



REDUCING “IATROGENIC DISABILITY” IN THE HOSPITALIZED FRAIL ELDERLY

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Abstract: *Background:* Hospitalization is the first cause of functional decline in the elderly: 30 to 60% of elderly patients lose some independence in basic activities of daily living (ADL) during a stay in hospital. This loss of independence results from the acute condition that led to admission, but is also related to the mode of management. *Objective:* This paper is a review of the literature on functional decline in elderly hospitalized patients. It is the first stage in a project aiming to prevent dependence that is induced during the course of care. *Methods:* During a 2-day workshop in Monaco, a task force of 20 international experts discussed and defined the concept of “iatrogenic disability”. *Results:* 1- “Iatrogenic disability” was defined by the task force as the avoidable dependence which often occurs during the course of care. It involves three components that interact and have a cumulative effect: a) the patient’s pre-existing frailty, b) the severity of the disorder that led to the patient’s admission, and lastly c) the hospital structure and the process of care. 2- The prevention of “iatrogenic disability” involves successive stages. - becoming aware that hospitalization may induce dependence. Epidemiological studies have identified at-risk populations by the use of composite scores (HARP, ISAR, SHERPA, COMPRI, etc). - considering that functional decline is not a fatality. Quality references have already been defined. Interventions to prevent dependence in targeted populations have been set up: simple geriatric consultation teams, single-factor interventions (aimed for example at mobility, delirium, iatrogenic disorders) or multidomain interventions (such as GEM and ACE units, HELP, Fast Track, NICHE). These interventions are essentially centered on the patient’s frailty and have limited results, as they take little account of the way the institution functions, which is not aimed at prevention of functional decline. The process of care reveals shortcomings: lack of geriatric knowledge, inadequate evaluation and management of functional status. The group suggests that interventions must not only identify at-risk patients so that they may benefit from specialized management, but they must also target the hospital structure and the process of care. This requires a graded “quality approach” and rethinking of the organization of the hospital around the elderly person.

Key words: Aged, hospitalization, iatrogenic disability, functional decline, geriatric assessment.

Introduction

Because of demographic aging, the elderly form an increasing proportion of the hospital population; whereas in 1992 the over-65s accounted for 37% of hospitalized patients (1), today they represent about 50% (2). These patients are particularly vulnerable because of decreased physiological reserves, the high prevalence of chronic diseases and high comorbidity. Hospitalization is a sentinel event in this population as it represents a stress that may hasten the onset of dependence (3). Thirty to 60% of elderly patients lose some independence in basic activities of daily living (ADL) in the course of a hospital stay (4). This loss results from the illness or the accident that led to admission, but is also related to the mode of management during the stay, the organization of discharge from hospital and to follow-up after discharge. Some part of the increased dependence observed after a hospital stay is thus avoidable. For this reason, we need to reflect on care practices with the goal of developing and implementing

procedures aiming to improve care and services to the elderly person who is “losing independence” or “at risk of losing independence”. This paper is the first stage of a project that aims to prevent “iatrogenic disability” in elderly hospitalized patients.

Methodology

Working group

A multidisciplinary, multiprofessional working group was set up during a two-day workshop in Monaco, 20-21 January 2011. It was made up of 20 international experts; all were health professionals in public or private practice, of varying geographical origins and diverse schools of training (geriatricians, psychiatrists, specialists in physical medicine and rehabilitation, specialists in public health, and also directors of institutions, healthcare managers, members of the Direction Générale de l’Organisation de la Santé and members of the Société Française de Gériatrie).





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The aim of this workshop was to reflect on the terminology that should be used to designate that part of dependence not directly related to the illness or accident that led to hospitalization, and which could be acted upon by optimizing the management of elderly subjects, by defining this part of dependence and by identifying the means to measure its prevalence.

Documentary research

Three project leaders (Dr. C. Lafont, Dr. S. Gérard, Dr. T. Voisin) were designated to select, analyze and summarize the relevant medical and scientific literature. A Medline (National Library of Medicine, United States) search was carried out on articles published during the last 16 years, between January 1, 1995, and January 1, 2011. The search terms were either medical subject heading (MeSH) terms, or terms in the title or summary (keywords). They were combined in as many steps as necessary using the operators "AND", "OR", "NOT": "Aged [MeSH] OR Aged, 80 and over [MeSH] OR Frail Elderly [MeSH]" AND "Hospitalization [MeSH] OR Patient Discharge [MeSH]" AND "Functional Decline [All fields] OR Loss of Independence [All fields] OR Functional Disability [MeSH]". This search yielded a list of 428 references corresponding to the indexed publications on the subject.

Other sources were searched: the websites of scientific societies specialized in the field, and all appropriate websites (government agencies, websites of intervention programs, etc.).

The three evaluators (CL, SG, TV) made a preliminary selection of the relevant articles by reading the abstracts. Further articles were extracted from the references of the publications selected, and others were contributed by members of the workshop. A final selection of 112 articles was used for the writing of this review.

Writing of the review

The three project leaders wrote a preliminary draft which was submitted to the workshop experts for correction. The draft was rewritten taking their remarks into account and was again reviewed by the working group before final submission to the review committee.

Results

Terminology and definitions

To refer to that part of dependence which is not directly related to the disease or accident (the cause of hospitalization) and which could be acted upon by optimizing the management of elderly persons, several terms were proposed by the workshop participants:

- Induced dependence,
- Iatrogenic disability,
- Nosocomial dependence,
- Avoidable dependence,
- Care-related dependence.

- After debate, a first vote retained two proposals:
- Iatrogenic disability, which connotes a direct relationship with the care provided
 - Avoidable dependence, which rather tends to suggest a plan of action.

In a second vote:

- 11 experts were in favor of iatrogenic disability,
- and 9 in favor of avoidable dependence.

We therefore retained the term of iatrogenic disability.

The working group expressed the need to define each of these terms.

Disability "refers to limitation of function (usually of activities of daily living) or restriction of activities" (World Health Organization ICF 2001) cited by McCusker (5). This limitation may have a physical, psychological or cognitive cause.

Iatrogenic conditions

In France, the High Committee for Public Health (6) considers iatrogenic conditions as "the undesirable or negative consequences on the individual or collective state of health of any act or measure practiced or prescribed by a qualified professional and which aims to preserve, improve or restore health" (7). The National Conference on Health has defined iatrogenic conditions as "any adverse condition of medical origin in the broad sense, taking into account the state of the art at a given time, and which in no way implies error, fault or negligence". By taking overall account of all acts of healthcare necessary for diagnosis and treatment, this definition has the advantage of not limiting the field of iatrogenic to medications alone. It also has the advantage of dissociating iatrogenic conditions from the notion of fault or responsibility. However, the expression "adverse condition of medical origin" remains too restrictive.

"Iatrogenic disability" has been defined as avoidable dependence which often occurs during the course of care.

Scientific basis of the project

Functional decline during hospitalization, medico-social and economic impact

Many elderly persons lose their independence during a stay in hospital. A variety of terms are employed in the literature to approach this problem: loss of function in ADL, loss of independence, ADL decline, new disabilities, functional impairment. Functional decline is defined as the decrease in ability to perform the tasks of everyday living because of a decrement in physical, psychological and/or cognitive functioning (8). Methods of measurement are heterogeneous and are often based on scales such as the ADL and/or the IADL, or the OARS (Older American Resources and Services) ADL, the Barthel index (BI) (9, 10, 11, 12, 13) or the Functional Independence Measure (FIM) (14), but also on other





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indirect criteria such as institutionalization, repeat hospital admissions, or deaths, or on composite scores using the same criteria. Measurement points differ according to the studies, with regard to both identification of baseline and to follow-up periods. Some authors measure decline from pre-morbid status (baseline 15 days before admission), while others measure it from status at admission or within 48 hours of admission. Follow-up evaluation is carried out either only at discharge from hospital, or at various time points during follow-up: 3, 6, 12 or even 18 months after discharge (15, 16).

Prevalence

Since 1980, longitudinal studies have drawn attention to a high prevalence of "disability" in elderly patients hospitalized following an acute illness. McVey et al. (17) observed that nearly one-third of patients aged 75 years and over develop at least one new disability in ADL after an acute illness and admission to a veteran's hospital. Hirsch et al. (18) reported statistically significant change in all functional scores for mobility, transfer, toileting, incontinence, feeding and grooming, in a population of 71 elderly persons hospitalized at Stanford University Hospital. Similarly, several other authors have observed in this frail population an impairment of mobility and/or cognitive function after a stay in hospital. However, most publications relate to small series or targeted populations such as veterans or women and use different evaluation methods, so the results are difficult to generalize.

To overcome these limitations, the Hospital Outcomes Project for the Elderly (HOPE) (19) developed a prospective multicenter study (five university-affiliated hospitals and one community hospital in geographically different regions of the United States) aiming to evaluate the outcome of 1279 elderly patients living at home and hospitalized for an acute disease. In this cohort, at discharge 31% of patients had lost the ability to perform at least one ADL, and 40% were no longer able to carry out three or more, which was qualified as a "catastrophic functional decline" (20). At 3 months, 19% of surviving patients had a decline in ADL and 40% had a decline in IADL compared with their earlier status (1, 3, 21).

In certain cohorts, even higher figures of prevalence have been observed: 40 to 42% for Wu AW (22) and Wu HY (23), and 47% for de Saint-Hubert (24).

Risk factors

Three reviews of the literature (5, 25, 26) and numerous clinical trials have identified risk factors for functional decline related to hospitalization.

Demographic factors

Advanced age remains a principal element of the frailty syndrome (27) and the majority of studies show that age is an independent risk factor for functional decline both during a hospital stay (4, 28, 29, 30) and afterwards (31, 22, 32). The percentage of patients affected by loss of independence increases regularly with increasing age. The breaking point

appears to occur in the 70-75 year age group. During hospitalization, functional decline affects 23% of subjects aged 70-74 years, 28% aged 75-79 years, 38% aged 80-84 years, 50% aged 85-89 years and 63% of those aged 90 years and over ($p < 0.001$) (33). The loss of independence is generally durable, and it is still present 3 or even 6 months after discharge.

In the most elderly subjects, we observed on the one hand an absence of recovery during their stay in hospital in patients who had lost their ability before admission (age >90 years vs age 70-74 years, OR=2.09, 95% CI 1.20-3.65) and on the other hand a loss of independence during hospitalization in those who had not previously lost their abilities (age >90 years vs age 70-74 years, OR=3.43, 95% CI 1.92-6.12) (33). As another demographic factor, gender is sometimes mentioned but it seems to play a minor role (11).

Cognitive and psychological status

Cognitive impairment (3, 4, 10, 30, 34) appears as a major risk factor for functional decline at discharge from hospital, and also in the following 3 months (35). The more severe the impairment, the greater the risk of decline (Table 1). A study of 2593 frail elderly patients (36) followed for one year showed that decline in ADL functioning was on average twice as high when the person had been admitted for an acute illness. Delirium is also predictive of loss of autonomy, both at discharge from hospital and three, or even 12 months later (37) (Table 1), which suggests that this geriatric syndrome may have long-lasting consequences. Delirium is in fact often revelatory of dementia, which explains this unfavorable prognosis. Moreover, dementia and delirium have the same underlying etiological and pathogenic factors (changes in brain metabolism, breakdown in cholinergic mediation, neuronal dysfunction) which alter the response to stress (10).

Lastly, certain psychological factors, poor self-perceived health (38), depression and quality of life (22) are also independent risk factors, as is the overlap syndrome of depression and delirium (39).

Functional status before hospitalization

Previous functional status plays an important role in the course of hospitalization and is a better indicator of outcome than the acute disease that led to admission (40).

In patients aged over 80 years, ADL capacity 2 weeks before hospitalization is the principal predictive criterion of functional status 2 months and 12 months after discharge.

Numerous authors (21, 22, 29, 31, 34, 38, 41) have examined pre-morbid functional status, measured 2 weeks before hospitalization, to evaluate the basic level of function. Some consider that a decline in performances between that date and admission is strongly predictive of functional decline at discharge (42).

Sléiman et al. (13) used the idea of functional trajectories by measuring the changes between the pre-morbid state and admission, then between admission and discharge, and lastly at





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some time after discharge. The first trajectory identifies the basic status of the patient and the impact of the disease that caused the hospitalization. The second evaluates the capacity of the subject to withstand illness and treatment. But it also relates to the procedures and events occurring during the hospital stay.

These trajectories can be used as prognostic factors and even as a "vital sign" that deserves the attention of care providers (33). Patients who improve their functional performances during hospitalization have a lower risk of death or institutionalization during the months that follow (43).

Social factors

These are often considered primarily as predictors of institutionalization but they are also independent factors of functional decline. Living alone (11, 28) or in a nursing home (5) plays an important role in the onset of decline. Lack of social contacts (relatives, week-end visits), poor accommodation and living in rented accommodation are also mentioned as factors.

Inability to pay for food and medical care (44) increases the likelihood of loss of independence in the months following hospitalization. Among the subjects aged 70 years and over in a cohort of 2200 patients, hospitalized in general medicine services, 20% of subjects who had moderate financial problems and 25% of those who had serious financial problems had greater difficulty in performing ADL in the three months following discharge from hospital ($p < 0.001$). This is an independent risk factor (Table 1).

Comorbidity and polymedication

For Mahoney et al. (29), having more than four comorbid diseases doubles the risk of losing independence. The type and the severity of the disease also have a demonstrable role: certain acute conditions, such as stroke, cancer, congestive heart failure, coronary failure, lung diseases and femoral neck fractures, are more particularly incriminated (3, 45). The development of pressure ulcers is also considered as a factor of poor prognosis (23, 34, 46).

Table 1

Main risk factors predicting functional decline in older hospitalized patients. Review of 10 selected studies. Age is not taken into account in this table

Risk factors	Method of measurement of functional decline	OR*	95% CI	p	n	Authors
Cognitive and psychological status						
Cognitive impairment	ADL between admission and discharge	2.44	1.7-3.5	$p < 0.001$	544	Pedone, 2005 (35)
Cognitive decline		15.96	10.8-23.6	$p < 0.001$		
Delirium	ADL between admission and discharge	3	1.6-5.8		727	Inouye, 1998 (37)
	ADL between admission and 3 months	2.7	1.4-5.2			
Overlap syndrome of depression and delirium	ADL between admission and 3 months	3.3	1.14-9.56		459	Givens, 2009 (39)
Pre-morbid functional status	ADL between admission and discharge	0.21	0.09-0.47	$p = 0.001$	156	Wu, 2006 (23)
	ADL between admission and 3 months	1.92	0.82-4.44	$p = 0.12$		
Mobility						
Walker	ADL between admission and discharge	2.77	1.63-4.72		1212	Mahoney, 1999 (48)
Walker	ADL between admission and 3 months	1.72	0.94-3.14		1212	
Cane		1.72	1.06-2.8			
Walking difficulties	ADL at D15	2.7	1.3-5.6		514	Lang, 2007 (41)
Fall risk	and D30 after discharge	2.1	1.3-6.8			
Unsteadiness	In-hospital ADL decline	2.6	1.5-4.5	$p = 0.003$	1557	Lindenberger 2003 (49)
	Failure to recover ADL	1.7	1.0-2.8	$p = 0.02$	563	
Nutritional status						
MNA < 11	In-hospital ADL decline	4.25	1.83-9.9	$p = 0.001$	275	Salvi, 2008 (12)
Very malnourished	In-hospital ADL decline	16.19	4.68-56.03	$p < 0.0001$	514	Lang, 2007 (41)
Malnutritional risk	ADL at D15 and D30 after discharge	2.2	1.7-7.6			
Social factors						
Financial disability	ADL decline at D90 post discharge	1.59	1.07-2.37		1540	Li, 2005 (44)
Comorbidity and polymedication						
Comorbidities > 4	New walking dependence between D15 and discharge	1.9	1.2-3		1181	Mahoney, 1999 (48)
Frailty						
- BMI < 18.5	ADL decline between D15 and discharge	3.41	1.49-7.81	$p = 0.004$	1686	Volpato, 2007 (30)
- ESR > 40		1.75	1.11-2.75	$p = 0.016$		
- Medications > 8		1.9	1.24-3.06	$p = 0.004$		
- Disease severity: CIRS-G > 10		2.17	1.21-3.89	$p = 0.01$		
- Cognitive decline		2.01	1.28-3.15	$p = 0.012$		
- Falls		1.73	1.01-2.94	$p = 0.045$		

OR adjusted for the principal associated factors, which differ according to the study; ESR erythrocyte sedimentation rate; CIRS Cumulative Illness Rating Scale score.





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Lastly, polymedication (42, 46) is a factor of frailty as it increases the likelihood of iatrogenic conditions (falls, delirium, metabolic disorders). The risk of functional decline is established when more than two medications are prescribed. Moreover, Sager and Rudberg (1) have shown that adverse drug reactions are also implicated in loss of independence in 20 to 25% of elderly hospitalized patients, and this finding has led to prescription review programs (47).

Mobility

Disability in the lower extremities is usually evaluated by means of objective tests of walking and balance, the chair-rise test or the mobility items of the ADL.

Mahoney et al. (29, 48) have shown, in a cohort of 1212 subjects aged 70 years and over, that use of ambulatory devices (cane or walker) before hospitalization is a risk factor for loss of autonomy during hospitalization and in the following 3 months (Table 1). Self-reported unsteadiness (49) reflects impaired balance function. Subjects aged 70 years and over who define themselves as “very unsteady” have 2.6 times more risk of loss of independence than those who define themselves as “very steady”. Unsteadiness also predicts failure of recovery during their stay ($p < 0.002$). Walking difficulties, risk of fall and the occurrence of recent falls (up to one year before admission) or recurrent falls are all factors correlated with functional decline months after discharge (23, 32, 41).

Nutritional status

Several authors (4, 22, 40, 50) indicate that malnutrition worsens dependence. However, there are complex interrelations between nutritional status and disease severity (Table 1).

In a study of 275 elderly subjects admitted to an acute care sector, Salvi et al. (12) show that an MNA-SF (short form) score < 11 is an independent risk factor for developing significant functional decline during the hospital stay ($p = 0.001$). The risk appears as soon as there is a suspicion of malnutrition ($p = 0.001$) and increases as malnutrition becomes more severe ($p < 0.0001$). For Lang et al. (41) the mere fact of being “at risk of malnutrition” multiplies by 2 and more the risk of loss of independence at 3 months.

Sensory deficits

Blindness and deafness increase the likelihood of functional decline and institutionalization (42, 43, 51). In spite of their high prevalence in the elderly and although they play an important role in social integration and personal safety, they are little evaluated in clinical practice.

Geriatric syndromes

Defined as “those clinical conditions in older patients that do not fit into discrete disease categories” (52), among them delirium, cognitive disturbances, falls and impaired mobility, functional disabilities and incontinence, they are considered as the “giants of geriatric medicine”. The presence of one or

several of these geriatric syndromes increases the risk of dependence during and after a hospital stay (11, 32). Several studies (31, 46) indicate that geriatric syndromes are a better element for identifying subjects at risk of functional decline than the acute disease that led to hospitalization or than comorbid conditions.

Socio-economic data and cost of iatrogenic dependence

The consequences of loss of dependence during hospitalization are severe: increased mortality (16% mortality at 3 months in patients with functional decline vs 7% in those without functional decline, $p < 0.001$) (3), longer hospital stay, increased complications related to care provision, placement in a retirement home, and of course increased dependence for the patients themselves. This is accompanied by impaired quality of life and an increase in the costs of management, on an individual as well as on a collective scale (53).

Although numerous risk factors have been identified, none of them, whether in isolation or in association with others, make it possible to reliably identify at-risk populations. Identification is however a stage of prime importance if prevention programs are to be set up. This observation has given rise to the development of composite models and scores to identify “target subjects”.

Identification of subjects at risk of loss of independence during hospitalization

Numerous tools have been proposed with this aim in mind, but for this review we have retained only those validated with hospitalized patients (Tables 2 and 3).

A first predictive index for functional decline in hospitalized elderly medical patients was developed by Inouye et al. in 1993 (34). It takes into account four parameters identified as risk factors in a development cohort of subjects aged 70 and over, hospitalized for an acute condition: pressure sores, impaired functional status, cognitive disturbance, low level of activity. Risk is classified in three levels according to the number of risk factors observed by patient interview and clinical observation (0 RF: low risk, 1-2 RF: intermediate risk, 3-4 RF: high risk).

The Hospital Admission Risk Profile (HARP) (31, 45) is a simple screening instrument which classifies patients aged 70 years or older as having on hospital admission a low, intermediate or high risk of losing the ability to perform activities of daily living. This tool was developed in two independent cohorts: a development cohort and a validation cohort that were both part of HOPE. In the development cohort, logistic regression analysis identified three patient characteristics as being independent predictive factors of functional decline: advanced age, impaired cognitive status and IADL impairment before admission. These factors were weighted to build the items of the HARP score: age (0, 1 or 2), the MMSE (0 or 1), and IADL (0 or 2). The final score of 0 to 5 classifies patients in 3 groups: 0 or 1 low risk, 2 or 3 intermediate risk, 4 or 5 high risk. The HARP instrument





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Table 2
Characteristics of identification scores of subjects at risk

Acronyms Authors	Items	Score stratification	Hazard ratio of functional decline	Administration mode	Place of assessment
Predictive index for functional decline Inouye et al. 1993 USA (34)	4 items - Pressure ulcers - MMS <20/30 - ADL impairments >1	3 levels 0: low 1-2: intermediate	1 4.6 (1.6-12.6)	Clinician administered	Medical services
HARP Sager et al. 1996 USA (31)	3 items - Age (0-1-2) - MMS < 15/21 (0-1) - IADL (7 functions) 2 weeks before admission	3-4: high Range: 0 – 5 0-1: low risk 2-3: intermediate 4-5: high risk	12.9 (4.8-34.5) functional decline 17% functional decline 28% functional decline 56%	Clinician administered	Hospitalized for acute illness
ISAR McCuster et al. 1999 Canada (42)	6 yes/no questions - Pre-morbid function dependence - Acute change in dependence - Recent hospitalization - Impaired memory - Impaired vision - Three or more medications	Range: 0 – 6 No classification reported Score > 2 means high risk	3.0 (1.3-6.94)	Self-reported or clinician administered	Emergency department
COMPRI Huyse et al. 2001 The Netherlands/Europe (57)	13 yes/no items - Expectation of doctor (4 items) - Expectation of nurse (3 items) - Patient health perception - Walking difficulties - 6 doctor visits /3 month - Polymedication - Recent hospitalization - Retired patient or not	Range: 0 – 13 > 6 means need "complex care"	Not reported	Physician and nurse and interviewing patient	Internal ward
SHERPA Cornette et al. 2005 Belgium (38)	5 items - Recent falls (0-2) - MMS < 15/21 (0-2) - Self-rated health (0-1.5) - Age (0-1.5-3) - Pre-morbid IADL impairment (0-1-2-3)	Range: 0 – 11.5 - 0-3: low risk - 3.5-4.5: mild - 5-6: moderate - > 6: high risk	1 2.0 4.2 10.4	Clinician administered	Hospitalized in emergency department
TRST Hustey et al. 2007 USA (55)	6 items - Cognitive impairment - Difficulty walking, transferring or recent fall - Alone, no available caregiver - Five or more medications - Recent hospitalization - Registered nurse concern	Range: 0 – 6 Cognitive impairment or score > 2 means high risk No classification reported	2.58 (1.5-4.5)	Self-reported or clinician administered	Emergency department or hospitalization
SPPB Volpato et al. 2007 Italy (21)	- 4-m walking speed (0-4) - Five chair-stand tests (0-4) - Balance test (0-4)	Range: 0 – 12	0.86 (0.75-0.98) per score point	Clinician administered	Hospitalized for acute illness

appears to be easy to use, but the potential users are not defined. It should make it possible to identify elderly hospitalized persons who could benefit from specialized geriatric care or who require geriatric evaluation. However, it has not been validated on post-surgical patients, those who lived in a retirement home before hospitalization or those hospitalized in intensive care sectors.

The Identification of Seniors At Risk screening tool (ISAR) (42) enables rapid evaluation of the hospitalized elderly (65 years and older). Ideally, this tool should be used in emergency departments, where it was validated. It detects elderly at-risk subjects (frail subjects, in the geriatric sense of the term) who

require fuller evaluation by a geriatrician. It comprises six self-report questions on functional dependence (premorbid and acute change), recent hospitalization, impaired memory and vision, and polymedication answered by "yes" or "no". The sum of the items yields a score between 0 and 6. If a positive answer is given to more than two questions (score > 2), the patient should undergo geriatric evaluation. This tool is rapid and easy to use and can be completed by the patient or by the caregiver or family.

The Score Hospitalier d'Evaluation du Risque de la Perte d'Autonomie (SHERPA) (38, 54) developed in two university hospitals in Louvain, Belgium, consists of five questions (fall in





Table 3
Validity criteria of the identification scores of at-risk subjects

Acronyms Authors	Outcome measurements	Sample size analyzed	Design	Reliability	Sensitivity	Specificity	Area under ROC curve	+LH	-LH
Predictive index for functional decline ** Inouye et al. 1993 USA (34)	ADL At admission At discharge	Development cohort (n=188) Validation cohort (n=148)	Prospective cohort study	Not reported	88%	54%	---	1.9	0.3
HARP** Sager et al. 1996 USA (31)	ADL At admission At discharge 3 months after discharge	Development cohort (n=448) Validation cohort (n=379)	Multicenter prospective cohort study	Not reported	Not reported		0.65	2.3	0.4
ISAR*** McCuster et al. 1999 USA (42)	- OARS ADL (at admission, at discharge, 3 and 6 months after discharge)	n=1673 Development cohort 60% (n=997) Validation cohort 40% (n=676)	Prospective follow-up cohort	Test-retest Concordance correlation coefficient: 0.78 (for first version 27 items)	74% (score >2)	45% (score >2)	0.70	1.4	0.5
COMPRI Huysse et al. 2002 The Netherlands/Europe (57)	At admission After discharge	n=275	Cohort study	Not reported	71% (score 5/6)	63% (score 5/6)	0.73 (score 5/6)	--	--
SHERPA* Cornette et al. 2005 Belgium (38)	Loss 1 point ADL	n=550	Cohort study	Not reported	67.9% (score = 4)	70.8% (score = 4)	0.734	1.5	0.4
TRST Hustey et al. 2007 USA (55)	ADL and IADL decline D30 and D120 after discharge	n=647	Cohort study	Not reported	63% 30 and 120- day ADL* 51% 63% 30- day IADL* 53% 63% 120- day IADL*	60% 30-day ADL* 0.66 120-day ADL* 0.56 30-day IADL 0.60 120-day IADL	0.64	--	--
SPPB Volpato et al. 2007 (21)	ADL and IADL - at admission - at discharge - 1 month after	n=87	Prospective cohort study	Not reported	Not reported	Not reported	Not reported	--	--

Level of proof *** 1a, ** 1b, * 2b

the previous year, abbreviated MMS score < 15/21, poor self-perceived health, age group, number of IADL carried out independently). It rapidly classifies in four groups patients aged over 70 years, living at home and undergoing unplanned hospitalization, according to their risk of loss of independence. SHERPA was constructed by giving each risk factor a weight proportional to the odds ratio observed in the development cohort, which yields a total score of 0 to 11.5. In order to simplify and to avoid an accumulation of patients in the intermediate risk category, four levels of risk were defined: (low 0-3, mild 3.5-4.5, moderate 5-6, high >6). This tool also predicts the rate of placement in an institution three months after discharge ($p < 0.001$) (38).

The Triage Risk Screening Tool (TRST) (55) was originally designed to identify aged subjects at risk of readmission. Today, it is used to predict functional decline, after an emergency department visit, of subjects aged over 65 years and living at home before their hospitalization. It uses a score with 6 items: history of cognitive impairment; difficulty in walking, transfer or recent falls; absence of caregiver or family in the home; 5 or more medications; admission to an emergency department in the previous 30 days or hospitalization in the

previous 90 days, registered nurse concern (for example, alcohol abuse). The score is a cumulative one from 0 to 6 (0 no risk, 6 maximum risk). The presence of cognitive impairment or 2 positive responses places the subject in a high-risk category.

Two evaluations, not originally designed to measure the risk of functional decline in the hospitalized elderly, have undergone validation studies for this indication.

The Short Physical Performance Battery (SPPB) (56), initially constructed for ambulatory patients, aims to identify subjects at risk of disability, hospitalization or death. It includes a 4-meter walking test, 5 chair rises and one balance test. Each item has a score from 0 to 4 and the total score is 0 to 12. This test is reliable, valid and sensitive to change. A validation study (21) in 87 elderly patients hospitalized for an acute medical condition showed that the score at discharge from hospital was predictive of functional decline, readmissions and death in the year after hospitalization.

The Care Complexity Prediction Instrument (COMPRI) (57), developed in 11 European hospitals, aims to detect subjects at risk for complex care needs (which include functional decline), poor state of health at discharge from





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hospital and prolonged stay. The scale includes 13 items, each with a yes-no response. The score is cumulative from 0 to 13. This tool is complex to use, is not specifically designed for use with the elderly and it measures disease severity rather than functional decline (58).

Strengths and limitations of the tools

If we take a critical look at these tools (8, 24, 53, 59, 60), we observe that at the present time there is no "gold standard" for measuring functional decline, so the predictive value of these instruments is difficult to establish. None of these prognostic scores has shown sufficient sensitivity and specificity. The ISAR score, which is the best validated, has only a sensitivity of 74% for a specificity of 45% (for a score ≥ 2) (42). The areas under the ROC curves are between 0.56 and 0.74, reflecting a low or modest predictive value. The likelihood ratios (LH) mentioned for the score of Inouye, the HARP, ISAR, and SHERPA scores are between 1.4 and 2.3 for a positive LH and between 0.3 and 0.5 for a negative LH. However, for a test to be clinically pertinent, the positive LH must be ≥ 10 , predicting an event when the test is positive, and the negative LH must be ≤ 0.1 to exclude the event when the test is negative. This suggests that some factors likely to explain functional decline have not been taken into account in the various models. Reliability was not evaluated for any of these instruments. With regard to suitability, the time required for administration and the skills required by the examiners are mentioned only for COMPRI. Successful diffusion of a tool is dependent on its acceptance by health professionals, that is, on its ease of use and administration time. COMPRI is the most complex and requires the participation of several health professionals. The same criticism can be made of the Inouye score, which sometimes requires a medical opinion. Conversely, the TRST and ISAR are simple and rapid to use, comprise only a small number of items and can be self-reported. As yet, these tools are not in general use and so it is difficult to foresee whether they are applicable in countries with different medical cultures and healthcare systems. Only ISAR has been validated in

Europe (61).

Three authors have compared several risk scores in the same population, different from the validation population; series were small in these studies. The principal results presented (Table 4) differed little from those obtained in the validation cohorts. Generally, these instruments are better at identifying low-risk patients and none has demonstrated a true superiority that could define it as a reference instrument.

Interventions aiming to limit dependence in the vulnerable hospitalized elderly

Since the works of Rubenstein et al. (62) in 1984, it has been shown that the evaluation and management of elderly subjects with geriatric syndromes improved their functional independence and quality of life and decreased the rate of readmissions (63). The benefit was greatest for the most high-risk patients. A multidisciplinary team can in fact identify vulnerable elderly subjects at an early stage, plan their care, organize discharge as soon as they are admitted and provide follow-up (64, 65, 66). The aim of these care models is above all to maintain functional independence, which is the main determinant of quality of life, costs and vital prognosis (67). Delaying functional decline and increasing the chances of living at home are at least as important as reducing the mortality of the frail elderly (65). Such management was first formally organized in the United States in the Geriatrics Evaluation and Management (GEM) units. However, in traditional hospital departments, the management of frail elderly subjects comes up against the problem of identification of the at-risk population and adherence to the standard geriatric recommendations. Numerous programs have been developed to palliate this problem. Some are centered on the intervention of a specialized team who play the role of experts, others focus their action on a specific problem that greatly affects independence, while others set up a global management plan. But, as yet, none of these models has become a gold standard and none has been generalized over the whole of a country or in an entire healthcare system.

Table 4
Comparison of the performances of several risk scores in other populations than the validation population

Studies	Instruments compared	Characteristics of sample analyzed	Functional decline prevalence	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Area under ROC curve
Braes (60)	TRST	Emergency department	Adm: 69.7%, D14: 28.5%,	≥ 74	≤ 36	≤ 33	≥ 83	0.55 to 0.58
	ISAR	n =314 subjects	D30: 23%, D90: 22.6%	≥ 77	≤ 50	≤ 38	≤ 33	0.63 to 0.64
	VIP	> 65 years		≥ 43	≥ 86	≤ 47	≥ 84	0.59 to 0.65
Hoogerduijn (59)	HARP	Internal ward	27.8% at 3 months after discharge	21	89	38.1	77.1	0.56
	ISAR	n =177 subjects		93	39	36.4	93.6	0.67
	COMPRI	Mean age 76.6 years		70	62	41.8	84.3	0.69
De Saint-Hubert (24)	HARP	Acute care	47% at 3 months after discharge	Not reported		Not reported		0.68
	ISAR	n = 98						0.58
	SHERPA	Mean age 81.8 years 57% female						0.73

PPV positive predictive value; NPV negative predictive value; ROC receiver operating characteristics; VIP variable indicative of placement risk (evaluates problems at discharge, not functional decline as a primary outcome).





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Geriatric consultation teams

Evaluation of geriatric patients by multidisciplinary consultation has shown no beneficial effect on mortality, functional decline or institutionalization at discharge (65, 66, 68).

Single-factor interventions to prevent hospital-induced dependence

Mobility

Some interventions comprising structured exercises, muscle strengthening and walking and balance programs (69, 70, 71) have been proposed to maintain the functional status of patients during hospitalization. In a randomized trial including 300 hospitalized elderly subjects and comprising an exercise program started during hospitalization and continued for 1 month, length of stay was not shortened but IADL was improved. There was no change in perceived general health status and other measures of physical function.

Delirium

Conversely, some interventions (37, 72) have reduced the functional decline related to hospitalization by decreasing the incidence of delirium in populations particularly at risk (45.5% vs 56.3%, $p = 0.03$) (72).

Drug-induced iatrogenic conditions

Prescription review has been attempted in order to fight iatrogenic conditions (47) due to the misuse of drugs.

Multi-domain interventions to prevent hospital-induced dependence

These interventions are those that yield the best results. Two models have developed in parallel for the management of elderly patients hospitalized for an acute disease: GEM units and ACE units.

- Geriatric Evaluation and Management (GEM) Units

In these units, the geriatrician in collaboration with a multidisciplinary team (clinical nurses, social workers and physiotherapists, among others) evaluates the functional status of the patients, identifies geriatric syndromes and initiates management in order to improve the clinical and functional results. Patients are thus selected by identification of one or several geriatric syndromes. This approach can be used in either a hospital or an ambulatory setting. The aim of these units (73) is to optimize the quality of care by better diagnoses, drug prescription and post-discharge planning. Through multidisciplinary evaluation that establishes and coordinates care in the long term, these units help to decrease readmissions and improve the patient's psychosocial and functional status, while reducing inappropriate use of resources. Quality of care is monitored through clinical indicators, such as the number of urinary catheters or development of bedsores.

- Acute Care of the Elderly (ACE) units (66, 67), whose concept is very close to that of GEM units, were developed and tested in the 1990s in the University Hospitals of Cleveland, Ohio. The originality of this approach lies in coordinating the interventions with the aim of preserving mobility and cognitive function of elderly hospitalized subjects by avoiding any interruption in the activities of daily living. The other key element lies in adapting the environment within the unit (non-slip, anti-noise floor covering, adequate lighting, calendars and clocks in all rooms, open spaces for walking, areas for activities and social contact). A multidisciplinary team (including a nurse, physiotherapist, occupational therapist, speech therapist, social worker, dietitian) with specialized knowledge in geriatrics carries out daily rounds to assess the patient's functional status, plan care during their stay and organize discharge right from the time of admission. This model is based on the principle of "total quality management". Every aspect must be examined as soon as the patient is admitted: the hospital stay, discharge and maintenance in the patient's own home.

ACE resulted in shorter duration of stay, decreased placements and increased satisfaction of the patients and their families without an increase in costs. However, the results with regard to function vary in the different publications. Improved ADL ability was observed in some studies but not in all (74, 75, 76).

The efficacy of the acute geriatric units has been studied in a recent meta-analysis (77) comparing patient management in these facilities with that of conventional hospital departments. The acute geriatric unit is defined as a hospital unit managed by a multidisciplinary team responsible for the treatment of elderly persons with acute medical problems. The main outcome criteria are functional decline (loss of one or more points on the ADL compared with pre-admission), ability to continue living at home and death during hospitalization and three months after discharge. The secondary outcome criteria are duration of hospital stay, cost of hospitalization and readmissions within 3 months after discharge. This meta-analysis was carried out on 11 studies (5 randomized trials, 4 non-randomized trials and 2 case-control studies). A single study was carried out in intention-to-treat analysis for results at discharge. The populations studied were heterogeneous, and patient age at inclusion differed between studies, from 65 years (3 studies), to over 70 years (5 studies) and over 75 years (1 study). Two studies excluded patients living in nursing homes, whereas another included only those living in institutions.

The main organizational characteristics of the 11 facilities analyzed were use of standardized geriatric evaluation, a weekly multidisciplinary meeting and early planning of discharge.

In this meta-analysis, 3 studies demonstrated reduced functional decline at discharge from hospital compared with conventional units (Table 5). A single study gave the results on functional decline at 3 months; it showed no difference between





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Table 5
Evaluation of interventions to prevent dependence in elderly hospitalized persons

Where developed	Program	Target population	Type of evaluation	Results	OR	References
<i>Geriatric consultation teams</i>						
	Geriatric evaluation and proposals for management		Multidisciplinary consultation as required	Mortality Functional decline Institutionalization	NS NS NS	Ellis (65) Parker (66) Gray (68)
<i>Single-factor interventions</i>						
	Mobility	Hospitalized mean age 78.2 years +/- 5.6	Physical exercises		NS	Siebens (69)
	Muscle strengthening	Hospitalized ≥ 70 years	Resistance exercises		NS	Mallery (70)
	Reduction of delirium	Hospitalized ≥ 70 years	Action on seven risk areas	Reduction of delirium Reduced rate of functional decline	0.4 CI 0.24-0.77 45.5% GI* vs 56.3% UC** (p= 0.03)	Vidan (72) Onder (47)
	Prescription revision	Hospitalized ≥ 65 years	Inappropriate drug use defined by Beers	Mortality Length of stay	NS NS	
<i>Multidomain interventions</i>						
	GEM	Hospitalized or ambulatory patients	Geriatrician Multidisciplinary team	Functional decline - random. - non random	0.82 CI 0.68-0.99 0.78 CI 0.65-0.94	Bartzan (77)
University Hospitals of Cleveland, 1990	ACE	Hospitalized or ambulatory patients ≥ 65 years	Geriatrician Multidisciplinary team Adapted environment	Return home - random. - non random	1.30 CI 1.11-1.52 1.28 CI 1.12-1.47	
				Mortality Re-hospitalization Duration of stay Costs	NS NS 0.8 day reduction No increase	Landefeld (74) Counsell (76)
Inouye, 1999	HELP	Hospitalized patients ≥ 70 years Intervention with 6 targets: - Cognitive decline - Sleep disturbances - Immobility - Dehydration - Vision and hearing	Geriatrician Multidisciplinary team Trained voluntary workers	Reduced delirium - incidence - duration - number of episodes Functional decline Decreased costs Dose-related effect	0.66 105 vs 160 days 62 vs 90 14% vs 33%	Inouye (78) Inouye (51) Inouye (80)
Kehlet, 1995	Fast Track	Initially colonic surgery, not specific for elderly Then major surgery, elderly		Shorter stay		Wilmore (89) Basse (83)
Hartford Foundation, 1992 New York	NICHE	Hospitalized elderly persons	Improved nursing practice Tools Websites Expert nurses	Fewer serious falls Reduced delirium Duration of stay Costs	30% decrease 60% decrease Decreased Not increased	Swauger (90)

* GI geriatric unit; **UC usual care (internal medicine).

conventional management and the geriatric units. The improvement observed (18% reduction of loss of independence) was similar to that observed when patients received physiotherapy during their hospital stay (71).

In the randomized as well as the non-randomized studies, patients managed in acute care units were more likely to return to their own homes (OR = 1.30, 95% CI 1.11-1.52) (OR = 1.28, 95% CI 1.12-1.47); this beneficial effect persisted at 3 months. Duration of hospital stay was shorter by an average of 9 days, although the range was large.

However, these units neither reduced mortality during hospitalization, nor decreased the frequency of readmission or death at 3 months.

The economic aspects of this type of management were studied in 4 of the 5 randomized studies and showed reduced costs compared with traditional units (combined mean difference -0.31, 95% CI -0.52 to -0.09; I²= 0%). Cost/efficacy was not evaluated because of the complexity of calculation.

- The Hospital Elder Life Program (HELP) (51) is a multidisciplinary intervention developed in a hospital setting to

prevent cognitive and physical decline, promote independence, facilitate discharge and prevent readmissions. This program is also centered on identification and management of geriatric syndromes. In all hospitalized patients aged 70 years and over, the care teams look for the following 6 risk factors: 1) cognitive impairment, 2) sleep deprivation, 3) immobility, 4) dehydration, 5) and 6) vision or hearing impairment. Targeted interventions are implemented for each of these factors. They are conducted by a multidisciplinary team that includes a specialized geriatric nurse and geriatric physicians who work in collaboration with the care teams to initiate personalized management. The team is assisted by voluntary workers trained to help in mobilizing patients early, with feeding and hydration. The volunteers also visit the patients daily, help them to orient themselves in time and space, and set up some therapeutic activities.

The quality procedures and performances of the interventions implemented were evaluated. Adherence was 89%.

HELP was shown to be effective in preventing delirium and





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in restoring sleep without medication. Observed results were:

- Decreased incidence of delirium (9.9% in the intervention group vs. 15% in the usual-management group, OR = 0.60, $p=0.02$) (78),
- Significantly reduced duration of episodes of delirium (105 days vs. 161, $p=0.02$),
- Significant reduction in the total number of episodes of delirium (62 vs. 90, $p=0.03$),
- Significant reduction in functional decline (14% in the intervention group vs. 33%) (51),
- Reduced related costs (79),
- A dose-response effect according to level of adherence to the intervention (80).

- Fast Track Evaluation and pre-, per- and post-operative management

The Fast Track (FT) concept, or early rehabilitation (enhanced recovery after surgery, ERAS), was introduced by Kehlet and Rosenberg in 1995 (81) in the context of colonic surgery (82). They suggest that the combination of laparoscopic surgery, epidural analgesia, early nutrition and rapid mobilization of patients reduces pain and surgery stress-related organ dysfunction. The same authors later developed a multimodal concept to reduce hospital stay to 2-3 days after open colorectal surgery (83, 84). The main objective was to facilitate recovery and improve patient comfort while reducing morbidity, duration of hospital stay and costs (85-87). It is however difficult to give a precise definition to the FT concept as many of its features are already part of traditional care (88), and it is all the measures taken together that will determine the success of this approach and not the application of one or other of the measures in isolation.

The FT concept (89) is based on a trained team and use of specific organization and care procedures, with four aims:

- Education of the patient before surgery about perioperative care and optimal management of comorbid conditions,
- Reduction of surgical stress: regional or epidural anaesthesia, minimally invasive surgery, maintenance of normal temperature during the procedure,
- Sedation of pain, pharmacological prevention of nausea and vomiting,
- Modification of perioperative management: early mobilization, minimal use of tubes, drains and catheters, early oral nutrition, restoration of sensory input (orientation, clocks, calendars, availability of glasses and/or hearing aids).

The combined implementation of all these components of FT has been shown to effectively prevent post-surgical complications and perioperative stress, to shorten hospital stay and hasten convalescence. In this way, FT promotes recovery of independence. Although the concept was not originally designed specifically for elderly subjects, the benefits of such management have been shown in studies that included a large number of high-risk elderly patients undergoing major surgery:

colonic resection, prostatectomy, aortic aneurysm (83).

- The Nurses Improving Care for Health System Elders (NICHE) (90) is a national program set up in 1992 by the Hartford Foundation at New York University. It aims to assist care facilities to evaluate routine geriatric care and to implement interventions, with nursing care, that are appropriate for the patients' age and are evidenced-based.

NICHE is centered on the practice of nursing care and a tool kit is provided. This includes good practice guides for nurses, models of nursing care, a Geriatric Institutional Assessment Profile instrument, and access to a computerized data bank on the NICHE website: "Try This" (<http://consultgerirn.org/resources>). However, one of the main advantages of this model is an educational program aiming to give nurses a qualification in geriatrics (91). The geriatric resource nurses are trained in the identification and management of geriatric syndromes (falls, delirium) by developing strategies that maintain or promote mobility. In turn, these nurses help other care team members to improve their practices on a scientific basis. The content of the NICHE kit can be adapted to the needs of different teams according to the way care is organized and the resources available. Its use in a hospital setting leads to improved knowledge of the management of elderly patients, optimizes their outcome by averting delirium, and decreases the frequency of serious falls by 30% and of use of restraint by 60% (2, 90). It also reduces duration of stay and cost of care, while increasing patient satisfaction.

Discussion

The concept of "iatrogenic disability"

In the Medline database, the combination of the terms "iatrogenic" AND "disability" does not yield any indexed reference. Mezey (92) was the first to suggest that the decline observed during or after hospitalization could be considered as a iatrogenic illness. Iatrogenic illness is described by Palmer (93) as "any illness resulting from a diagnostic procedure or from any form of therapy or a harmful event that is not a natural consequence of the patient's disease". "Iatrogenic disability" meets this definition as the disability is related to a cascade of events or procedures set off by the acute illness and hospitalization, and which has damaging effects on the patient's functional status. However, this definition omits an important aspect, which is the "avoidable" aspect of this phenomenon. With regard to the term "avoidable" it is important to make clear that this in no way implies error, fault or negligence. The task force therefore defined "iatrogenic disability" as "avoidable dependence which often occurs with the course of care".

Iatrogenic disability has three components (Figure 1) that are interrelated and cumulative:

- pre-existing patient frailty: this is a combination of aging and the consequences of comorbid conditions, and is reflected in impaired reaction to stress. Rozzini et al. (94) give a





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retrospective definition of this frailty, considering that change in functional status during hospitalization may be the reflection of an inability to react to stress and is in itself a sign of frailty. The "frail" phenotype has been defined by Fried on the basis of 5 criteria (27) (unintentional weight loss, self-reported exhaustion, low physical activity, slow walking speed, weakness). These criteria are predictive of risk of loss of independence for patients living at home, but are not necessarily applicable to patients admitted to acute care departments. An interventional study is under way to validate the impact of the Fried criteria on the risk of functional decline and to measure the impact of a targeted intervention. Only the methodology has been published. At the present time, vulnerability is assessed by the standardized geriatric evaluation which takes into account certain factors of frailty and certain comorbid conditions.

- the severity of the condition that led to the patient's hospital admission plays an undeniable role in the process of disability. This has been demonstrated by Ferruci and Pahor (95) in population studies, the Established Population Epidemiologic Studies of the Elderly (EPESE). It is moreover recognized that certain disorders are more likely to be correlated with loss of independence. Sager et al. (3) in the HOPE cohort showed that six conditions: cerebrovascular accidents, hip fracture, cardiac and coronary failure, lung diseases and cancers, may be incriminated in the functional decline of 49% of hospitalized patients.

- lastly, hospitalization (20) has a major impact on loss of independence in elderly hospitalized subjects.

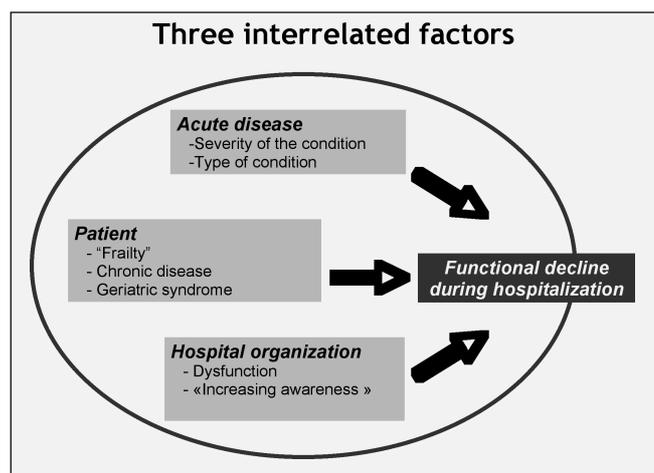
- The hospital facility which admits the patient may be incriminated, as the hospital functioning centers on managing acute disorders and not on improving functional status. The environment is designed to deliver rapid and effective care based on high technology, but nothing is provided to improve functional status. Changes in the way and pace of life due to hospitalization (96), particularly the sudden interruption of certain activities (toileting, meal preparation), sleep deprivation (33), confinement to bed that is not always justified and leads to deconditioning (45, 97), the iatrogenic effects of treatments (98) or the use of invasive devices (unnecessary infusions or urinary catheters) (99), or inadequate nutrition are all factors that destabilize the frail elderly person. The institution, as it functions at the present time, is incapable of responding to this state of affairs because of lack of adequation between the needs of the elderly hospitalized subject and the general organization of hospital departments.

Similarly, provision of care in a hospital setting is dysfunctional in several ways: 1) inadequate knowledge of geriatrics and non-transfer of knowledge into the daily practice of care providers, 2) non-standardized practices and lack of concertation between the various care providers, 3) lack of "awareness-raising" about this problem, 4) lack of systematic clinical evaluation of functional independence and of its changes, 5) insufficient concern of care providers for the

functional status of the elderly person, in particular with regard to mobility, 6) deficiencies in the offer and implementation of assistance when the patient returns home after an emergency admission, and lastly 7) lack of information given to the patient and relatives on the patient's degree of vulnerability.

Figure 1

Schematic representation of the various factors involved in the functional decline of the hospitalized elderly person



Prevention of "iatrogenic disability"

In order to prevent "iatrogenic disability", first of all we have to accept its reality. Increasing awareness can be seen in the numerous studies carried out during the last 20 years. The main steps that have been taken are:

- Identification of at-risk populations by revealing risk factors or by using composite risk scores, such as HARP, ISAR, SHERPA or COMPRI.
- Establishment of reference quality standards aiming to improve management of acute conditions in the elderly subject and to prevent dependence (Table 6).
- Implementation of single-factor or multi-domain interventions in targeted populations.

However, up to the present time the validity of the tools used to target at-risk subjects is debatable as they are centered on the patient alone, and many factors explaining functional decline have not been taken into account. Most tools, moreover, have not been validated outside the health systems in which they were developed. Similarly, all interventions have as their only target the patient and what defines him or her in terms of frailty, which is too narrow an approach to the problem.

If "iatrogenic disability" is to be prevented, it must have precise definition criteria, that are 1) measurable (scales, temporal criteria), 2) care-related (in the broad sense: treatments, procedures, structure), and 3) avoidable.

Lastly, we need to recognize that this avoidable part of dependence is essentially related to structural organization, as





Table 6
Characteristics of main quality references for management of the hospitalized elderly

Authors, Year of publication, Topics Countries, References	Description of the tool	Characteristics *	
Carr, 2003 British Columbia (104)	Report and recommendations: acute care nurse network	Recommendations for nurses: continence, falls, delirium, skin integrity, etc. Provides carers with tools to aid in evaluation and management	Not reported
**AHMAC, 2004 Australia (105)	Best practice approaches to minimize functional decline in the older person across the acute, sub-acute and residential care settings	Rapid guide to recommendations for all the healthcare team, aiming to prevent functional decline in elderly hospitalized. Five chapters: - cognition and emotional health - mobility, vigor and self-care - continence - nutrition - skin integrity	1+2+3+4
Wenger, 2007 USA (103)	Assessing Care Of Vulnerable Elderly 3	Quality program targeting vulnerable elderly: 392 QIs on 22 care topics (eg pain, dementia, falls) and 4 care domains (prevention, diagnosis, treatment, follow-up) for hospitalized as well as community-living patients	1+2+3+4
Care Quality Commission, 2010 United Kingdom, (106)	Essential standards of quality and safety	Very comprehensive reference on good professional practice for health professionals and users	

1 = systematic search of the literature, 2 = level of evidence and grading of recommendations, 3 = multidisciplinary panel of clinical experts, 4 = review and external validation.
**AHMAC: Australian Health Minister's Advisory Council

pointed out by Palmer (100) when describing the "dysfunctional syndrome" (figure 2). The fight against the avoidable part of dependence must thus not be restricted to management of the acute illness and the patient's frailty, but must also take into account the organization and quality of care, which must give equal weight to treatment of the acute illness and maintenance of the elderly person's functional status.

Few studies in the literature have examined this organizational aspect. It is suggested in certain models of care such as the GEM units or the ACE units which offer integrated healthcare services during hospitalization, but in this system there is no true continuity of care after discharge, and no system has really solved the problem of the management of elderly subjects admitted to non-geriatric specialized departments.

More solid bases appear in the OPTIMAH program (101, 102) which is already operational in some pilot units in Canada.

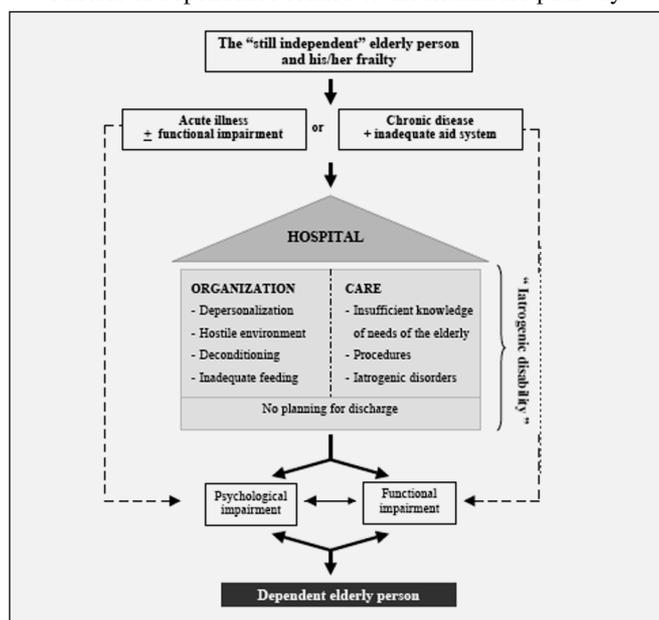
This program combines optimization of hospital care for aged patients and the creation of a continuum in patient management through a city-hospital network. It is based on a change of culture with regard to care of the hospitalized elderly person: inclusion of the patient and the family in all decisions, valorization of healthcare staff through geriatric training for all concerned. From an organizational viewpoint, the objective is to adapt hospital structure to elderly patients, so as to prevent avoidable complications (loss of independence 30%, delirium 30-50%, iatrogenic conditions 38%). Adaptation takes into account the architectural aspect, medical equipment and hotel services, the number of healthcare staff. This requires motivation by the hospital managers and collaboration with administrative management, nursing care management and those in charge of service providers in order to achieve better care for the elderly, whatever the department to which they are admitted.

The goals of an OPTIMAH unit are:

- systematic preventive intervention with identification of at-risk subjects and monitoring of six aspects of health identified by the acronym AINEES (autonomy and mobility, integrity of the skin, nutrition, continence, cognitive status

Figure 2

Factors of dependence related to the healthcare pathway



Adapted from Palmer, 1998: Dysfunctional syndrome (100)





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- and behavior, sleep),
- prevention and treatment of malnutrition,
 - pharmacovigilance,
 - training of the healthcare team, whatever their profession, and practical application of what has been learnt in the care routine,
 - involvement of patients and their families in care, in decisions and planning of discharge,
 - sharing of information with the city-hospital network.

After the system had been in operation for some months, preliminary results showed that malnutrition and cognitive changes were detected earlier, fewer incontinence pads were used and fewer subjects were deconditioned.

With regard to the impact of quality of care, only one recent publication refers to the quality indicator ACOVE QI (103). In this work, Arora et al. (20) studied in a cohort of 898 vulnerable elderly subjects the impact, on functional decline related to hospitalization, of a healthcare quality project (process-of-care based quality indicators, POC QIs). Six ACOVE quality indicators (QIs) (cognitive evaluation, functional evaluation, maintenance of mobility, management of pain, nutritional evaluation and follow-up) were routinely used and others such as management of delirium or bedsores were selected according to the clinical situations. Only one ACOVE QI was found to be effective in preventing functional decline: this was nutritional evaluation and management (OR=0.37, 95% CI 0.21-0.64, $p < 0.001$). However, in this study average adherence was low at 57.8%. Except for this work and for the OPTIMAH program, no details are given in the interventions on the application or otherwise of quality standards to the management of elderly hospitalized persons. However, several references exist relating to all areas of management of the elderly (Table 6). Most were developed by state organizations or by their regional departments, in collaboration with professional organizations and users' representatives. Some deal specifically with nursing care, others are intended rather for physicians. The development of these quality standards is generally based on a common foundation: 1) systematic review of the literature, 2) level of proof and graded recommendations, 3) group of multidisciplinary experts, 4) review and external validation. Apart from the references described in Table 6, references from other countries are available, such as Canada, New Zealand and Catalonia. They approach only certain aspects of the quality of management of the elderly and provide little information on evaluation of dependence and prevention of functional decline during hospitalization.

Conclusion

The fight against "iatrogenic dependence" must be a priority because of the frequency of this phenomenon, its severity and cost. The objective is a realistic one, as effective interventions already exist.

It must include screening of the patients most at risk, so that they may benefit from fuller investigation by a specialized team.

It should be based on a graded quality approach, with measurements that should be systematically included in procedures for management of the elderly.

Lastly, it must be an organizational priority, which implies rethinking hospital organization around the elderly person, bearing in mind that nearly half of hospitalized patients are over 65 (107-112).

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