be similar to those associated with in-hospital functional decline, or discharge to a nursing home. Although prolonged stays are likely to be a consequence rather than a cause of functional impairments, the inverse might also be true for some elderly patients. Previous studies have shown that hospitalization is frequently followed by an often irreversible functional decline that cannot be attributed solely to the acute problem itself, or to complications of its treatment (2, 4). During hospitalization in the acute care setting, the deconditioning effect of bed immobilization and lack of physical activity is probably the most preventable cause of functional loss in the elderly (35, 36). Additional days spent in the hospital environment while awaiting a bed in a rehabilitation or

nursing home are likely to increase this risk of functional loss. Therefore, early identification of patients at risk for prolonged stay due to inappropriate days would not only be of economic interest, but might also possibly contribute to reducing the incidence of these adverse outcomes. Moreover, if it were shown that the risk of inappropriate use is not uniform within the elderly inpatient population, identifying those at greatest risk might help to prevent premature discharge of all elderly inpatients in an attempt to reduce inappropriate days.

Our aim was to identify which characteristics of elderly medical inpatients were associated with the presence of inappropriate hospital days during an index stay. We hypothesized that subjects with functional impairments in basic and instrumental activities of daily living (BADL and IADL, respectively), as well as in cognitive, and affective functions, would have an increased likelihood of spending inappropriate days in the hospital.

SUBJECTS AND METHODS

Study population and setting

The potential participants in this study were patients aged 75 years and over, consecutively admitted to the internal medicine service of a non-academic medical center located in a rural area of western, French-speaking Switzerland. From July 1995 to February 1996, 240 eligible patients were screened. Thirty-four (14.8%) were excluded because of inability to answer questions due to severe cognitive impairment (defined as the inability to give his/her name and date of birth, N=16), aphasia (N=5), terminal illness, unstable medical condition or coma (N=13). In addition, 10 patients (4.3%) refused to participate in the study. Thus, a total of 196 patients were eventually recruited. This study was approved by the institutional Review Board of the Faculty of Medicine, University of Lausanne. Written informed consent was obtained from each patient.

Data collection

Within 48 hours of admission, a trained research nurse interviewed the patients at bedside. Data collection included demographics, living situation, educational level, self-rated income (on a 5-point Likert scale, from no difficulties at all to many difficulties), as well as basic activities of daily living (BADL) (37) and instrumental activities of daily living (IADL) (38) prior to hospitalization. Self-perceived health status, cognitive status [Folstein's Mini Mental State Exam (MMSE), (39)] and affective status [Yesavage's Geriatric Depression Scale, short form (GDS), (40)] were also assessed. Home care services were systematically contacted to collect data on formal help received at home prior to hospitalization. In addition, in-hospital BADL performance was obtained

from the ward nurse in charge of the patient. Main admission diagnosis, Charlson's comorbidity index (41) and data on medication prescribed at home were collected from the medical chart. Information about length of stay and destination after discharge were collected from the administrative files.

Another trained nurse independently performed a concurrent chart review to identify inappropriate days. The modified version of the AEP currently used in this hospital has been described previously (16, 17), and includes a single list of 24 criteria to assess both the day of admission and subsequent days (see Appendix). Its reliability has been evaluated in the same setting, and found to be good (κ 0.80) (16, 17). According to this protocol, a day was considered inappropriate if it did not meet at least one of the 24 criteria. "Override" options were possible, allowing the reviewer to consider a day appropriate even in the absence of one criterion and vice-versa. Use of an override option had to be approved by a senior physician. It was never used during the study. For each inappropriate day, the reviewer selected a cause from the Delay Tool's causes of delay (9, 17).

Statistical analysis

Characteristics of subjects with and without inappropriate days were first compared by bivariate analysis using χ^2 or Fischer exact tests, depending on the distribution, for categorical variables. Student's *t*-test was used for continuous variables. A multivariate logistic regression analysis was performed to identify baseline characteristics independently associated with the presence of inappropriate days. The dependent variable was dichotomized according to the presence or absence of at least one inappropriate day. To be included in the model, variables had to show a statistically significant association in bivariate analysis. Although age, gender and Charlson comorbidity index had a borderline or non-significant association with the presence of inappropriate days in bivariate analysis, we included these variables in the model to control for their confounding effects. Because of high correlation, we had to exclude several variables from the final model. The performance-based measure of in-hospital BADL was preferred to the self-reported pre-admission BADL (Spearman's ρ 0.41, $p < 0.001$), because it was a more objective measure. Similarly, the pre-admission IADL and the measure of mobility (going out of home < 1 time / week) had a high negative correlation (Spearman's ρ - 0.41, $p < 0.001$). We decided to include the more commonly used IADL measure in the final model. A similar analysis was performed for the subgroup of subjects whose admission was considered inappropriate. Because of the very small number, non-para-

metric tests (Kruskall-Wallis and Fisher's exact test) were performed. Statistical analyses were performed using Stata 5.0 (Stata Corp, College Station, TX).

RESULTS

Baseline characteristics of the entire study population are shown in the first column of Table 1. The typical subject was an 82.4-year-old woman, living alone, with less than a high school education, and no financial difficulties. The most frequent admitting diagnoses were non-specific geriatric syndromes (29.1%) [i.e., falls (17.4%), malaise (3.5%), and failure to thrive (8.2%)], and cardiovascular diseases (19.4%). At the time of admission, more than two-thirds had at least one comorbidity, and about 16% had three or more comorbidities according to Charlson's index. Self-perceived health was rated fair or poor by 60.2% of the patients. Whereas the mean number of prescription drugs was 4.5 (range 0 to 13), 5% of the patients were not taking any medication. Dependency in one or more BADL and IADL prior to hospital admission was reported by 46.4% and 93.9% of the population, respectively. Using the commonly recommended cut-offs (39, 40, 42), abnormal MMSE (<24) and GDS (≥ 6) scores were observed in 41.3% and 17.4% of the patients, respectively.

Median length of stay was 8.0 days (mean 10.7, range 1-84). Overall, 9 patients (4.6%) died during the index stay, and none had inappropriate hospital days. Sixty-eight (34.7%) patients had a stay considered partially or totally inappropriate. Eighteen (9.2%) of the 196 admissions, and 550 (26.2%) of the 2098 hospital days were considered inappropriate. The number of inappropriate days ranged from 1 to 73 (median 5), representing on average 50% of the patient stay. All 18 patients with inappropriate admission had their entire stay considered inappropriate. The majority of inappropriate days (87.1%) were due to discharge delays, that were largely attributable to delays in admission to nursing homes (59.3%) and rehabilitation facilities (6.5%). Patients and/or their family were deemed responsible for discharge delays accounting for 14.6% of inappropriate days (e.g., because they were undecided regarding a test or treatment), while hospital staff was deemed responsible for 5.8% of inappropriate days (e.g., because the physician in charge was undecided regarding discharge disposition).

Bivariate analysis (Table 1) showed that patients with inappropriate days lived alone, and received formal help from in-home care services more frequently, and were less mobile. They more often had an admitting diagnosis of falls, malaise or failure to thrive. Cardiovascular and pulmonary diagnoses were

Table 1 - Baseline characteristics of the total population and univariate comparisons in patients with and without inappropriate hospital days.

	Total population N=196	Inappropriate days		p*
		Yes N=68	No N=128	
Age (mean ± SD), years	82.4 (± 4.6)	83.2 (± 4.4)	82.0 (± 4.7)	0.072
Women, %	63.3	72.1	58.6	0.063
Living alone, %	55.6	69.1	48.4	0.006
High school education, %	34.2	29.4	36.7	0.305
Comfortable income, %	59.7	52.9	63.3	0.160
Going out of home < 1 time / week, %	21.9	33.8	15.6	0.003
In-home help prior to hospitalization				
Informal (i.e., family), %	52.0	57.4	49.2	0.278
Formal (i.e., in-home care), %	38.3	48.5	32.8	0.031
Major admitting diagnosis:				
Falls / malaise / failure to thrive, %	29.1	42.7	21.9	0.002
Cardiovascular disease, %	19.4	8.8	25.0	0.006
Pulmonary disease, %	6.6	1.5	9.4	0.034
One or more comorbidities, %	69.4	70.6	68.8	0.790
Polypharmacy (> 4 drugs), %	49.0	52.9	46.9	0.419

* Chi-square test (categorical variables) or Student's t-test (continuous variables) comparing patients with and without inappropriate days. Self-rated income on a 5-point Likert scale (no financial difficulties at all to many difficulties). Charlson comorbidity index (41).

less frequent. However, there was no difference in comorbidity (mean Charlson comorbidity score 1.3 ± 0.2 vs 1.5 ± 0.2 , $p=0.310$ for patients with and without inappropriate days, respectively).

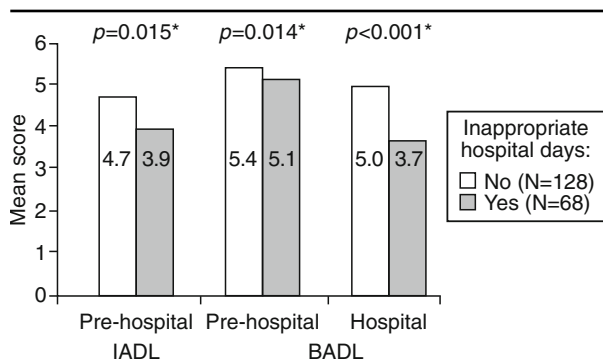
Figures 1 and 2 compare physical and mental status of patients with and without inappropriate hospital days. Patients with inappropriate days were more impaired in basic and instrumental ADL before hospitalization, and in basic ADL at admission. In addition, they had an abnormal GDS score (≥ 6) more frequently, and tended to have an abnormal MMSE score (< 24) more frequently.

Results of multivariate analysis (Table 2) showed that an independent association remained for patients living alone, and those with an abnormal GDS score; these patients had a 2.6 and 2.8-fold greater likelihood, respectively, to have inappropriate hospital days. This likelihood also increased with an increased dependency in basic as well as instrumental ADL. In contrast, a cardiovascular or a pulmonary admission diagnosis was inversely associated with the presence of inappropriate hospital days. Interaction terms between living arrangement, age, gender and functional status were tested, but were not significant and did not improve the model. Repeated multivariate analysis using a higher GDS cut-off (≥ 8) to increase its specificity gave similar results (OR 6.4, 95%CI 1.6 - 24.8, $p=0.008$).

In addition to these analyses, we also examined the subgroup of patients (N=18) whose admission was considered inappropriate. Due to the very small sample size, analysis was limited to bivariate comparisons, and results have to be interpreted with caution. Compared to the other patients, those with inappropriate admission had greater impairments in IADL (median score 3.5 vs 5.0, $p=0.022$ Kruskal-Wallis rank sum test), and tended to have an abnormal MMSE more frequently (11/18 vs 70/178, $p=0.084$ Fisher's exact test). In addition, they were more likely to have an admitting diagnosis of falls, malaise or failure to thrive (10/18 vs 47/178, $p=0.014$ Fisher's exact test). Although patients with inappropriate admission had higher GDS scores than the other patients (median score 4.0 vs 3.0, $p=0.010$ Kruskal-Wallis rank sum test), the difference in proportion with an abnormal GDS did not reach statistical significance (27.8% vs 16.3, $p=0.208$ Fisher's exact test). As a sensitivity analysis, we repeated a multivariate analysis predicting the occurrence of inappropriate days after excluding this subgroup of patients; the results were essentially the same (Table 2).

DISCUSSION

This study identified several patient characteristics associated with inappropriate hospital days in a cohort



*p value from Student's t test

IADL: Instrumental Activities of Daily Living. Include using the phone, grocery shopping, cooking, housekeeping, doing the laundry, using transportation, taking medications, handling finances. Scores range from 0 to 8, with higher scores indicating higher function (38).

BADL: Basic Activities of Daily Living. Include bathing, dressing, using the toilet, transferring between bed and chair, maintaining continence, feeding. Scores range from 0 to 6, with higher scores indicating higher function (37).

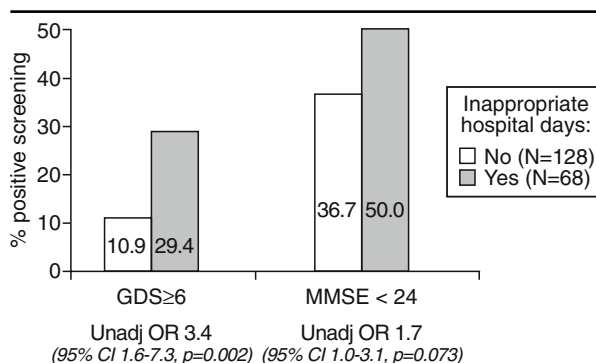
Figure 1 - Univariate comparisons of function in BADL and IADL in subjects with and without inappropriate hospital days.

of elderly medical inpatients. These findings demonstrate that, contrary to a widespread belief, all elderly patients do not carry the same risk of inappropriate hospital use. In addition, these results extend previous knowledge on patient characteristics proposed in targeting hospital utilization review (24), and suggest several interventional pathways that might decrease inappropriate hospital use.

Our initial hypothesis of an association between inappropriate days and an abnormal GDS score was confirmed. This finding has potential implications, because depression is frequently unrecognized in elderly persons (43, 44), and might therefore be a modifiable risk factor were it identified. The relationship between depressive symptoms and inappropriate days is probably complex. Possibly, these patients' abnormal GDS might just be reactive to their hospital admission, and related to their increased likelihood to be discharged to a nursing home (45), the most frequent cause of discharge delay. Alternatively, a causal relationship might exist between depressive symptoms and inappropriate days, and at least 2 different mechanisms can be hypothesized to explain discharge delays. First, some patients might have been directly responsible for delays because they refused treatments, or modified discharge disposition, as previously described (43). Second, physician and/or hospital staff might be responsible for delays because they adopted a more cautious attitude resulting from the amplification of physical complaints, or difficulties in

disentangling somatic from depressive complaints in these patients. These hypotheses are supported by our finding that 20.4% of inappropriate days were due to delays caused directly by the patient, or the hospital staff. However, due to the small sample size, the subgroup analysis comparing these subjects to those with other causes of delay failed to show differences in the proportion of abnormal GDS scores. Nevertheless, these results suggest that better identification of depression might help hospital staff become sooner aware of discharge problems in these patients. In addition, treatment of depression during the hospital stay could theoretically have some impact on inappropriate days. However, this effect is likely to be small given the delay between treatment initiation and full effectiveness, although patients with depressive symptoms tended to have longer median hospital stay than those without depressive symptoms (10.0 vs 8.0 days, $p=0.051$, Kruskal-Wallis rank sum test). Additional interventions such as enhancement of depression detection, and treatment by community primary care physicians will be necessary to achieve further reduction of inappropriate days. From this perspective, managed care organizations could play a significant role, but the best model to achieve this objective is still unknown (46).

Our results also confirm the hypothesized association between inappropriate days and functional impairment in BADL and IADL, and reveal an association with living situation (living alone). These associations likely reflect the increased risk of patients with ADL impairments and those living alone of either requiring a transfer to another



GDS: Geriatric Depression Scale (short form). Scores range from 0 to 15, with scores of 6 or more suggesting the presence of depression (40).

MMSE: Mini Mental State Exam. Scores range from 0 to 30, with scores below 24 suggesting the presence of cognitive impairment (39).

Unadj OR (95%CI): Unadjusted odds ratio with 95% confidence interval. p-values from χ^2 test.

Figure 2 - Univariate comparisons of affective and cognitive functions in subjects with and without inappropriate hospital days.

Table 2 - Results of the multivariate analyses predicting the occurrence of inappropriate hospital days.

Characteristics	Entire population		Excluding subjects with inappropriate admission	
	Adj OR * (95% CI)	<i>p</i>	Adj OR * (95% CI)	<i>p</i>
Living alone	2.6 (1.2 - 5.8)	0.016	2.9 (1.2-7.0)	0.018
In-hospital BADL dependency	1.5 (1.2-1.8)	0.001	1.7 (1.3-2.3)	<0.001
Pre-hospital IADL dependency	1.3 (1.0-1.6)	0.032	1.2 (0.9-1.4)	0.253
Abnormal GDS score	2.8 (1.1-7.3)	0.031	2.9 (1.0-8.1)	0.047
Abnormal MMSE score §	0.8 (0.4-1.8)	0.580	0.7 (0.3-1.7)	0.445
Cardiovascular diagnosis	0.2 (0.1-0.7)	0.008	0.3 (0.1-0.9)	0.029
Pulmonary diagnosis	0.1 (0.01-0.7)	0.022	0.1 (0.01-0.9)	0.044
Age #	1.0 (0.9 - 1.1)	0.515	1.0 (0.9 - 1.1)	0.771
Female gender	1.4 (0.6 - 3.1)	0.466	1.0 (0.4 - 2.5)	0.964

* Odds ratio adjusted for Charlson comorbidity index in addition to above variables.

For each point lost.

Geriatric Depression Scale score ≥ 6 .

§ Mini Mental State Exam score < 24 .

For each additional year.

level of care (rehabilitation, nursing home), or receiving post-discharge in-home care services (14, 15, 42, 47). This interpretation is supported by the finding that most inappropriate days were due to delays in discharge to a nursing home, as described in other studies (6, 9, 14, 15, 17). From a quality management perspective, some of these characteristics (e.g., living alone) could be used for targeting utilization review. Earlier identification of these patients might help to better anticipate and avoid some delays in discharge planning, resulting in earlier access to services that are more appropriate to their needs, such as occupational therapy or recreational activities.

Contrary to our initial hypothesis, we did not find an independent association between cognitive impairment and the occurrence of inappropriate hospital days. Several explanations can be advanced. Most likely this is due to the exclusion of patients with severe cognitive impairment from the study. Inclusion of these subjects

would probably have resulted in an increase in both inappropriate admissions and days. A type II error seems unlikely given the high prevalence of an abnormal MMSE, and the significant associations found for other functional characteristics. Finally, the MMSE psychometric properties might have been altered because the patients were tested in less than ideal conditions (i.e., acute medical conditions, emergency room environment), resulting in a high false-positive rate. Some subjects with an abnormal MMSE may have suffered from delirium that required, in itself or because of underlying acute illnesses, high intensity care that satisfied AEP criteria. However, to limit this problem we excluded subjects with unstable medical conditions, and those admitted to intensive care.

The negative association between cardiovascular or pulmonary admitting diagnoses, and inappropriate days is not unexpected because these conditions require technical interventions (e.g., intravenous

catheters, monitoring) that easily fulfill the AEP criteria (19). More interesting is our finding that a less specific admitting diagnosis (falls, malaise and failure to thrive) was not independently associated with inappropriate days, contrary to results of other studies (15, 19). Similarly, increasing age was not significantly associated with inappropriate days in this sample of elderly inpatients. The adjustment for functional impairments in the multivariate analysis, and the exclusion of patients under 75 years may explain these differences with the results of studies that included patients of all ages (5, 6, 14, 15, 20, 24). These findings underscore the need to adjust for confounders such as functional status when studying elderly populations.

This study has several limitations. First, the AEP might not be the ideal instrument since it was not specifically designed for elderly patients. For example, organizing a family conference is not an AEP criteria for appropriateness, but can be a crucial intervention that leads to substantial benefits in the quality of care of an elderly patient. A day where such a conference takes place should not be considered inappropriate. Similarly, an additional day spent in the hospital to make sure that a new medication is well tolerated should not be considered inappropriate, if such an observation cannot take place out of the hospital because the patient has no informal support, and no available primary care physician. However, one might argue that utilization review instruments such as the AEP are not designed to describe the specific needs of any one group of patients, but rather to characterize the level of care provided specifically in the acute care setting. In addition, only a quarter of inappropriate days secondary to discharge delays were due to reasons other than a transfer to nursing home or rehabilitation. Finally, most studies have demonstrated fair to good correlations between AEP results and clinicians' judgment, including geriatricians' judgment in a specific study of geriatric patients (23). An additional limitation of the AEP is that although it might be a valid tool to detect inappropriate use due to overutilization in the acute care setting, it does not address underutilization, which could be at least as important an issue in the care of acutely ill elderly patients. A second limitation is the small sample size that might have limited our statistical power to identify other characteristics of interest, and precluded subgroup analyses of the reasons for inappropriate days, as well as the characteristics associated with inappropriate admissions. Finally, this study took place in a specific setting and health care environment. Although our figures for inappropriate admission and days are within the ranges of other study results (5-7, 11, 12, 17-25), including those focusing on geriatric patients (11, 23), and although the Swiss health care system shares many characteristics with

health care systems of other developed countries, the generalization of our findings to other settings should be made with extreme caution. The availability of nursing home and rehabilitation beds, access to in-home services, or specificities of payment systems are some but a few of the characteristics likely to influence these findings. In particular, the absence of a prospective payment in Switzerland might explain the longer hospital stays observed in this study (median 8.0 days). For example, in 1996, the average length of stay of US Medicare enrollees aged 75 to 84 years, and 85 years and over was only 7.0 and 7.3 days, respectively (47). However, this difference might also be partially explained by the fact that our sample did not include surgical patients, who have shorter average stays.

Despite these limitations, we believe that our results have important implications. First, as they challenge the common view that all elderly are at increased risk for inappropriate hospital use, our results underscore the need for careful targeting when trying to reduce inappropriate days because of financial constraints due to prospective payment systems. In this regard, the patient characteristics identified in this study might permit better targeting for early discharge planning in these at-risk elderly subjects, and contribute to avoiding premature discharge of other vulnerable elderly patients. Second, from a health service perspective, the proportion of inappropriate days found in this study raises the question of whether the transfer of some resources actually invested in the acute care of these elderly patients to rehabilitation or long-term care would result in a better overall quality of care. Finally, it should be determined in future studies whether interventions designed to modify specific risk factors, such as depressive symptoms, will not only reduce inappropriate hospital use, but also contribute to the prevention of functional decline associated with prolonged stays.

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REFERENCES

1. Winograd C.H., Gerety M.B., Chung M., Goldstein M.K., Dominguez F.J., Vallone R.: Screening for frailty: criteria and predictors of outcomes. *J. Am. Geriatr. Soc.* 39: 778-784, 1991.
2. Hirsch C.H., Sommers L., Olsen A., Mullen L., Winograd

- C.H.: The natural history of functional morbidity in hospitalized older patients. *J. Am. Geriatr. Soc.* 38: 1296-1303, 1990.
3. Incalzi R.A., Gemma A., Capparella O., Terranova L., Porceda P., Tresalti E., Carbonin P.: Predicting mortality and length of stay of geriatric patients in an acute care general hospital. *J. Gerontol.* 47: M35-M39, 1992.
 4. Sager M.A., Franke T., Inouye S.K., Landefeld C.S., Morgan T.M., Rudberg M.A., Siebens H., Winograd C.H.: Functional outcomes of acute medical illness and hospitalization in older persons. *Arch. Intern. Med.* 156: 645-652, 1996.
 5. Apolone G., Alfieri V., Braga A., Caimi V., Cestari C., Crespi V., Crosti P.F., De Filippi F., Gelosa M., Lanzi E.: A survey of the necessity of the hospitalization day in an Italian teaching hospital. *Qual. Assur. in Health Care* 3: 1-9, 1991.
 6. Klar R., Muller U., Monting J.S.: Medically inappropriate inpatient care in West Germany. *Soz. Praeventivmed.* 35: 209-212, 1990.
 7. Paldi Y., Porath A., Friedman L., Mozes B.: Factors associated with inappropriate hospitalization in medical wards: a cross-sectional study in two university hospitals. *Int. J. Qual. Health Care* 7: 261-265, 1995.
 8. Gertman P.M., Restuccia J.D.: The appropriateness evaluation protocol: a technique for assessing unnecessary days of hospital care. *Med. Care* 19: 855-871, 1981.
 9. Selker H.P., Beshansky J.R., Pauker S.G., Kassirer J.P.: The epidemiology of delays in a teaching hospital. The development and use of a tool that detects unnecessary hospital days. *Med. Care* 27: 112-129, 1989.
 10. Barberger-Gateau P., Dabis F., Moise A., Gimbert M., Galley P., Salamon R.: Factors related to length of hospitalization of elderly patients during short stay. *Rev. Epidemiol. Santé Publique* 35: 463-473, 1987.
 11. Fellin G., Apolone G., Tampieri A., Bevilacqua L., Meregalli G., Minella G., Liberati A.: Appropriateness of hospital use: an overview of Italian studies. *Int. J. Qual. Health Care* 7: 219-225, 1995.
 12. Bare M.L., Prat A., Lledo L., Asenjo M.A., Salleras L.: Appropriateness of admissions and hospitalization days in an acute-care teaching hospital. *Rev. Epidemiol. Santé Publique* 43: 328-336, 1995.
 13. Lorenzo S., Sunol R.: An overview of Spanish studies on appropriateness of hospital use. *Int. J. Qual. Health Care* 7: 213-218, 1995.
 14. Glass R.I., Weiner M.S.: Seeking a social disposition for the medical patient: CAAST, a simple and objective clinical index. *Med. Care* 14: 637-641, 1976.
 15. Glass R.I., Mulvihill M.N., Smith H.J., Peto R., Bucheister D., Stoll B.J.: The 4 score: an index for predicting a patient's non-medical hospital days. *Am. J. Public Health* 67: 751-755, 1977.
 16. Santos-Eggimann B.: Hospital utilization reviews under field conditions: potential and improvements. *Int. J. Technol. Assess. Health Care* 9: 514-521, 1993.
 17. Santos-Eggimann B., Paccaud F., Blanc T.: Medical appropriateness of hospital utilization: an overview of the Swiss experience. *Int. J. Qual. Health Care* 7: 227-232, 1995.
 18. Siu A.L., Sonnenberg F.A., Manning W.G., Goldberg G.A., Bloomfield E.S., Newhouse J.P., Brook R.H.: Inappropriate use of hospitals in a randomized trial of health insurance plans. *N. Engl. J. Med.* 315: 1259-1266, 1986.
 19. Mozes B., Schiff E., Modan B.: Factors affecting inappropriate hospital stay. *Qual. Assur. in Health Care* 3: 211-217, 1991.
 20. Siu A.L., Manning W.G., Benjamin B.: Patient, provider and hospital characteristics associated with inappropriate hospitalization. *Am. J. Public Health* 80: 1253-1256, 1990.
 21. Smith H.E., Pryce A., Carlisle L., Jones J.M., Scarpello J., Pantin C.: Appropriateness of acute medical admissions and length of stay. *J. R. Coll. Physicians Lond.* 31: 527-532, 1997.
 22. Coast J., Inglis A., Morgan K., Gray S., Kammerling M., Frankel S.: The hospital admissions study in England: are there alternatives to emergency hospital admission? *J. Epidemiol. Community Health* 49: 194-199, 1995.
 23. Tsang P., Severs M.P.: A study of appropriateness of acute geriatric admissions and an assessment of the Appropriateness Evaluation Protocol. *J. R. Coll. Physicians Lond.* 29: 311-314, 1995.
 24. DeCoster C., Roos N.P., Carriere K.C., Peterson S.: Inappropriate hospital use by patients receiving care for medical conditions: targeting utilization review. *CMAJ* 157: 889-896, 1997.
 25. Booth B.M., Ludke R.L., Fisher E.M.: Inappropriate hospital care and severity of illness: results from a nationwide study. *Am. J. Med. Quality* 13: 36-43, 1998.
 26. Maguire P.A., Taylor I.C., Stout R.W.: Elderly patients in acute medical wards: factors predicting length of stay in hospital. *BMJ* 292: 1251-1253, 1986.
 27. Inouye S.K., Wagner D.R., Acampora D., Horwitz R.I., Cooney L.M.J., Hurst L.D., Tinetti M.E.: A predictive index for functional decline in hospitalized elderly medical patients. *J. Gen. Intern. Med.* 8: 645-652, 1993.
 28. Narain P., Rubenstein L.Z., Wieland G.D., Rosbrook B., Strome L.S., Pietruszka F., Morley J.E.: Predictors of immediate and 6-month outcomes in hospitalized elderly patients. The importance of functional status. *J. Am. Geriatr. Soc.* 36: 775-783, 1988.
 29. Liu K., Coughlin T., McBride T.: Predicting nursing-home admission and length of stay. A duration analysis. *Med. Care* 29: 125-141, 1991.
 30. Wolinsky F.D., Callahan C.M., Fitzgerald J.F., Johnson R.J.: Changes in functional status and the risks of subsequent nursing home placement and death. *J. Gerontol.* 48: S94-S101, 1993.
 31. Reed R.L., Pearlman R.A., Buchner D.M.: Risk factors for early unplanned hospital readmission in the elderly. *J. Gen. Intern. Med.* 6: 223-228, 1991.
 32. Burns R., Nichols L.O.: Factors predicting readmission of older general medicine patients. *J. Gen. Intern. Med.* 6: 389-393, 1991.
 33. Di Iorio A., Longo A.L., Costanza A.M., Bandinelli S., Capasso S., Gigante M., Bavazzano A., Guizzardi G., Senin U., Ferrucci L., Abate G.: Characteristics of geriatric patients related to early and late readmissions to hospital. *Aging Clin. Exp. Res.* 10: 339-346, 1998.
 34. Chopard P., Perneger T.V., Gaspoz J.M., Lovis C., Gousset D., Rouillard C., Sarasin F.P., Unger P.F., Waldvogel F.A., Junod A.F.: Predictors of inappropriate hospital days in a department of internal medicine. *Int. J. Epidemiol.* 27: 513-519, 1998.
 35. Hoenig H.M., Rubenstein L.Z.: Hospital-associated deconditioning and dysfunction. *J. Am. Geriatr. Soc.* 39: 220-222, 1991.

36. Büla C.J., Rubenstein L.Z.: Risks of hospitalization for elderly persons: a clinical overview. *Clin. Geriatr.* 3: 17-30, 1995.
37. Katz S.: Assessing self-maintenance: Activities of daily living, mobility, and instrumental activities of daily living. *J. Am. Geriatr. Soc.* 31: 721-727, 1983.
38. Lawton M.P.: Aging and performance of home tasks. *Human Factors* 32: 527-536, 1990.
39. Folstein M.F., Folstein S.E., McHugh P.R.: "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J. Psychiatr. Res.* 12: 189-198, 1975.
40. Sheikh J.I., Yesavage J.A.: Geriatric Depression scale (GDS): recent evidence and development of a shorter version. *Clin. Gerontol.* 5: 165-173, 1986.
41. Charlson M.E., Pompei P., Ales K.L., MacKenzie C.R.: A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *J. Chronic Dis.* 40: 373-383, 1987.
42. Gerety M.B., Williams J.W. Jr., Mulrow C.D., Cornell J.E., Kadri A.A., Rosenberg J., Chiodo L.K., Long M.: Performance of case-finding tools for depression in the nursing home: influence of clinical and functional characteristics and selection of optimal threshold scores. *J. Am. Geriatr. Soc.* 42: 1103-1109, 1994.
43. Beck D.A., Koenig H.G., Beck J.S.: Depression. *Clin. Geriatr. Med.* 14: 765-786, 1998.
44. Pouget R., Yersin B., Wietlisbach V., Burnand B., Büla C.J.: Depressed mood in a cohort of elderly medical inpatients: Prevalence, clinical correlates, and recognition rate. *Aging Clin. Exp. Res.* 12: 301-307, 2000.
45. Büla C.J., Ingold B., Wietlisbach V., Burckhardt P., Burnand B., Yersin B.: Is early functional assessment useful to predict discharge location in elderly medical inpatients? *Gerontologist* 38: 98, 1998 (Abstract).
46. Meredith L.S., Rubenstein L.V., Rost K., Ford D.E., Gordon N., Nutting P., Camp P., Wells K.B.: Treating depression in staff-model versus network-model managed care organizations. *J. Gen. Intern. Med.* 14: 39-48, 1999.
47. Graves E.J., Kozak L.J.: National hospital discharge survey: annual summary, 1996. *Vital & Health Statistics - Series 13: Data From the National Health Survey* i-iv, 1998.

APPENDIX

Revised Appropriateness Evaluation Protocol (16, 17)

(Commentary available upon written request to author)

List of criteria:

Criteria linked to medical procedures

1. Surgical procedure fulfilling at least one of the conditions listed in commentary.
2. Paramedical investigation fulfilling at least one of the conditions listed in commentary.
3. Treatment requiring frequent dose adjustments under direct medical supervision.
4. Patient requiring close medical monitoring by a doctor at least twice a day.

Criteria linked to paramedical services

5. Admission to intensive care unit (including cardiac monitoring and artificial respiration).
6. Respiratory care, administration of oxygen, CPPB, IPPB and intensive respiratory therapy.
7. Parenteral therapy (medication, electrolytes, fluids, protein).
8. Chemotherapy lasting more than one day.
9. Intramuscular and/or subcutaneous injections at least three times a day when ambulatory care or transfer to another type of establishment is impossible.
10. Treatment of major surgical or traumatic wound, including care

of surgical site, and/or presence of drains or catheters (except permanent urinary catheters).

11. Fluid balance assessment.
12. Patient requiring close clinical monitoring by a nurse at least three times a day, according to written medical prescription.
13. Intensive physiotherapy at least b.i.d. with daily medical monitoring, including strict bedrest and progressive mobilization when ambulatory care or transfer to another type of establishment is impossible.

Criteria linked to health status of patient

14. Cardiac frequency <50/min or >140/min.
15. Blood pressure: systolic <90 or >200 mmHg and/or diastolic <60 or >120 mmHg.
16. Severe and/or symptomatic abnormality of a blood test, electrolytes or blood gases; symptomatic acute metabolic disorder, acute aggravation of chronic metabolic disorder.
17. Persistent fever with a minimum 38°C axillary temperature of at least 5 days duration, or with onset during hospitalization.
18. Recent acute confusional state.
19. Other acute, or recently aggravated neurological disorder.
20. Documented, new acute myocardial infarction.
21. Acute abdominal pain of undetermined origin.
22. Active blood loss.
23. Attempted suicide (until condition allows psychiatric treatment).