Réseau francophone de prévention des
traumatismes et de promotion de la sécurité
under the direction of Hélène Bourdessol and Stéphanie Pin

Good Practice Guide

Prevention of falls in the elderly living at home

Référentiels

éditions inpes

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Translator's notes

The present document, *Good Practice Guide – Prevention of falls in the elderly living at home*, was originally published under the French title: "*Référentiel de bonnes pratiques – Prévention des chutes chez les personnes âgées à domicile*". It is the result of a collaborative, international effort within the *Réseau francophone de prévention des traumatismes et de promotion de la sécurité*, a network of French-speaking health professionals and organizations focused on injury prevention and safety promotion.

The document thus comprises a number of references to French, Quebecois, Swiss and Belgian organizations, programs and documents that do not have established English-language names. These French-language names have been kept in this translation to provide readers with functional information, should they wish to contact an organization or enquire about a document or program described here.

However, to ease comprehension of these French-language elements, illustrative translations and/or explanations have been provided when needed. Most of these have been integrated directly in the text, either enclosed in parentheses or in the form of a footnote. The key organizations with French names that are mentioned in the text have been grouped in an annex (see "Organization names in French", p. 131).

It is hoped that the English-speaking reader will find this Good Practice Guide to be a rich and pertinent source of information for the prevention of falls in the elderly living at home.

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Traduction biomédicale

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We also express our thanks to the team of assistants at INPES for their organization of meetings, and the various institutions for their confidence in our experts group.

Preface

Aging has become a major preoccupation for society. Economic, social and healthcare policies have evolved to respond to this preoccupation and provide the means for autonomous living to the majority of the elderly population. However, the continuing increase in the number of aged citizens over the next few decades will nevertheless create new challenges that concern all citizens.

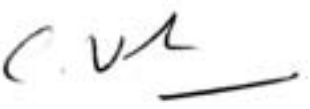
Over the last 50 years, life expectancy has increased spectacularly due to the improvements in quality of life that can be offered to the aging population. Although more and more people are keeping their good health through the years, aging still creates physical and functional fragility and thus the elderly remain at greater risk of loss of autonomy.

One person out of three (65 or over, living at home) will fall within the year. This frequent event is the number one cause of traumatic death in this population, even though research in this field has demonstrated that falls can be prevented.

Falls in the elderly are caused by multiple factors. They find their roots in the aging process itself, but are also influenced by the person's behavior, habits and environment. Falls can thus be prevented by addressing all of these risk factors.

This Good Practice Guide proposes a global approach to the prevention of falls. It is intended for all those who are involved in the care of the elderly and is an invitation to all health and sociomedical actors to join forces for the well-being of the elderly individual.

Philippe Douste-Blazy
Minister of Solidarity, Health and the Family



Catherine Vautrin
State Secretary for the Elderly

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Foreword

This guide was created through an international collaborative effort of French-speaking countries and is part of the activities of the Réseau francophone de prévention des traumatismes et de promotion de la sécurité. This network was created several years ago to allow for the exchange of knowledge and experience among French-speaking professionals specialized in injury prevention and safety promotion. It has since evolved beyond the simple analysis of practices to become a promoter of close collaboration for the development of public health actions.

In 2001, a seminar was hold during which institutional representatives from France (INPES – Institut national de prévention et d'éducation pour la santé, and Cnamts – Caisse nationale d'assurance maladie des travailleurs salariés) Quebec (Directions de santé publique ("Public Health Departments") of Montréal, Estrie and Bas Saint-Laurent), Belgium (Éduca Santé) and Switzerland (Direction générale de la santé ("Department of healthcare") of Geneva) reunited to elaborate a French-initiated project for a Good Practice Guide for the prevention of falls in the elderly. A steering committee was created and they set as an objective the establishment of recommendations for the creation of programs based on sound scientific research in the field of fall prevention.

In France, Belgium Switzerland and Quebec, the elderly represent an increasingly large proportion of the population and thus falls and their consequences have become major health issues. Addressing this problem was thus a logical choice for the network. Other actors in healthcare have also been conscious of this problem and have already engaged in fall prevention actions and programs. However, assessment in terms of the reduction of accidental falls and their costly and complex results remains insufficient.

This Guide is the result of more than two years of collaboration. Its aim is to provide all healthcare and sociomedical professionals (physicians, nurses, physical and occupational therapists, home-assis-

tance personnel, program and professional training managers, etc.) with the means to, i) screen for the risk of falls in individuals aged 65 years or more and living in their own homes and ii) offer well-adapted and efficacious interventions. This Guide is action-oriented and multidisciplinary. Its approach and presentation are somewhat different from other good practice guides or clinical practice recommendations produced by medical institutions and academies. It provides essential recommendations for fall prevention and can be used not only by those seeking a global approach for fall prevention services or programs, but also by professionals acting at the patient level. Finally, it also has the goal of improving the overall quality of interventions concerning the elderly.

This is the first Good Practice Guide for fall prevention in the elderly originally written in French. We hope that this English translation will provide new perspectives for public health beyond French-speaking countries and contribute to the creation of new studies.

Martine Bantuelle
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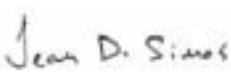

INTRODUCTION

The reasons for this work

CONTEXT

The progressive aging of the population, particularly the increase in the number of people living to a very advanced age, has become a major issue in public health due to the societal challenges that this demographic change creates. In Western countries such as France, Belgium, Switzerland or Canada, demographic aging is due to both a longer life expectancy and a major reduction in natality. This demographic evolution creates new, particularly economic and social, challenges.

Health and well-being programs must take into account the increasing proportion of elderly persons. Health in the elderly has indeed improved greatly over the 20th century, but aging is still characterized in particular by the appearance of invalidating chronic diseases, which in turn affect the patient's daily activities and quality of life. Many countries, in cooperation with political, medical, social and other partners, are already considering institutional changes to better address aging from an overall prospective (World Health Organization, 2002). Several programs are taking a positive approach to aging, thus following the example of The World Health Organization (WHO), which adapted the expression "active aging" in the late 1990s. With this, WHO wishes to send a message that goes beyond "healthy aging" for the elderly; in addition to simply extending life spans, it is also necessary to increase the quality of these extra years by allowing for a physically, mentally and socially active life. Recognition of the rights of the elderly and the principles of independence, participation, dignity, assistance and personal growth are precursory to the idea of active aging and have been recognized by the United Nations.

Overall, the quality of life of the elderly has improved considerably, but this improvement is not universal. Some people live with difficulties that may include isolation, one

or several chronic diseases, dependence*[1], etc. However, some of these difficulties can by minimized or eliminated, which is why the maintenance of functional capacity* in the elderly constitutes a major human, social and economic issue.

SCOPE AND LIMITS OF THE GUIDE

This Good Practice Guide for the prevention of falls in the elderly is built upon a global approach to aging. Involuntary falls are frequent in the elderly and may cause a loss of quality of life for the victim. The impact in terms of cost to healthcare services may also be significant.

It is estimated that each year, a third of the elderly aged 65 years or more and living at home will experience a fall. Persons at a very advanced age and women are the most frequent victims. Physical consequences vary according to the person and may include decreased mobility or increased dependence* for daily activities. Psychological consequences are frequent, leading to a decrease in self-confidence that may in turn accelerate the loss of functional capacity*. Falls in the elderly lead to numerous hospitalizations, most frequently involving a fracture of the hip. Finally, falls are the primary cause of death by unintentional injuries in this population.

Numerous factors may play a role in falling. These include effects of aging, disease, the behavior of the person in certain high-risk situations, the person's surroundings and solitude. More so than any one of these factors, it is usually the interaction of several that results in a fall.

The chronological age of a patient is at best a partial indicator of expected changes in the aging process. Indeed, considerable differences in activity levels, overall health, and degree of independence can be observed in two equally aged patients. Several researchers and specialists thus recommend an approach based on functional capacities*, instead of age, whenever possible (Kino-Quebec, 2002). This is why prevention programs need to be either individualized or designed for a sub-population of elderly individuals with a pre-defined risk profile. This perspective, emphasizing modifiable risk factors instead of age, will be at the heart of this Good Practice Guide. However, to limit the scope of the Guide, the recommendations made here will mainly be oriented toward persons aged 65 years or older; this corresponds to the population most concerned by fall prevention. Furthermore, the risk factors that present before and lead to the fall will be prioritized in this Guide, although other risk factors will also be discussed to provide a more global vision of the problem. These include risk factors presenting during or after the fall, or conversely those further upstream in the patient's history. In particular, the risk of fracture, present in 90% of fall cases, will be discussed.

A global approach (see "Key definitions", p. 22) to the patient is thus necessary for effective prevention of falls. The entire history—and future—of risk factors should be taken into account, not just those detected during screening, before deciding on a preventive intervention.

Falls engage a wide spectrum of public health and interventions are possible at many levels, ranging from general health campaigns on determinants of health and age-related risks to functional rehabilitation of individuals injured in a fall. This Guide gives priority to the prevention of falls in

1. See "Glossary", p. 127.

elderly people living in their own home who present a risk of falling. Some health-promotion strategies will be briefly presented. Conversely, techniques for the management of elderly persons who have fallen in rehabilitation or extended care services will not be discussed.

Many fall prevention programs for the elderly have been initiated at local or regional levels. Although they frequently refer to recognized programs (the "programme PIED" in Quebec, or the Tinetti program), their evaluation methodologies often lack pertinence concerning the real impact on

SOCIODEMOGRAPHIC DATA ON THE ELDERLY

Today, the elderly account for approximately 15% of the reference populations used here.

In Quebec, there are close to a million (960,000) people aged 65 or older, representing 13% of the population (Institut de la statistque du Quebec, 2003).

In Switzerland this age group counts 1.1 million individuals, or 15% of the total population (OFS (Office fédéral de la statistique), 2001).

In France and Belgium these proportions are respectively 16% (close to 10 million individuals) and 17% (1.7 million individuals) (Ined (Institut national d'études démographiques, France), 2003; Insee (Institut national de la statistique et des études économiques, France), 2004; INS (Institut national de statistique, Belgium) 2004).

These numbers should continue to increase over the next few decades. Persons over the age of 60 should account for a third of the population in Western European countries in 2030 (Eurostat, 1998, World Health Organization, 2002).

Women in Europe currently benefit from an average life expectancy of more than 80 years (81 in Belgium, 83 in Switzerland and France). Current life expectancy at birth for men is 75 years in France and 77 in Switzerland. Data for Quebec are identical: 81 years for women and 75 for men (Office des personnes handicapées of Quebec ("Office for handicapped persons"), 2002; Statistics Canada, 2002).

Demographic aging has been accompanied by major changes in the lifestyle of the elderly. One of the primary factors for these changes has been the creation of retirement plans that provide a level of financial autonomy previously unavailable to the elderly.

In France, this has resulted in a considerably improved standard of living, which for a good number of retirees, is comparable to that of people still in activity. This has had an important influence on their living conditions (HCSP (Haut Comité de la santé publique), 2002).

Today the vast majority of the elderly, whether living alone or as a couple, are financially independent (Salles, 1998). However, this independence may result in increased isolation in very old individuals following the death of a spouse. This problem affects women in particular, as men tend to have shorter life expectancies.

In France the percentages of people living alone are 18% for those in their sixties, 30% for those in their seventies and more than 40% for those in their eighties (Chaleix, 2001).

Post World War II medical and socioeconomic advances have led to considerable improvement in the health of the elderly, thus extending the period of physical autonomy, and retarding the onset of the effects of aging. The fact that the majority of elderly people are currently living in their own home is in part attributable to improvements to health, financial independence and the development of home assistance services. In France, it is estimated that only 4% of people over 60 are living in supervised care facilities. However, this proportion does increase rapidly with age and dependence levels: less than 1% of people between the ages of 60 and 64 are institutionalized, but this climbs to 44% for those over the age of 95 (Coudin and Paicheler, 2002; Dufour-Kippelen and Mesrine, 2003).

fall reduction, or other dimensions such as mental health or effects on the patient's social life. Despite these limits, some programs have demonstrated tangible improvements in balance or recovery of certain physical capacities.

Although it is difficult today to evaluate their real economic impact, fall prevention programs for the elderly can help in avoiding the costs of unnecessary consultations, or in more serious cases, long hospitalized care, rehabilitation or the management of loss of autonomy.

This Guide was developed for the prevention of falls in people aged 65 years or more and who live at home. Its goal is to ease the screening of older patients at risk of falling and the implementation of preventive actions. It is accessible for all types of healthcare providers (physicians, nurses, physical and occupational therapists, program managers and providers of professional training, etc.) and can be used not only by those seeking a global approach for fall prevention services or programs but also by professionals acting at the patient level. In summary, it provides essential recommendations and components for fall prevention.

In Quebec, this Guide is the third document within the Public Health Program 2003-2012, which identifies, "promoting and supporting multifactorial measures to prevent falls aimed at the at-risk elderly, in particular those who have already suffered a fall" as a priority objective for the prevention of injury in the elderly. The first document, *La prévention des chutes dans un continuum de services pour les aînés à domicile*. Document d'orientation[2], was developed for managers and planners of health networks to favor the implementation of effective interventions. A second complementary document looks more closely at the frequency of falls in the elderly, analyzes the most recent studies on risk factors and their levels of evidence and discusses effective interventions.

KEY DEFINITIONS

Health promotion

Health promotion is the process that gives individuals and communities the means to increase their control on determinants of health and thus improve their own state of health. For the implementation of this process, health is considered to be *"a state of complete well-being, physical, social, and mental, and not merely the absence of disease or illness."*[3]

To achieve health, *"an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment."* Health is *"seen as a resource of everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities. Therefore, health promotion is not just the responsibility of the health sector, but goes beyond healthy lifestyles to wellbeing."*

Health promotion intervention builds upon five fields of action.

1. Build healthy public policy

"Health promotion goes beyond health care. It puts health on the agenda of policy-makers in all sectors and at all levels, directing them to be aware of the health consequences of their decisions and to accept their responsibilities for health."

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2. "Fall prevention in a continuum of services for the elderly living at home. Orientation document."

3. All citations for this definition are from the Ottawa Charter (World Health Organization, 1986).

2. Create supportive environments for health
"The inextricable links between people and their environment constitute the basis for a socioecological approach to health." The evolution of lifestyles *"should be a source of health for people. The way society organizes work should help create a healthy society."* Health promotion *"generates living and working conditions that are safe, stimulating, satisfying and enjoyable."*

3. Strengthen community action
"Health promotion works through concrete and effective community action in setting priorities, making decisions, planning strategies and implementing them to achieve better health." Objectives are *"to enhance self-help and social support, and to develop flexible systems for strengthening public participation and direction of health matters."* For this, *"full and continuous access to information, learning opportunities for health, as well as funding support"* are needed.

4. Develop personal skills
"Health promotion supports personal and social development through providing information, education for health and enhancing life skills." To give people the means to *"make choices conducive to their own health"*, health promotion must enable *"people to learn throughout life, to prepare themselves for all of its stages."*

5. Reorient health services
"Beyond its responsibility for providing clinical and curative services," the health sector must *"embrace an expanded mandate which is sensitive and respects cultural needs. This mandate should support the needs of individuals and communities for a healthier life, and open channels between the health sector and broader social, political, economic and physical environmental components. Reorienting health services also requires stronger attention to health research as well as changes in professional education and training. This must lead to a change of attitude and organization of health services, which refocuses on the total needs of the individual as a whole person."*

Prevention

Prevention includes a group of actions *"aimed at reducing the impact of determinants of diseases or health problems, at avoiding the onset of diseases or health problems, at arresting their progression or at limiting their consequences. Preventive measures can include medical intervention, environmental control, legislative, financial or behavioural measures, political lobbying or health education."*[4]

1. Primary prevention (before the fall)
Primary prevention includes *"actions aimed at reducing the incidence of a disease or health problem in a population by reducing the occurrence of causes and risk factors. Incidence refers to the occurrence of new cases."*

2. Secondary prevention (after one or more falls)
Secondary prevention brings together *"actions aimed at early detection and treatment of a disease or a health problem. Secondary prevention aims at identifying the disease or health problem at its earliest stage and at applying prompt and effective treatment to alleviate adverse consequences."*

3. Tertiary prevention (reduction of disability after a fall)
Tertiary prevention includes *"actions aimed at reducing the progression and complications of an established disease or health problem. It consists of measures intended to reduce impairments, disabilities and disadvantages*

4. All citations for this definition are taken from the Glossaire européen de santé publique (BDSP, 2003).

and improve the quality of life. Tertiary prevention is an important aspect of medical care and rehabilitation."

These different categories correspond to the terminology used in the consulted bibliographic resources and thus will be used in this Guide.[5]

Health education

"Health education is a component of general education and does not dissociate biological, psychological, social and cultural aspects of health. Its goal is to grant all citizens lifelong access to the skills and means for the improvement of personal and community health and quality of life."[6] Health education is one of the five axes of health promotion.

"A health education program comprises three complementary and coherent activities:

- *general interest communication campaigns to emphasize the importance of major health issues and to contribute to the progressive modification of perceptions and social norms,*
- *the wide distribution of scientifically validated information on subjects such as health promotion, means of prevention, diseases, health services, etc. using different means and levels of communication that are adapted to specific populations,*
- *community-based educative programs that, in conjunction with individual or group accompaniment, assist individuals or groups in the assimilation of information and the acquisition of aptitudes for healthier individual or community lifestyles."*

"Even combined, communication and information activities alone are not sufficient for educative programs. Like all other forms of education, health education must be built on personal contact; only community-level activities can provide needed accompaniment and assistance to the target population."

"Perceptions, beliefs, preexisting knowledge and the expectations of the population must be identified and incorporated into an educative process that organizes and encourages the exchange of information between the intended audience and health and socio-educative professionals. Education programs allow for personal involvement and personal choice; by favoring the autonomy and participation of citizens, they contribute to the development of equitable health."

"Health education provides individuals with the means of understanding and applying health information as a function of their particular needs, expectations and skills. As such, the simple diffusion and popularization of scientific knowledge is insufficient."

"Concerning community-level activities, health education utilizes validated tools and methods that favor the active communication of participants and allow them to be involved throughout the process, from the choice of priorities to the final evaluation. Health education should be within the reach of all citizens and always have at its heart the reduction of social inequalities in health."

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5. It should be noted however that according to Inserm (Institut national de la santé et de la recherche médicale) (*La Santé des enfants et des adolescents : propositions pour la préserver*. Expertise opérationnelle ("Propositions for preserving child and adolescent health. Operational expertise»). Paris, Inserm, 2003), the *"classic distinction between primary, secondary and tertiary prevention has given way to the notions of:*
– general or universal prevention: interventions focusing on the general population or at least on groups that were not established by defined risks;
– selective prevention: interventions targeting sub-groups with significantly higher risk for developing a particular problem;
– indicated prevention: interventions targeting subjects with indications that are inferior to established diagnostic criteria."

6. All citations for this definition are taken from the Plan national d'éducation pour la santé ("National health education plan") (Ministry of Solidarity and Employment and State Secretariat for Health and Handicaps, 2001).

Elaboration

This Good Practice Guide was elaborated by a steering committee after an analysis of the scientific literature and collective discussion. The text was then submitted to a reading committee before finalization.

The steering committee comprised 14 professionals from France, Belgium, Quebec and Switzerland, working in the field of injury prevention and health promotion in the elderly. The committee included a coordinator (who provided direction and organized the work sessions) and a scientific editor (who incorporated the contributions in a final document for steering committee approval), both of whom were representatives of INPES (Institut national de prévention et d'éducation pour la santé). The other members of the steering committee provided literature summaries, proposed strategic orientations and participated in the elaboration of recommendations.

To assure feedback from the different potential users of the Good Practice Guide, the solicited reading committee comprised people from multiple disciplines and professions in the fields of public health and sociomedical services. Participants from all four of the involved countries were included. The feedback from the reading committee resulted most notably in adaptations to the Guide to better respond to the expectations and needs of users.

This Good Practice Guide was elaborated in three phases.

Phase one: The members of the steering committee assembled existing guides and recommendations on the theme of fall prevention. Each participant provided those articles and resources that were known to him or her. This allowed for the creation of an initial knowledge base, to define themes of interest and to distribute documentary research among the steering committee members. Three orientations were retained: risk factors, screening tools and interventions. Each of these orientations integrates the personal, behavioral and environmental elements of the person.

Phase two: Summaries were elaborated for risk factors, screening tools and interventions from a more complete bibliography comprising the following elements:

- renowned and essential reference works;
- national references and guides identified by the committee members;
- data from national and international institutions:

– in France: the Ministry of health and Social Protection (http://www.sante.gouv.fr); Insee (http://www.insee.fr);
– in Canada: ISQ (Institut de la statistique Quebec) (http://www.stat.gouv.qc.ca); Health Canada (http://www.hc-sc.gc.ca/index-eng.php);
– in Switzerland: OFS (Office fédéral de la statistique) (http://www.bfs.admin.ch/bfs/portal/fr/index.html);
– international: Statistical Office of the European Communities (http://europa.eu.int/comm/eurostat); World Health Organization (http://www.who.int).

- a corpus of scientific articles established through a Pubmed database search[7].

The query language was English. The principal keywords are presented in the box on "Key words used for the compilation of the corpus", p. 27. The years of publication were restricted to the period from 1969 to 2004 as more than 80% of the articles were published after 1989.

The bibliographic research was stopped on December 31, 2003; several references from 2004 were later integrated, notably on the subject of fracture prevention (this theme was modified following reader feedback). Whenever possible, the documents were considered in their entirety.

For the chosen orientations (risk factors, screening tools and interventions) analytical tables were established to assess methodological quality and the level of scientific evidence for the consulted documents. These tables were based on classifications proposed by a number of recognized sources (see among others: Anaes (Agence nationale d'accréditation et d'évaluation en santé), 2000; American Geriatric Society *et al.*, 2001; SSMG (Société scientifique de médecine générale), 2001). Retained classification levels are presented in the section "Guide structure and use", p. 28.

Phase three: Whenever possible, the above-described evidence-based approach was used to establish recommendations. For cases where levels of evidence or data were insufficient, recommendations were discussed and adopted by consensus in committee. These "steering committee opinions" are meant to attract the reader's attention to fields and topics that were relatively unknown as the Guide was being written and furthermore to encourage the development and in-depth evaluation of potentially promising interventions within these fields and topics.

The steering committee reunited on two occasions, in Montréal in May 2002 (as an annex event to the World Conferences on Injury Prevention and Safety Promotion) and in Paris in September 2003. These were complemented by several telephone conferences to assure the progression and follow-up of the Guide.

7. http://www.ncbi.nlm.nih.gov/entrez.

KEY WORDS USED FOR THE COMPILATION OF THE CORPUS

Key words used to limit the documentary research to the concerned age group:

- Aged
- Aged, 80 and over
- Frail elderly

Key words used to define the nature of studies and trials:

- Comparative study
- Evaluation studies
- Follow-up studies
- Longitudinal studies
- Prospective studies
- Meta-analysis
- Pilot projects
- Program evaluation
- Review

Key words used to determine the type of risk factors:

- Accidental falls
- Accidents at home
- Fractures
- Wounds and injuries
- Nutrition disorders
- Nutritional status
- Alcohol drinking
- Alcoholism
- Alcohol-related disorders
- Alcoholic intoxication
- Substance-related disorders
- Psychotropic drugs

Key words used to isolate age-related problems (diseases, etc.):

- Musculoskeletal equilibrium
- Gait
- Activities of daily living
- Geriatric assessment
- Body composition
- Bone density
- Osteoporosis
- Exercise

Key words used to define the parameters of prevention and health education:

- Health education
- Patient education
- Health promotion
- Accident prevention

Guide structure and use

The primary goal of this Good Practice Guide is to provide all health and socio-medical professionals with the information they need to screen for the risk of falls in the elderly and to propose effective and adapted prevention interventions.

It is action-oriented and multidisciplinary. Its approach and presentation are somewhat different from other good practice guides or clinical practice recommendations produced by medical institutions and academies.

GENERAL ORGANIZATION

The first section of this Guide presents a decision tree that summarizes the principal recommendations of the steering committee for screening processes and resulting interventions.

The second section presents an analysis of the literature focusing on the three indispensible elements of all fall prevention programs.

1. Knowledge of risk factors for falling

Multiple factors are involved in the risk of falling. These factors may be intrinsic to the person and the aging process, behavioral, or found in the person's immediate environment. The main risk factors will be presented succinctly, illustrating how they intervene in the mechanism of falls and how the interact.

Literature data are sometimes ambiguous for certain risk factors. The association between falls and intrinsic factors, particularly gait and balance, has been demonstrated through methodologically rigorous studies.

Conversely, studies responding to recognized quality standards are lacking for behavioral and environmental risk factors and thus their role in falls is often poorly defined (the *Guide d'analyse de la littérature et gradation des recommandations*[8], Anaes,

8. "Guide for the analysis of literature and recommendation grading."

2000 (now HAS, Haute Autorité de santé), presents a French-language discussion of quality criteria).

Methods exist to evaluate the level of scientific evidence supporting the association of a risk factor with a phenomenon.

Levels of evidence allow for hierarchical, qualitative organization of available scientific information. Charts have been developed to assess evidence levels. They are essentially based on:

- the methodology used to establish a relation (study protocols and conditions, tools for statistical analysis, sample size);
- the number of studies on the relation and their coherence.

To provide a summary of the scientific literature addressing the etiology* of falls in the elderly, the Guide provides a simplified table that indicates the level of scientific evidence for the relation between a given risk factor and falling **[table I]**.

2. Assessment of the level of risk for the elderly person

Screening tools and means of assessment for the risk of falls in the elderly will be presented. This will include user profiles and instructions for interpreting results. The assessment tools themselves and detailed descriptions are available in the third section ("For use in practice") of the Guide. Some of these tools have more in-depth versions, which are readily available.

3. The choice of adapted interventions

In order to respect the objective of adapting interventions to the risk profiles of the elderly person, the recommendations will be formulated with regards both to the type of intervention and to the content of the intervention.

Recommendations will be based on the results expressed in the scientific literature. In particular, data will be prioritized from those studies evaluating the efficacy of interventions either in reducing the number of falls and their severity, or in the reduction of risk factors. As for fall etiology*, certain interventions have benefited more widely from vigorous study. For example, interventions targeting certain behavioral factors (nutrition, risk-taking, alcohol use) have not been assessed in-depth. Obviously, making recommendations when rigorous and coherent data are lacking is a delicate affair.

This Good Practice Guide integrates these differences in evidence by proposing four levels of recommendations that account for evaluative quality, quantity and coherence **[table II]** (Anaes, 2000). The recommenda-

TABLE I

Levels of scientific evidence for the association of risk factors and falls

Level of evidence	Definition
High	The relation between the risk factor and falls is continuously demonstrated in studies respecting quality criteria recognized by the scientific community[a].
Moderate	The relation between the risk factor and falls is often demonstrated in studies respecting quality criteria recognized by the scientific community.
Poor	The relation between the risk factor and falls is occasionally demonstrated in studies respecting quality criteria recognized by the scientific community.

a. *See Le Guide d'analyse de la littérature et gradation des recommandations produced by Anaes (now HAS), available online (in French.* http://www.has-sante.fr/, *"Toutes nos publications", "Methodologie").*

TABLE II

Levels of recommendation for fall prevention interventions

Level of recommendation	Definition
Highly recommended	A reduction in falls is continuously observed in high-quality studies that include the intervention[a].
Recommended	A reduction in falls is often observed in high-quality studies that include the intervention.
Promising	There is expert consensus on the efficacy of the intervention for the reduction of falls.
Not recommended	There is not sufficient evidence (no high-quality studies and/or no demonstration of association in existing studies and/or no expert consensus) that the intervention reduces falls efficaciously.

a. *See Le Guide d'analyse de la littérature et gradation des recommandations produced by Anaes (now HAS), available online (in French.* http://www.has-sante.fr/, *"Toutes nos publications", "Methodologie").*

tion level, "promising", does not signify that the intervention is ineffective, but that it had not been subjected to sufficient evaluation when the Guide was being written. The decision was made be the steering committee to include a level of, "not recommended", for interventions that are either less efficacious than others in terms of fall reduction or lack proof of efficacy.

To keep the Guide accessible for the largest possible number of users, the choice was made to simplify the habitually complex presentation of levels of evidence and of recommendations. Biographical references will be provided for those wishing to have access to numerical data on the risk levels and levels of evidence as they are presented here.

USING THE GUIDE

The Good Practice Guide can be easily used for sociomedical practice. Although it can be read in its entirety, the authors recommend starting with the decision tree **[figure 1]** and the summary tables **[table III]**, **[table IV]** and **[table V]** in the first section. This will allow the professional to rapidly choose an adapted approach to an elderly patient aged 65 or older and living at home. Some of these tables provide referrals to the pertinent section of the Guide to allow easy access to additional information on risk factors, screening tools or interventions.

Summaries and tables are equally provided in the second, detailed section of the Guide to allow for selective reading according to the users interest and availability.

Some of the more complex or ambiguous terms, as determined by the authors and readers of the Guide, have been defined in a glossary included in the "Annexes", p. 123. The terms in question are marked with an asterisk in the text.

Summary of recommendations

1. Falling is a **multifactorial event** that necessitates a global approach to the elderly patient. Intrinsic (balance impairment, chronic and acute disease), behavioral (medication, nutrition, alcohol use, risk-taking, fear of falling) and environmental (inside and outside the home) risks must be taken into account for a risk prevention program.

2. Different **types of interventions** for the elderly can be initiated with the goal of reducing or preventing falls. Two types of programs can be distinguished: those based in health promotion and focused on primary prevention of falls (although their fall reduction effectiveness has not yet been demonstrated, they do result in improvements in overall health in the elderly); and those designed for secondary prevention and focused specifically on fall risk factors. The latter have shown positive results for the reduction of falls in certain conditions.

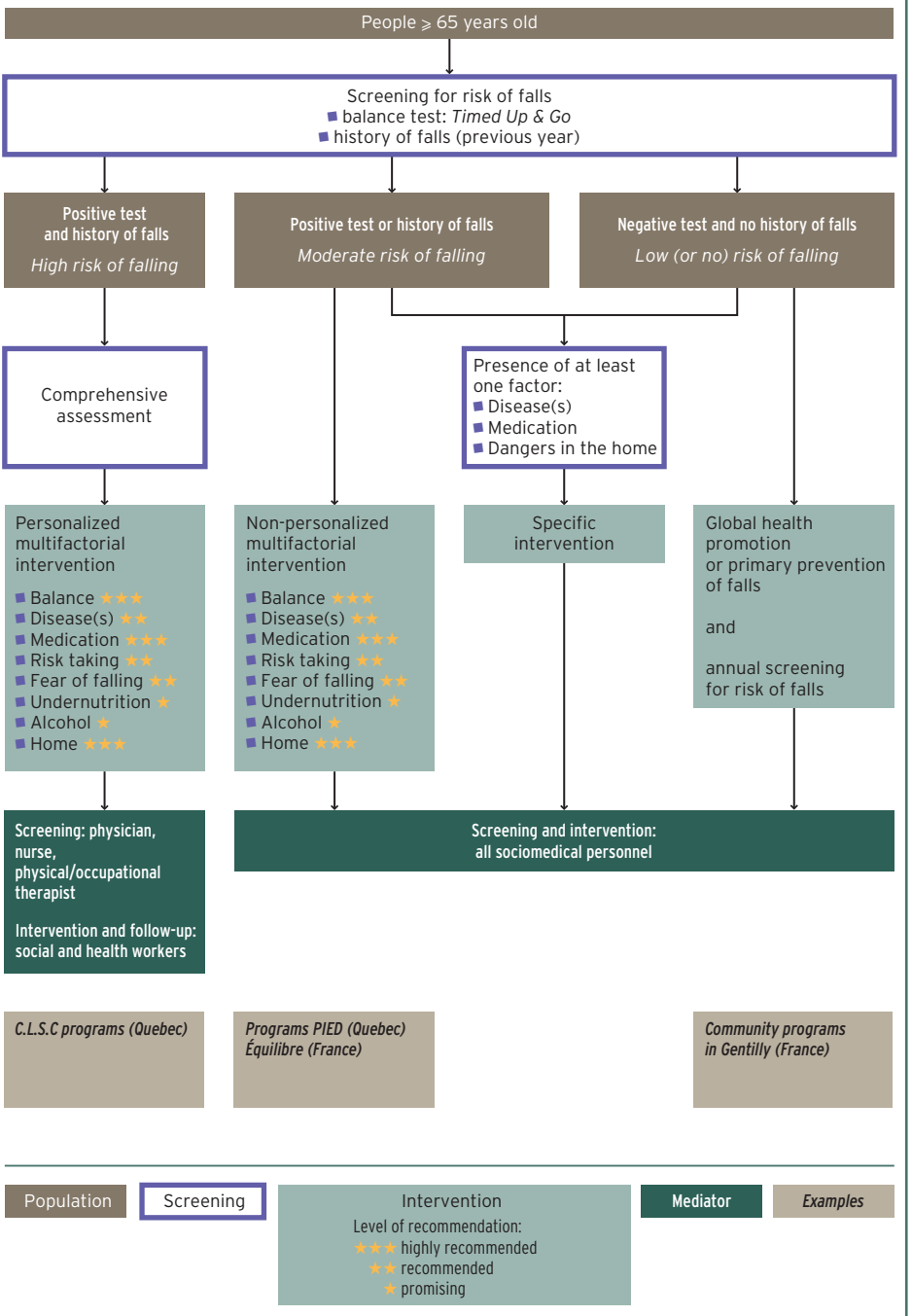
3. A fall prevention program should not be initiated generically for people 65 or older; that is to say **without taking into account their personal state of health and risk levels**. Aged patients presenting a risk of falling, i.e. having already fallen and/or presenting gait or balance impairments, should be prioritized for fall prevention programs **[table III]**.

4. It is recommended to **identify elderly individuals with a risk of falling**, evaluate their risk levels and propose adapted programs. A decision tree may be of assistance for health and sociomedical professionals during this phase of screening and orientation of elderly individuals **[figure 1]** after hospitalization or placement in supervised care centers.

5. **For the elderly with a high risk of falling** (history of falling and balance or gait impairments) it is recommended to propose a multifactorial and personalized program as a function of their risk profile. This program should include comprehensive assessment focused on four or five of the most frequent risk factors for falling and interventions targeting the detected risks.

FIGURE 1

Decision tree for the prevention of falls in the elderly living at home



The evaluation should give priority to:
- balance and gait impairment,
- medication,
- dangers in the home,
- chronic or acute diseases.

Although less imperative, the evaluation should also address:
- risk taking,
- the fear of falling.

Assessing nutrition and alcohol consumption may also provide valuable information **[table IV]**.

The risk profile thus established will serve as a basis for a personalized prevention program.

6. **For the elderly with a moderate risk of falling** (history of falling or balance or gait impairment) it is recommended to propose a multifactorial fall prevention program. Comprehensive assessment and personalization of the program are not obligatory. The program should include a collection of interventions that are applicable for all participants and are focused on four or five of the most frequent risk factors for falling **[table IV]**:
- balance and gait impairment,
- medication,
- dangers in the home,
- chronic or acute diseases,
- risk taking,
- fear of falling,
- undernutrition,
- alcohol consumption.

TABLE III

Levels of recommendation for different types of interventions

Type of intervention		Population: ⩾ 65 years of age		
		No risk of falling	Moderate risk of falling	High risk of falling
Personalized multifactorial	p. 78	Not recommended	Recommended	Highly recommended
Non-personalized multifactorial	p. 76	Not recommended	Recommended	Recommended
Restricted to isolated risk factors	p. 81	Recommended	Recommended	Recommended
Health promotion, primary prevention	p. 70	Promising	Promising	Not recommended

TABLE IV

Content of personalized or non-personalized multifactorial interventions

Risk factor	Level of recommendation for interventions on this factor	Assessment tools (personalized intervention)	Action strategy
Intrinsic factors			
Balance and gait impairment	Highly recommended	p. 62	p. 84
Chronic or acute diseases	Recommended	p. 62	p. 85
Behavioral factors			
Medication	Highly recommended	p. 64	p. 86
Risks in daily activities	Recommended	p. 65	p. 88
Fear of falling	Recommended	p. 65	p. 88
Undernutrition	Promising	p. 66	p. 89
Alcohol consumption	Promising	p. 66	p. 89
Environmental factors			
Dangers in the home	Highly recommended	p. 67	p. 90

TABLE V

Contents of restricted interventions targeting certain isolated factors

Risk factor	Level of recommendation for interventions on this factor	Assessment tools	Action strategy
Intrinsic factors			
Balance and gait impairment	Highly recommended	p. 62	p. 84
Chronic or acute diseases	Recommended	p. 62	p. 85
Behavioral factors			
Medication	Highly recommended	p. 64	p. 86
Risks in daily activities	Not recommended	p. 65	p. 88
Fear of falling	Not recommended	p. 65	p. 88
Undernutrition	Not recommended	p. 66	p. 89
Alcohol consumption	Not recommended	p. 66	p. 89
Environmental factors			
Dangers in the home	Highly recommended	p. 67	p. 90

7. **Some restricted interventions targeting certain isolated risk factors** have demonstrated their efficacy for reducing falls **[table V]**:

- balance and gait impairment,
- medication,
- dangers in the home,
- chronic or acute diseases.

These interventions should be intended for elderly persons having these particular risk factors, but screening negative for high risk of falling.

8. **For the elderly with a low (or no) risk of falling**, it is recommended to propose a health promotion and safety program, or a primary prevention program for fall risk factors. Annual reassessment is highly recommended for elderly patients aged 65 or older.

9. More specifically, it is essential that the **content, intensity and length of the interventions** be sufficient and well-adapted to the problem of falls. An educative approach is an effective complementary strategy for shaping globally the perceptions and behavior of the elderly patient, which can play a role in the etiology* of falls (medication, nutrition, risk-taking, environmental dangers, fear of falling).

10. **Follow-up for elderly patients** participating in a fall prevention program is essential and should include encouragement for the maintenance of safer behavior, verification of patient-implemented changes and the prevention of high-risk situations.

RATIONALE AND RECOMMENDATIONS

Falls in the elderly

DATA ON FALLS IN THE ELDERLY

Falling is the action of involuntarily collapsing to the ground. Falls have been associated with sensory, neuromuscular and bone and joint deficiencies (Dargent-Molina and Bréart, 1995) and falls resulting in trauma are a major cause of mortality and morbidity. In the elderly, falls are the main cause of accidental death (Dargent-Molina and Bréart, 1995; CFES, 1999).

In industrialized countries, it is estimated that a third of elderly persons aged 65 or more and living at home fall each year (Dargent-Molina and Bréart, 1995) and this proportion increases with age. Women are approximately two times more likely to fall than men, although this difference between men and women disappears as age increases; after 80 years, proportions become identical, and after 85 years, relative frequencies are comparable (Dargent-Molina and Bréart, 1995).

Although physical consequences of falls are extremely variable, they frequently provoke a loss of self-confidence that may in turn accelerate the loss of functional capacity (Vignat, 2001).

For some individuals, a fall will result in decreased mobility and increased dependence. Fractures occur in 5% of falls, the most serious of which are proximal fractures of the femur (less than 1% of cases) **[figure 2]**. Other injuries necessitating medical attention, including dislocations, sprains, hematomas and deep wounds requiring stitching, will occur in 5% to 10% of falls (Dargent-Molina and Bréart, 1995).

In the most serious cases, falls may result in a significant loss of functional capacity that may in turn necessitate post-hospitalization placement in institutionalized care.

Fall frequency and consequences can be visualized in the form of a pyramid **[figure 3]**. This schema was developed using data from studies done in Quebec (ISQ, 2003) and furthermore integrates the results of epidemio-

FIGURE 2

Principal risk factors for falls and fractures

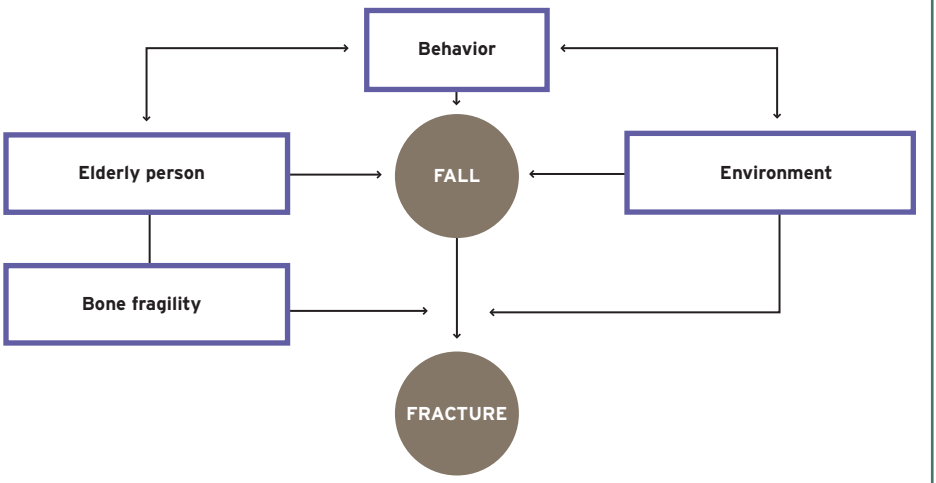
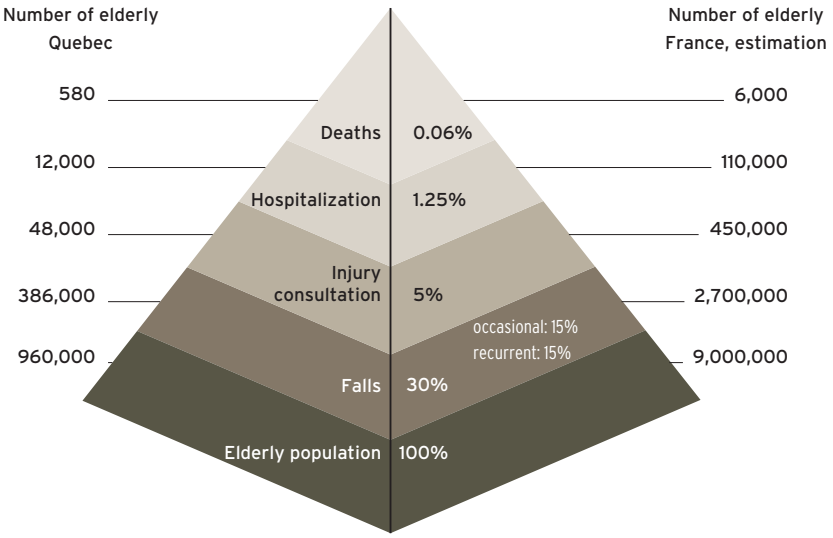


FIGURE 3

Falls and their consequences in the elderly populations (≥ 65 years) of France and Quebec



Estimations established from the Enquête sociale et de santé ("Health and social issues study"), 1998.

logical studies (Dargent-Molina and Bréart, 1995). It illustrates the impact of falls on the elderly population.

In 1998 in Quebec, more than 300,000 falls were reported in a population of more than a million people aged 65 or older. More than half of these falls were recurrent. In all, 50,640 falls resulted in injury that necessitated medical consultation, 12,681 led to hospitalization and 600 resulted in death.

France's elderly population counts 9 million individuals and falls are estimated at 2,700,000. These result in 450,000 injuries, 110,000 hospitalizations and more than 5,000 deaths. Similar data were not available from Belgium and Switzerland, but these proportions from Quebec and France most likely correctly illustrate the significance of falls in the elderly.

THE MULTIFACTORIAL NATURE OF FALLS

Falls are a result of a wide range of complex and interdependent factors. Since the 1980s, over 400 fall risk factors have been described by researchers (Skelton and Dinan, 1999). The relative importance of the various risk factors and their interactions are not currently well described. Studies do suggest however that the importance of any one factor is relatively small and that falls are more so a result of several factors acting together (Campbell, Borrie *et al.*, 1989). Thus, the risk of falling within the year increases linearly with the number of risk factors: from 8% when no risk factors are present to 78% when four or more risk factors are present (Tinetti, Speechley *et al.*, 1988).

In the scientific literature, risk factors are often presented in terms of three interactive dimensions, i.e. state of health of the elderly person, behavior, and environment **[figure 4]**. To ease the use of this Guide, these three dimensions are presented separately. However, cross-references will be provided whenever possible to illustrate the multifactorial nature of falls and the numerous interactions between risk-factors.

Although the roles of a certain number of risk factors in falling are better understood today, information is still lacking for others. For example, research into behavioral (e.g., risk-taking, nutrition) and environmental factors is immature, as these studies are often difficult to design and their results difficult to measure.

SOCIODEMOGRAPHIC FACTORS

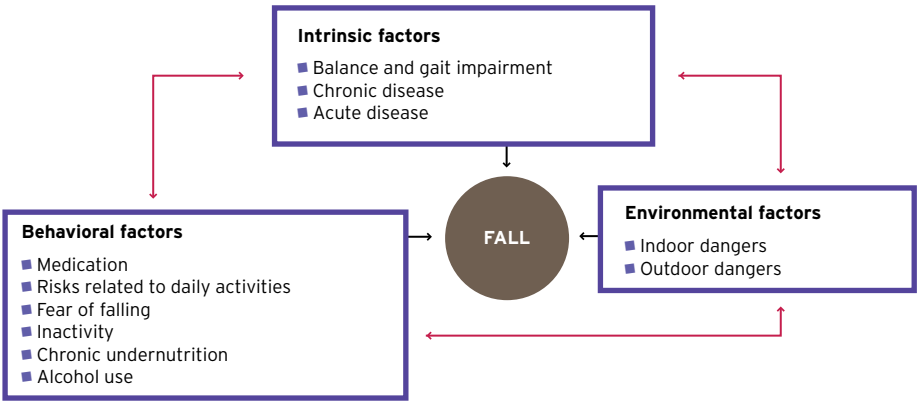
The frequency of falls increases with age. It is estimated that each year, a third of the elderly over 65 and half of those over 85 will fall once or more. The combined effects of aging and age-related diseases augment the risk of falling and the gravity of resulting injury **[table VI]** (Dargent-Molina and Bréart, 1995).

Over a certain age, even those who do not present any particular risk factors should engage in a certain number of preventive initiatives, in particular regular physical activity (WHO, 2002).

Other sociodemographic factors that increase the risk of falls have been variably demonstrated in studies **[table VI]**. Although some of these factors cannot be modified, or cannot be easily modified, they do provide information for determining the elderly populations that should receive access to fall prevention programs. Women are at a greater risk of falling than men, which may be explained by a more pronounced physical fragility (Gordon and Huang, 1995; Tinetti, Doucette *et al.*, 1995;

FIGURE 4

Factors involved in falls



Luukinen, Koski *et al.* 1996). People living alone, often elderly women, may run an additional risk after a fall with an associated increased risk of serious consequences, that of spending additional time on the ground, which increases the risk of loss of autonomy (Debray, 2003). This is more pronounced in elderly individuals who live alone or who do not receive social support (Luukinen, Koski *et al.*, 1996; Howland, Lachman *et al.*, 1998).

LEVEL OF EVIDENCE

- High: The relation between the risk factor and falls is continuously demonstrated in studies respecting quality criteria recognized by the scientific community[a].
- Moderate: The relation between the risk factor and falls is often demonstrated in studies respecting quality criteria recognized by the scientific community.
- Poor: The relation between the risk factor and falls is sometimes demonstrated in studies respecting quality criteria recognized by the scientific community.

For detailed information on levels of evidence and numerical data, please see the specific references provided in the text as well as the following general references:

– American Geriatrics Society, British Geriatrics Society and American Academy of Orthopaedic Surgeons Panel of Falls Prevention. "Guidelines for the prevention of falls in older persons", Journal of the American Geriatrics Society, 2001; 49 (5): 664-72.
– Lord, S.R., Sherrington C., Menz H.B. "Falls in Older People: risk factors and strategies for prevention." Cambridge, Cambridge University Press, 2001, 258 p.
– (In French) Dargent-Molina P., Bréart G. "Épidémiologie des chutes et des traumatismes liés aux chutes chez les personnes âgées", Revue d'épidémiologie et de santé publique, 1995; 43 (1): 72-83.

a. Criteria for high quality studies are available in French in *Le Guide d'analyse de la littérature et gradation des recommandations*, produced by Anaes (now HAS) and available online (http://www.has-sante.fr/, "Toutes nos publications", "Methodologie").

TABLE VI

Fall risk factors and associated levels of evidence

	Level of evidence		
	High	Moderate	Poor
Sociodemographic factors			
Advanced age	X		
Female	X		
Isolation			X
History of falling	X		
Intrinsic factors			
Balance, strength or gait impairment	X		
Chronic diseases:			
Locomotor system disorders (arthrosis, foot problems, etc.)		X	
Sensory disorders (cataract, neuropathy, etc)		X	
Neurological disorders (stroke sequelae, Parkinson's disease, etc.)	X		
Cognitive impairment, dementia	X		
Depression		X	
Urinary incontinence		X	
Acute diseases:			
Low blood pressure		X	
Dehydratation or undernutrition		X	
Urinary infection		X	
Behavioral factors			
Medication:			
Use of 4 or more drugs	X		
Psychotropic drug (all categories)	X		
IA antiarrhythmics (e.g., quinidine)		X	
Daily activities:			
Inappropriate eyewear		X	
Inappropriate footwear			X
Risk taking or improper use of assistive devices			X
Inactivity			X
Fear of falling		X	
Undernutrition:			
Chronic undernutrition			X
Deficiencies in vitamins, minerals, etc.			X
Alcohol consumption			X
Environmental factors			
Dangers in the home			X
Dangers outside the home			Unknown

Adapted from Lord, Sherrington *et al.* (2001).

RISK FACTORS INTRINSIC TO THE ELDERLY PERSON

Balance and gait impairment

The sense of balance, or equilibrioception, is necessary for maintaining posture. It integrates information from three different sources of perception:

- vision,
- the vestibular system*,
- proprioceptive* afferent nerves.

Balance can be static (standing still) or dynamic (walking). Other systems are involved in balance, including the central nervous system, which allows for adaptation to environmental changes, and the muscular system, essential for maintaining balance (CNEG (Collège national des enseignants de gériatrie) 2000a).

Sensory systems

Sensory systems are involved in the maintenance of posture and movement (CNEG, 2000a). Afferent information from the soles of the feet and muscle-tendon receptors* is needed to maintain the erect position against gravity. Reductions in sensory receptor performance can thus create balance impairment leading to falls (Whipple, Wolfson *et al.*, 1993; Van Deursen and Simoneau, 1999). In fall research, the most studied sensory system is vision, which plays a role in maintaining posture, notably when proprioception is deficient. However, its most important roles are the planning of movement and spatial orientation (Startzell, Owens *et al.*, 2000; Tromp, Pluijm *et al.*, 2001). The scientific literature underlines the following risk factors concerning the role of vision in the dynamic of falls (Sattin, 1992; Northridge, Nevitt *et al.*, 1995):

- alteration of visual acuity;
- decline of depth perception*;
- decline in field of vision and sensitivity to contrast;
- loss of saccade* precision.

Central nervous system

Reaction times and adaptation capacities diminish with aging (CNEG, 2000) and maintaining balance requires more attention (Chen, Schultz *et al.*, 1996; Shumway-Cook, Brauer *et al.*, 2000; Melzer, Benjura *et al.*, 2001; Redfern, Jennings *et al.*, 2001). Also, balance is more easily perturbed by the apparition of moving objects in the field of vision (Borger, Whitney *et al.*, 1999). This increases the risk of falling in the elderly when engaged in multi-task situations (Marsh and Geel, 2000), for example, walking while searching for one's keys in a sack.

KEY POINTS

Balance and gait are possible due to the treatment of information coming from several systems:

- sensory systems: vision, the vestibular system*[a], cutaneous sensation* (exteroception*), proprioception and plantar sensitivity.
- the central nervous system (attention, coordination, reaction speed);
- the locomotor system (musculoskeletal system).

As age advances, changes occur in these systems, for example:

- reduction of visual acuity and field of vision;
- reduction of cutaneous sensation* and plantar sensitivity, proprioceptive deficits;
- reduction in attention and reaction speeds, movement coordination difficulties;
- loss of muscle strength.

How these changes influence the likelihood of falls has not been systematically studied. However, there functional consequences, in particular those of balance and gait impairment, are often the source of falls and consequential fractures **[table VI]** (Skelton and Dinan, 1999).

a. Terms with an asterisk appear in the glossary.

Muscular system

Other capacities intervening in maintaining balance are muscular strength, which is needed to carry out normal activities such as standing up from a chair, and muscular explosive power* of the lower limbs (Skelton and Dinan, 1999), which is called upon to stop oneself from falling, after having slipped on something, for example (Skelton and Beyer, 2003). These capacities too diminish with age (Lord, Lloyd *et al.*, 1996; Baloh, Corona *et al.*, 1998; Maki, 2000; Bohannon, 1996). Indeed, the normal aging process is accompanied by loss of muscle mass (sarcopenia*) (Skelton and Beyer, 2003). The decrease in muscle strength is due to (Fiatarone and Evans, 1993):

- physiological changes;
- the accumulation of disabilities and physical impairments;
- inactivity;
- insufficient nutrition;
- certain diseases (for example, arthrosis).

The link between loss of muscle strength and falls in the elderly presenting with weight loss is significant and clinically demonstrated (Dutta and Hadley, 1995; Bertière, 2002) (see "Chronic undernutrition", p. 52).

Age-related diseases

Some chronic or acute diseases are known to increase the risk of falling in the elderly (Tinetti, 2003; American Geriatrics Society *et al.*, 2001; CNEG, 2000; Tinetti, Baker, McAvay *et al.*, 1994; Tinetti, Speechley and Ginter, 1988). This risk is further increased when two or more diseases are simultaneously present (Tinetti, Williams *et al.*, 1986).

Beyond the age of 65, these fall-associated diseases are frequent and often concurrent (Sermet, 2004). They affect the different systems involved in posture maintenance and cerebral blood flow, thus provoking balance and gait impairment, malaises, faintness and fainting, which in turn may result in falls (CNEG, 2000a). Furthermore, drugs used to manage these diseases can themselves be associated with an increased risk of falls (see "Medication", p. 64).

Chronic diseases

Locomotor system disorders

Arthrosis has been identified as a fall risk factor in a literature review on the subject (Kenny, Rubenstein *et al.*, 2002).

Arthrosis results in:

- reduced joint mobility;
- loss of muscle mass (due to reduced use);
- pain.

Foot deformations (hallux valgus and painful bunions, hammer toes), which increase postural instability, are also associated with more frequent falling (Tinetti, Speechley *et al.*, 1988).

Sensory disorders

Some visual disorders have been demonstrated in the literature as risk factors for multiple falls (two or more) (Ivers, Cumming *et al.*, 1998). These include:

- cataracts*, which cause visual deficiencies and increase sensitivity to bright light;
- glaucoma*, which reduces peripheral vision;
- age-related macular degeneration*, which reduces central vision.

Concerning proprioceptive* disorders, polyneuropathies* ("polyneuritis") (mainly diabetic but also nutrition and alcohol-related) have also been tied to an increased risk of falling (Koski, Luukinen *et al.*, 1998; Van Deursen and Simoneau, 1999; Schwartz, Hillier *et al.*, 2002) due to their role in decreasing sensitivity, which can affect balance and gait.

Neurological disorders

A prospective study in elderly people 70 years old or more and living at home demonstrated the association of strokes, particularly those resulting in neurological dam-

age, with an increase in the risk of falling in men (Campbell, Borrie *et al*., 1989). The falls were a result of the motor, visual and sensory nerve damage caused by the stroke.

People with Parkinson's disease are at a higher risk of falls and recurrent falls (two or more). Several factors associated with the disease are responsible for this (Bloem, 1992): Decrease in postural reflexes, poor control of voluntary movement, dyskinesia*, gait impairment, muscle weakness and rigidity in the lower limbs, and secondary effects of medication (including orthostatic hypotension*).

Cognitive impairment and dementia**

Yearly fall incidence in elderly people with cognitive impairment is from 40% to 60%; double that of those without cognitive impairment (Prudham and Evans, 1981; Buchner and Larson, 1987; Morris, Rubin *et al*., 1987; Tinetti, Speechley *et al*., 1988; Tinetti, Doucette *et al*., 1995; Shaw and Kenny, 1998). In people with dementia, men run a greater risk of falling than women (Van Dijk, Meulenberg *et al*., 1993) and falls become more frequent in moderate stage dementia (Nakamura, Meguro *et al*., 1996).

The prognosis for people with dementia who have fallen is poorer than those who do not present cognitive impairments (Buchner and Larson, 1987; Nevitt, Cummings *et al*., 1989; Guo, Wills *et al*., 1998; Shaw and Kenny, 1998) and include increased risk of injury, institutionalization (Morris, Rubin *et al*., 1987) and premature death (Shaw and Kenny, 1998).

The increased risk of falls and associated injury in people with cognitive impairment* is attributed to (Lafont, Voisin *et al*., 2002; Shaw and Kenny, 1998; Buchner and Larson, 1987):

- problems with vigilance;
- poor evaluation of dangerous situations;
- increased frequency of concurrent diseases;
- a low body mass index (BMI), possibly associated with undernutrition;
- alterations in motor function, sensory organization and balance (more pronounced than in people of comparable age without cognitive impairment*);
- walking behavior deficits;
- increased use of psychotropic drugs.

Depression

Depression is a factor in falls, the development of incontinence and the loss of functional autonomy (Kenny, Rubenstein *et al*., 2002; Tinetti, Inouye *et al*., 1995). Inversely, falls can result in symptoms of depression and a fear of recurrent falls (Biderman, Cwikel *et al*., 2002) (see "The fear of falling and the first fall", p. 50).

Furthermore, some factors are associated with both falls and depression (Biderman, Cwikel *et al*., 2002):

- a negative perception of one's state of health;
- cognitive impairment*;
- difficulties with daily-life activities (see "Environmental risk factors (in and out of the home)", p. 55);
- reduced gait speed.

Chronic urinary incontinence

Several studies have identified chronic urinary incontinence* (Tromp, Smit *et al*., 1998; Tromp, Pluijm *et al*., 2001) and urge incontinence (Luukinen, Koski *et al*., 1996; de Rekeneire *et al*., 2003) as factors associated with recurrent falls and fractures.

This may be explained in several ways. Falls and incontinence can both be the result of specific diseases or physiological or structural abnormalities (CNEG, 2000b). Urge incontinence is not a direct risk factor for falls, but may exacerbate postural instability when trying to carry out simultaneous multiple tasks, thus leading to a fall (Brown, Vittinghoff *et al*., 2000; Wolf, Riolo *et al*., 2000).

Furthermore, Tinetti, Inouye *et al.* (1995) demonstrated certain factors that predispose elderly individuals 72 or older to urinary incontinence, falls and reduced functional autonomy* together. These factors are:

- lower limb joint disease;
- loss of visual and auditory acuity;
- states of anxiety or depression.

Acute diseases

*Hypotension**

Hypotension may be caused by certain medications including diuretics and antihypertensives, standing up rapidly (orthostatic hypotension*) or occur after eating (postprandial hypertension*). It may provoke a decrease in cerebral perfusion*, resulting in dizziness, malaises or a loss of consciousness (Mader, 1989; CNEG, 2000a).

Orthostatic hypotension events seem to happen equally whether the initial position was seated or recumbent. However, an association between orthostatic hypotension and falls has not been reported consistently in the scientific literature (Mader, 1989; Kenny, Rubenstein *et al.*, 2002).

Postprandial hypotension, however, has been frequently associated with falls (Aronow and Chul, 1994; Puisieux, Bulckaen *et al.*, 2000).

Evidence is regularly increasing concerning the links between falls and fainting*, carotid sinus hypersensitivity* and vasovagal syncope* (Faddis and Rich, 2002; Kenny, 2002). For example, some preliminary data suggest that people with unexplained falls may present a slightly inadequate cerebral blood flow, of cardiac or circulatory etiology. However, prevalence* data is missing for this (Prudham and Evans, 1981; Nevitt, Cumming *et al.*, 1989; Kenny, Rubenstein *et al.*, 2002).

Dehydratation and undernutrition

Dehydratation and/or insufficient nutrition result in generalized weakness that limits postural maintenance and thus may cause falls in the elderly (Alexander, 2000).

Hypoglycemia, whether due to generally insufficient nutrition or insufficient nutrition when being treated for diabetes (tablets, insulin), may also increase the risk of falling (Alexander, 2000).

Infections

Acute infections may increase the risk of falling by aggravating generalized weakness or a state of dehydratation or poor nutrition (SSMG, 2001).

KEY POINTS

Certain chronic or acute diseases that affect the sensory, central nervous or muscular systems, or reduce cerebral perfusion* can provoke balance impairment, malaises, faintness or fainting, which, in turn, result in falls **[table VI] .**

The principal chronic diseases that may increase the risk of falls are:

- locomotor system disorders (arthrosis, foot deformations, etc.);
- sensory disorders (cataracts, glaucoma, proprioceptive* disorders, polyneuropathies*, etc.);
- neurological disorders (damage following a stroke, Parkinson's disease, etc.);
- cognitive impairment* and dementia*;
- depression;
- chronic urinary incontinence.

Acute diseases identified as risk factors are:

- orthostatic hypotension*;
- dehydratation and undernutrition;
- infections.

BEHAVIORAL RISK FACTORS

Medication

The management of the effects of drugs in the elderly is more delicate than in other age groups. This is because:

- the elderly are often living with several diseases, which may result in multiple medication use;
- aging results in changes to drug metabolism, due in particular to reduction in renal function;
- the elderly are more sensitive to secondary effects (dizziness, fatigue, hypotension*, nausea), that may increase the risk of falling.

KEY POINTS

The use of medication is an important and well-documented risk factor for falls **[table VI]**.

Multiple medication use (four drugs or more) and its associated drug interactions has been demonstrated to increase the risk of falling and injury.

Also, some drug classes have been shown to increase the risk of falling, in particular psychotropic drugs and antiarrhythmics.

Due notably to an increased frequency of chronic and acute disease, the elderly population is particularly sensitive to secondary effects and drug interactions.

Multiple medication use

The association between an increase in the risk of falling and injury and the total number of drugs being used has been demonstrated (Tinetti, Speechley *et al.*, 1988). This is particularly true for four or more drugs (Leipzig, Cumming *et al.*, 1999a; Leipzig, Cumming *et al.*, 1999b; Health Canada, 2002; O'Loughlin, Robitaille *et al.*, 1993; Ryynanen, Kivela *et al.*, 1993; Cumming, 1998).

Also, a relation exists between the number of drugs being used and the incidence rate* of secondary effects. In addition to their own effects, drugs have an interaction potential, which may generate additional secondary effects in some cases (Piette, 2004) thus possibly increasing even further a risk of falling in an elderly person already weakened by multiple concurrent diseases, for which the multiple medications are often a sign.

Psychotropic and cardiovascular drugs

Psychotropic (antidepressants, sedative-hypnotics, tranquilizers, antipsychotics) and cardiovascular (antiarrhythmics, digoxin, nitrites, and diuretics) drugs are the pharmacological classes most frequently associated with an increase in fall risks (Ray, Griffin *et al.*, 1987; Ray, Griffin *et al.*, 1989; Ruthazer and Lipsitz, 1993; Lord, Anstey *et al.*, 1995; Li, Hamdy *et al.*, 1996; Leipzig, Cumming *et al.*, 1999a).

Some of these substances increase specifically the risk of falls resulting in serious injury. For example, several studies have identified the use of antidepressants and sedative-hypnotics as risk factors for femur fractures (Ray, Griffin, Schaffner *et al.*, 1987; Ruthazer and Lipsitz, 1993).

An association between certain drugs and falls does not necessarily indicate a causal relationship; in reality, the disease for which the drug was prescribed, for example depression or cardiac rhythm disturbances (see "Age-related diseases", p. 45), may be the element favoring falls. However, the use of psychotropic drugs seems to be a disease-independent risk factor for falls (Leipzig, Cumming *et al.*, 1999a). The role of drug doses that are not adapted to the pharmacological sensitivity of certain elderly individuals is probably essential in falls, but this was not assessed in the reference literature.

For fall prevention, it is particularly important to take into account the use of psychotropic drugs because (Tamblyn, 1996;

Brymer and Rusnell, 2000; Campbell, Roberston, Gardner *et al*., 1999):
- they are one of the most prescribed drugs for the elderly, in some cases without a clear indication;
- drug prescriptions can be modified by the prescriber to reduce their role as a risk factor, although the management of multiple concurrent diseases in the elderly may limit or complicate this.

The principal secondary effects of antidepressants that favor falls are (CNEG, 2000a) drowsiness, dizziness, orthostatic hypotension* and blurred vision, and for sedative-hypnotics, drowsiness, fatigue, muscle weakness, hypotension*, dizziness and blurry vision. The hypotensive effect of diuretics and vasodilators (as well as the possible arrhythmic* effect of antiarrhythmics such as digoxin) have also been suggested.

Drug interactions and secondary effects

Caution should be exercised concerning interactions between:
- two or more psychotropic drugs of different classes, which can aggravate drowsiness and akinesia (Leipzig, Cumming *et al*., 1999a);
- drugs and undernutrition and/or dehydratation, which increases levels of drugs in blood, thus their secondary effects (Tamblyn, 1996);
- diuretics (risk of hyponatremia*, dehydratation, hypotension, hypokalemia*, drug intoxication by accumulation), vasodilators (risk of hypotension) or antiarrhythmics (risk of rhythm disturbances) (Leipzig, Cumming *et al*., 1999b);
- postural fragility and psychotropic drugs, which can worsen the risk of dizziness and postural instability (Leipzig, Cumming *et al*., 1999a).

Even when multiple medication use is absent, the elderly present a greater risk of iatrogenic* effects. Counseling and surveillance should be provided in particular for (Tamblyn, 1996):
- the elderly with memory disorders or living alone (compliance* problems);
- the elderly with visual disorders (errors when taking drugs).

Daily activities

Risk taking and improper use of assistive devices

The following behaviors are often considered to constitute risk taking (Reinsch, MacRae *et al*., 1992; O'Loughlin, Robitaille *et al*., 1993; Tinetti, Doucette *et al*., 1995; Connell and Wolf, 1997):
- hurrying;
- climbing onto a chair or ladder;
- walking with hands in pockets;
- using assistive devices (cane, walker) improperly;
- wearing inappropriate footwear;
- neglecting to use appropriate eyewear;
- using inappropriate supports to enter or leave bathtubs.

Although it is thought that risk taking is frequent in the elderly, the association with the risk of falls is currently poorly documented. For example, a recent study demonstrated that approximately half of elderly people admit to one or more of the following risky

KEY POINTS

The majority of falls happen during daily activities such as walking, getting out of a chair or a bed, or going up or down staircases. Paradoxically, there is currently very little data on falls related to these activities.

Some studies have however shown that certain risk-taking behaviors are associated with an increased frequency of falls **[table VI]**.

behaviors when using staircases (Startzell, Owens *et al*., 2000):

- going up or down the stairs in inappropriate footwear;
- not using the handrail;
- leaving objects on the steps.

In a study by Studenski, Duncan *et al*. (1994) on an elderly group presenting a high risk of falls, it was found that the probability of reoccurring falls was significantly affected by the person's attitude toward the risk taking behavior.

Inappropriate eyewear

Vision plays an important role in maintaining balance. Low vision and certain vision diseases can provoke falls (see "Balance and gait impairment", p. 44 and "Age-related diseases", p. 45).

Several authors have recently underlined the impact of certain types of inappropriate eyewear on falls. Bi- or tri-focal eyewear in particular may increase the risk of falling, notably in staircases and in unfamiliar environments (Lord, Dayhew *et al*., 2002).

Inappropriate footwear

Questions concerning types of footwear are relatively well documented, but the influence of this factor on falls has not yet been analyzed. Studies have been focused on the influence of different types of footwear on balance and gait in the elderly (Robbins, Waked *et al*., 1995; Lord and Bashford, 1996; Robbins, Waked *et al*., 1997; Robbins, Waked *et al*., 1998; Arnadottir and Mercer, 2000).

Balance and gait results in women were superior when walking barefoot or in walking shoes, as compared to dress shoes or high-heeled shoes. Sole thickness however, did not seem to influence balance and gait (Menz and Lord, 1999). In elderly men, stability and the perception of foot position was better in shoes with rigid soles (Menz and Lord, 1999).

It has been established that a major proportion of falls in the elderly occur in the home (see "Environmental risk factors (in and out of the home)", p. 55). However, the majority of elderly people do not invest in a pair of closed shoes for use in the home (tennis shoes, for example), preferring the use of slippers, which can cause falls (Munro and Steele, 1999).

The fear of falling and the first fall

Fear of falling

The fear of falling, even before it actually happens, is an important factor in the decline of autonomy. Indeed, the fear of falling can result in changes in motor function in the elderly, for example in walking behavior (Maki, 1997). The elderly frequently admit to having reduced their activities because of a fear of falling (Tinetti, Mendes de Leon *et al*., 1994; Howland, Lachman *et al*., 1998; Murphy, Williams *et al*., 2002). This in turn can lead to progressive deconditioning* of physical capacities, ultimately increasing the risk of falls **[figure 5]** (Campbell, Borrie *et al*., 1989; Dargent-Molina and Bréart, 1995; Vellas, Wayne *et al*., 1997; Cumming, Salked *et al*., 2000).

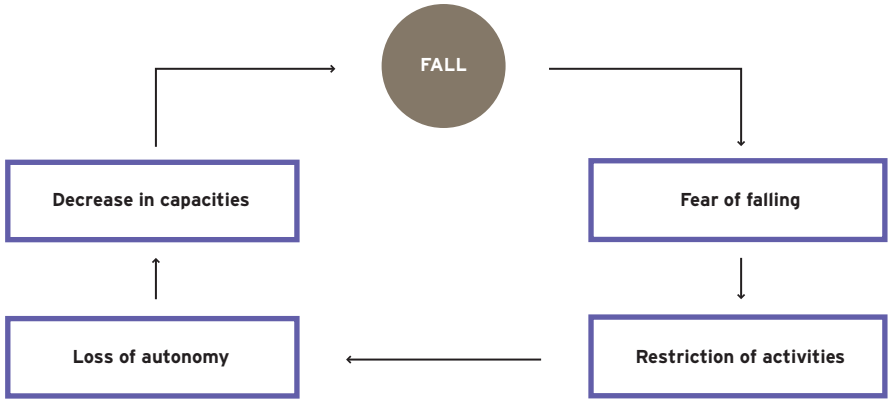
For those having already fallen, this phenomenon, called "post-fall syndrome", may lead to confinement in the home, the loss of initiative and even to irreversible, bedridden invalidity (Murphy and Isaacs, 1982; Debray, 2003). The people who are most likely to limit their activities due to a fear of falling are those who do not talk about it or who have little social support (Howland, Lachman *et al*., 1998).

The first fall

The first fall is a major factor for recurrence (Campbell, Borrie *et al*., 1989; Nevitt, Cumming *et al*., 1989; Luukinen, Koski *et al*., 1996; Friedman, Munoz *et al*., 2002) and

FIGURE 5

Post-fall syndrome



the consequences for the elderly person are numerous. Its psychological impact is poorly understood and should receive further exploration (Vignat, 2001; Kuntzmann, 1986). A fall may be perceived as a precursor to physical decline and alteration of capacities. Thus elderly people may decide to not speak of their fear of falling to their family, friends or doctors (Tennstedt, Howland *et al.*, 1998); it is suspected that only 10% of yearly falls in the elderly are communicated to doctors (O'Loughlin, 1991).

Several studies have illustrated certain consequences that may develop after an initial fall, including (Vellas, Wayne, Romero *et al.*, 1997; Murphy, Williams, Gill, 2002):

- a post-fall syndrome for a third of victims;
- fear and anxiety;
- desocialization;
- reduction in quality of life.

Those close to the person having fallen may also modify their behavior. In particular, a tendency of wanting to overprotect victims has been observed, which may lead to their institutionalization (Vignat, 2001).

Finally, the inability of a fall victim to get back up is a major recurrence and mortality factor: 40% of the elderly having spent more than three hours on the ground after a fall die in the following six months (Debray, 2003).

KEY POINTS

The fear of falling is a fall risk factor that can lead to a significant reduction of activity and a loss of autonomy, even in people having never fallen.
The fall itself is never a trivial event. Its importance will vary according to the person and the situation, but consequences can be very significant.
In particular, a fall greatly increases the risk of falling again **[table VI]**.

Inactivity

Negative effects of insufficient physical activity on the health and autonomy of the elderly are now well known (CDC, 1996; Kino-Quebec, 2002; WHO, 2002), but the possible link between inactivity and falls is poorly documented.

Inactivity and falls

Regular physical exercise delays the onset of the main chronic diseases (including cardiovascular diseases) in the elderly and lessens their functional consequences (CDC, 1996; Kino-Quebec, 2002; HCSP, 2000).

In particular, exercise improves mobility, which may contribute to reducing falls. Regular physical exercise also limits muscular atrophy (sarcopenia*). Muscular atrophy is more frequent in the elderly and may reduce gait and balance capacities and generate falls (Di Pietro, 2001; Drewnowski and Evans, 2001). See "Age-related diseases", p. 45.

Physical activity programs for the elderly comprising mobility exercises are among the most effective fall reduction strategies available today, especially when they include muscle-strengthening and balance elements. (American Geriatrics Society *et al.*, 2001; Gillespie, Gillespie *et al.*, 2003). See "Preserve or reestablish balance and gait with physical exercise", p. 84.

Falls, physical exercise and osteoporosis

The role of physical exercise for the prevention of osteoporosis* is continuously better understood. The level of physical exercise during youth and continuing throughout life is the most important preventive factor for osteoporosis. Nevertheless, starting or restarting a moderate exercise program later in life also leads to reductions in the loss of bone mass and the risk of fractures (Di Pietro, 2001). Physical exercise is a recommended osteoporosis and fracture prevention strategy (Inserm, 1997; Brown, Josse *et al.*, 2002; Woolf and Akesson, 2003). See "Fracture prevention", p. 82.

KEY POINTS

Inactivity as a risk factor for falls is currently poorly documented. Nevertheless, the recognized beneficial effects of physical exercise on functional capacity, balance and mobility would seem to suggest that the link is probable **[table VI]**. The equivalent of at least thirty minutes of moderate daily exercise is effective for maintaining health and preventing several diseases and disabilities that are frequent in the elderly.

Chronic undernutrition

Undernutrition-related fracture risks

Several authors (Bonjour, Rapin *et al.*, 1992; Delmi, Rapin *et al.*, 1990) have suggested that undernutrition in the elderly may increase the risk of fractures during a fall. Others, using body measurement and laboratory data, have found a greater likelihood of falls in people with nutritional deficiency (Vellas, Conceicao *et al.*, 1990).

In a study done in Geneva (Rapin, Bruyère *et al.*, 1985), it was found that at hospitalization, "(patients with) hip fractures were in a state of malnutrition in nearly 80% of the cases, dating to well before the fracture (8 months before)".

Undernutrition may lead to sarcopenia* and ensuing reduction in performance, coordination and movement, which may in turn favor the risk of falling (Evans, 1995; Vellas, Baumgartner *et al.*, 1992; Baumgartner, Koehler *et al.*, 1998; Baumgartner, Waters *et al.*, 1999; Bertière, 2002).

Furthermore, adequate muscle mass is important because it acts as a protective cushion, reducing the impact recieved by the bone during a fall (Dutta and Hadley, 1995; Bertière, 2002). Higher weight or weight gain during adulthood may thus provide a protective effect during falls, both in women and in men (Gordon and Huang, 1995).

Inversely, falls may induce undernutrition due to their probable involvement in decreased mobility, loss of appetite and

risk of needing assistance for eating (Vellas, Baumgartner *et al.*, 1992). See "Fracture risk factors", p. 57.

Micronutrient related fall risks

Micronutrient deficiencies will appear when caloric intake is less than 1,500 kcal per day. Deficits are mainly in zinc (needed for the sense of taste), calcium, selenium (antioxidant) and vitamins (Ferry, Alix *et al.*, 2002).

Bone is the main reservoir for calcium and it is needed to maintain bone density as long as possible. Calcium levels are maintained through a system of regulation for which vitamin D plays a major role (Cormier, 2002). If calcium or vitamin deficiencies are present, the body maintains calcemia at the expense of bone tissue. Bones may thus become fragile, increasing the risk of fractures (Cormier, 2002). Also, vitamin D deficiencies are associated with muscle weakness and falls (Janssen, Samson and Verhaar, 2002; Pfeifer, Begerow and Minne, 2002).

Although studies are few, falls seem to be associated also with deficiencies in vitamin B12 due to effects on proprioception* and B9 due to its role in cognitive impairment* (Baumgartner, Kohler *et al.*, 1998; Constans, 1998).

At-risk situations

In some cases, undernutrition may unite with other factors and lead to an increased risk of falling, in particular for:

- Chronic diseases (see "Age-related diseases", p. 45): the frequency of falls is significantly higher in people with any chronic disease due to the nutritional deficiencies that they create (Gostynski, 1991).
- Cognitive diseases: undernutrition and weight loss are frequent in patients with Alzheimer's disease and weight loss increases as disease severity increases (Rivière, Lauque *et al.*, 1998).
- Reduced physical activity due to disease has a direct incidence on loss of muscle mass and fall-related fracture risks (Evans, 1995; Dutta and Hadley, 1995). See "Inactivity", p. 51.
- Alcohol abuse increases the risk of B12 and B9 vitamin deficiencies, which increases the risk of falls. See "Alcohol consumption", p. 66).

KEY POINTS

Chronic undernutrition is frequent in the elderly and may have several origins; it is not a risk factor for falls in and of itself.

However, undernutrition may lead to decreased muscle mass (sarcopenia*) and generalized weakness that may in turn favor falls and increase the risk of fall-related fractures.

Deficiencies in micronutrients - some trace elements and vitamins - are associated with a risk of falling and an increased likelihood of fractures **[table VI]**.

Causes of undernutrition in the elderly

There are several causes of undernutrition in the elderly (Ferry, Alix *et al.*, 2002; CNEG, 2000; Lauque, Gillette-Guyonnet, Vellas, 2002).

Beyond the consequences of aging on the sense of taste and nutritional assimilation, there are social and psychosocial factors that should not be neglected. These include loss of pleasure in eating, depression, financial difficulties, shopping problems, isolation, etc.

Acute disease affects appetite while increasing dietary needs and is thus an important factor in undernutrition (see "Age-related diseases", p. 45) When subjected to a quantitatively and qualitatively insufficient diet, the elderly patient becomes more vulnerable to disease aggression than a younger patient would be (Lesourd, 1995; Vellas, Baumgartner *et al.*, 1992).

Regaining lost weight becomes difficult in the short interval between disease aggressions and, disease after disease, a state of undernutrition is established with resulting loss of muscle mass, possibly leading to an insufficiency in muscular reserve **[figure 6]**.

Alcohol consumption

Acute alcohol consumption, meaning the abusive use of alcohol in a short period, is normally distinguished from chronic consumption, meaning its abuse over a long period.

Generally, as alcohol consumption increases, so does the risk of negative consequences on the individual's health and well-being. Alcohol abuse presents immediate and secondary risks, the latter being postponed and cumulative. Morbidity and mortality increase when alcohol consumption is globally greater than 21 servings per week for men (3 servings per day for daily drinkers) or 14 servings for women (2 servings per day). Consumption above these levels is habitually considered abusive[9].

However for those 65 and over, these thresholds have been lowered due to an age-related decrease in alcohol tolerance. For this group, health risks increase when alcohol use exceeds 7 servings per week (1 serving per day, or two on rare occasions) (NIAAA, 1998; O'Connell, Chin *et al.*, 2003).

Consensus exists among healthcare and road safety specialists on the health and accident risks associated with alcohol consumption, including in the elderly (WHO, 2002). However, despite an increasing number of studies on the subject, the impact of alcohol use on falls in the elderly is currently poorly understood (Bégin, 2003).

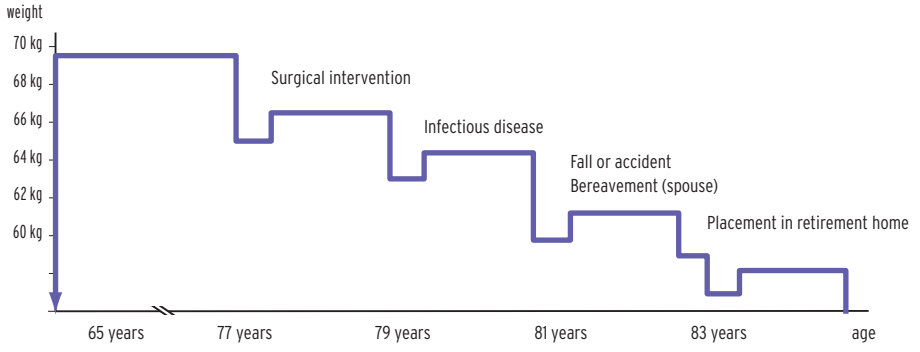
Fall risks associated with acute alcohol consumption

Acute alcohol consumption is a risk factor frequently associated with trauma. Alcohol alters the function of the central nervous system and may affect balance, gait and

9. INPES publishes a French language brochure entitled, Êtes-vous sûr de tout connaître sur les risques liés à l'alcool? ("Do you know all there is to know on alcohol-related risks? ") that provides a rapid summary of information on alcohol use and abuse.

FIGURE 6

Accumulative weight loss in the elderly



Sources: Vellas, Baumgartner *et al.*, 1992; Ferry, Alix *et al.*, 2002.

cognitive function (Sattin, 1992). Accident risk is present even when only small quantities of alcohol are consumed, as motor and sensory function begin to be significantly affected at blood alcohol levels of approximately 0.3 g/l (Bégin, Bélanger-Bonneau *et al.*, 2000; Guttenberg, 2002).

Retrospective studies in Australia, the United States and Germany illustrated an association between falls and alcohol consumption in the elderly (Bell, Talbot-Stern *et al.*, 2000; Weyerer, Schäufele *et al.*, 1999; Zautcke, Coker *et al.*, 2002).

Alcohol worsens fall outcome and is more frequently associated with injuries caused by falls than with other injuries in both men and women aged 65 and over (Pickett, Hartling *et al.*, 1998; Stenbacka, Jansson *et al.*, 2002).

KEY POINTS

The association between alcohol consumption and fall incidence is currently poorly documented, although research on this question is increasing.
Chronic and/or acute alcohol abuse is associated with an increased risk of trauma including fractures.
Acute consumption may be directly responsible for falls (disruption of balance and gait); chronic consumption may increase the risk of osteoporosis and fractures.
Finally, the use of alcohol in certain situations, particularly in combination with some medications, may increase the risk of falling **[table VI]**.

Fall and fracture risks associated with chronic alcohol consumption

Numerous studies have provided evidence for associations between chronic alcohol consumption and loss of bone density*, osteoporosis* or the risk of fractures (Gordon and Huang, 1995; Moniz, 1994; Laitinen and Välimäki, 1991; Rico, 1990; Spencer, Rubio *et al.*, 1986; Slemenda, Christian *et al.*, 1992).

Excessive alcohol consumption over a long period (Felson, Kiel *et al.*, 1988) and the quantity of alcohol consumed (Høidrup, Grønbaek *et al.*, 1999) are risk factors for hip fractures in both men and women (Baron, Farahmand *et al.*, 2001). Fracture risks are also higher in people with alcohol related disease (Yuan, Dawson *et al.*, 2001). See "Fracture risk factors", p. 57.

At-risk situations

Thresholds are given only as general guidelines and their interpretation must incorporate the person's corpulence and physical and mental health.

Alcohol consumption is contraindicated in the elderly in many situations, particularly in the presence of (SFA (Société française d'alcoologie) 2003):

- undernutrition: alcohol favors deficiencies in vitamins B12 and B9 and may worsen undernutrition (see "Chronic undernutrition", p. 52);
- medication (sedatives or hypnotics): alcohol may increase the depressant effects of sedatives or hypnotics on the central nervous system. Acute consumption of a large amount of alcohol can potentiate therapeutic effect and increase the risk of secondary effects (see "Medication", p. 64).

ENVIRONMENTAL RISK FACTORS (IN AND OUT OF THE HOME)

Sites and environmental characteristics presenting a high risk of falling

Studies have demonstrated that the vast majority of living accommodations of the elderly present environmental risks (Carter, Campbell *et al.*, 1997; Sattin, Rodriguez *et al.*, 1998; Gill, Robinson *et al.*, 1999; Lowery, Buri *et al.*, 2000; Stevens, Holman *et al.*,

2001). Currently the role of environmental risk factors in falls is poorly understood, as studies have not really established a direct link between falls and the number of in-the-home risk factors or the presence of certain living accommodation characteristics (Gill, Robinson *et al.*, 1999).

Lowery *et al.* (2000) estimate that only 10% of falls associated with environmental factors are correctly identified as such.

Falls happen roughly equally throughout the home (O'Loughlin, Robitaille *et al.*, 1993) although several authors underline, in particular, staircases (Tinetti, Speechley *et al.*, 1988; Archea, 1985; Hornbrook, Stevens *et al.*, 1994), and the kitchen (Petit and Marteau, 1992) as high-risk environments for the elderly.

In addition to the site itself, some environmental characteristics are associated with an increased risk of falling (Carter, Campbell *et al.*, 1997; Lowery, Buri, Ballard *et al.*, 2000):

- unfamiliar environments;
- poorly maintained sites;
- deficient structural elements (e.g., stair steps with different heights, irregular or slippery floors, absence of handrails in staircases, hard to access light switches);
- obstacles (e.g., buckled carpets, cluttered rooms);
- insufficient or badly oriented lighting.

Falls outside of the home are usually associated with irregular, wet, or icy sidewalk surfaces, slippery floors in supermarkets or poorly lit walkways (Gallagher and Scott, 1997; National Ageing Research Institute, 2000).

Site characteristics that increase the risk of injury

The degree of danger in terms of injury is largely dependent on (Lévesque, Lamontagne, Maurice *et al.*, 1999):

- the site: staircases, like all elevated environments, present a significant risk of injury (Tinetti, Doucette *et al.*, 1995; Archea, 1985);
- surface characteristics: some floorings (ceramic, smooth stone) are very hard and may be very slippery when wet;
- characteristics of the site or furnishings (very cluttered rooms, furniture with pointed corners or glass surfaces);
- characteristics of products used in the site (waxes for flooring, oils in bathtubs);
- time spent on the site.

See "Fracture risk factors", p. 57.

Role of the characteristics of the elderly person in environmental falls

Falls occur when individual capacities and behavior interact and provoke a loss of balance. This event will manifest at a particular time and place, representing a dysfunction of the interface between the person and the immediate environment. It is thus important to evaluate patients and their behavior within their domestic environment (Gill, Robinson, Williams *et al.*, 1999; Northridge, Nevitt, Kelsey *et al.*, 1995).

KEY POINTS

From one-third to two thirds of falls happen inside buildings, most frequently in the person's own home (Speechley and Tinetti, 1991; Sattin, 1992; Reinsch, MacRae *et al.*, 1992).

Environmental characteristics play a role in both the frequency and the seriousness of falls **[table VI]**. The following factors in particular have been demonstrated in the literature:

- insufficient lighting;
- the state of the floor;
- the presence of obstacles;
- absence of security equipment (e.g., handrails, grab-bars).

Certain characteristics of the elderly will thus increase the risk of environmentally provoked falls.

Very old age

The frequency of falls in the home increases with age.

Health problems

In 19% of the cases, patients report that a fall was caused by a health problem (see "Risk factors intrinsic to the elderly person", p. 44) (Sjorgen and Bjornstig, 1991). The fragile elderly fall more frequently in the home when doing routine activities (e.g., walking) and tend to experience more serious injury for comparable falls. The more healthy and active elderly tend to fall more often out of the home when engaged in an activity that implies moderate or significant displacement of their center of gravity (e.g., using a stepladder) (Speechley and Tinetti, 1991).

Vision problems

Changes in vision (see "Balance and gait impairment", p. 44) can modify the perception of the environment by the elderly and thus increase the risk of falling due to environmental characteristics (Northridge, Nevitt *et al.*, 1995; Tobis, Block *et al.*, 1990).

The nature of the activity

The complexity of the activity, a lack of attention or carelessness can increase the risk of falling in some sites (kitchen, staircase) and the seriousness of the fall (Lowery, Buri, Ballard, 2000). See "Daily activities", p. 49).

FRACTURE RISK FACTORS

Fractures occur when the concerned bone cannot resist the force of impact, meaning that it cannot dissipate the energy transmitted by the impact (Melton and Riggs, 1985). Fracture risk is thus a function of both the severity of the impact and the resistance of the bone **[figure 7]**.

FIGURE 7

Genesis of fractures

$$\text{Fracture risk} = \frac{\text{Impact intensity}}{\text{Mechanical resistance capacity of bone}}$$

As for the risk of falling, the risk of fracture combines intrinsic factors*, behavioral factors and environmental factors.

Impact intensity

In the elderly, fractures are most frequently the result of a fall. Car or leisure activity accidents can also lead to fractures in the elderly, but this is less frequent than in younger populations. Hip fractures are the most frequent type of fracture, occurring in 1% of elderly patients hospitalized after a fall.

Impact intensity is influenced by (Melton and Riggs, 1985; Cummings and Nevitt, 1989; Greenspan, Myers *et al.*, 1994):

- the height of the fall;
- the rigidity of the surface;
- fall orientation, notably lateral;
- the part of the body contacting the ground first;
- the protective responses used during the fall.

See "Environmental risk factors (in and out of the home)", p. 55.

Mechanical resistance capacity of bone

The resistance capacity of bone is determined by (Cummings and Nevitt, 1989;

Greenspan, Myers *et al.*, 1994; Dargent-Molina and Bréart, 1995; Wolff, Van Croonenborg *et al.*, 1999):

- the quantity and quality of tissue surrounding the skeleton (muscle, fat);
- the mineral density and microarchitecture of the skeleton.

Several researchers consider that one of the best predictors of fracture is bone mineral density (Brown, Josse *et al.*, 2002). Bone mass at a given age is determined by factors influencing bone both during growth and during adulthood (Wolff, Van Croonenborg *et al.*, 1999): insufficient nutrition, deficiencies in calcium and vitamin D (see "Chronic undernutrition", p. 52) and alcohol abuse (see "Alcohol consumption", p. 66) can also compromise the stability of bone density in old age.

The role of osteoporosis* in the risk of fractures is also well established (Brown, Josse *et al.*, 2002; DGS and Aflar, 2002). One woman in three over the age of 50 is affected by this disease that causes a loss of bone mass and a deterioration of bone microarchitecture (Hanley and Josse, 1996). The risk factors for osteoporosis are cumulative (Renfro and Brown, 1998; Inserm, 1997):

- risk increases with age;
- women are more at risk than men;
- very thin women (body mass index* < 18 kg/m²) or women having very thin bones are at higher risk;
- menopause increases fracture risks due to weakening of bone;
- certain lifestyles are also risk factors (alcoholism, smoking, insufficient dietary calcium (< 400 mg/day), inactivity);
- some medications may play a role (e.g., Glucocorticoids);
- heredity may play a role (family history of osteoporosis).

Screening and assessing the risk of falling

KEY POINTS

Elderly people aged 65 years or older should be screened for fall risks once per year. Risk of falls can be screened for quickly by checking for a history of falls in the last year and performing the Timed up & go (TUG) test. High risk exists if fall history is positive and TUG is positive (completed in more than 14 seconds); risk is moderate if fall history is positive or TUG is positive; risk is low or absent if fall history is negative and TUG is negative (completed in less than 14 seconds).

For those with a high risk of falling, comprehensive assessment is strongly recommended to detect specific risk factors. This assessment must be multidisciplinary and multifactorial. It must also include an assessment of the concerned person's home.

For those with a moderate or low (or no) risk of falls, a minimal assessment of at least the following elements is recommended:

- medication;
- dangers in the home;
- chronic or acute diseases.

The ability of sociomedical care providers to detect a risk of falling in elderly individuals and identify their modifiable risk factors using simple screening tools and other information is a major element of fall prevention. This process should allow them to provide adapted interventions and thus increase the likelihood of measurable results in fall reduction (American Geriatrics Society *et al.*, 2001; National Ageing Research Institute, 2004; Gillespie, Gillespie, Robertson *et al.*, 2003).

SCREENING INDIVIDUALS FOR A RISK OF FALLING

To further increase their effectiveness, it is recommended to provide fall prevention programs for those elderly people who are the most vulnerable to falls. These individuals will thus benefit from better-adapted and more effective targeted interventions (American Geriatrics Society *et al.*, 2001; National Ageing Research Institute, 2004; Gillespie, Gillespie, Robertson *et al.*, 2003). To detect the at-risk elderly, the steering committee recommends a two step screening process **[figure 8]**.

The entire screening process takes no more than 10 minutes and can be done by all health or sociomedical care providers aware of the issue of falls in the elderly.

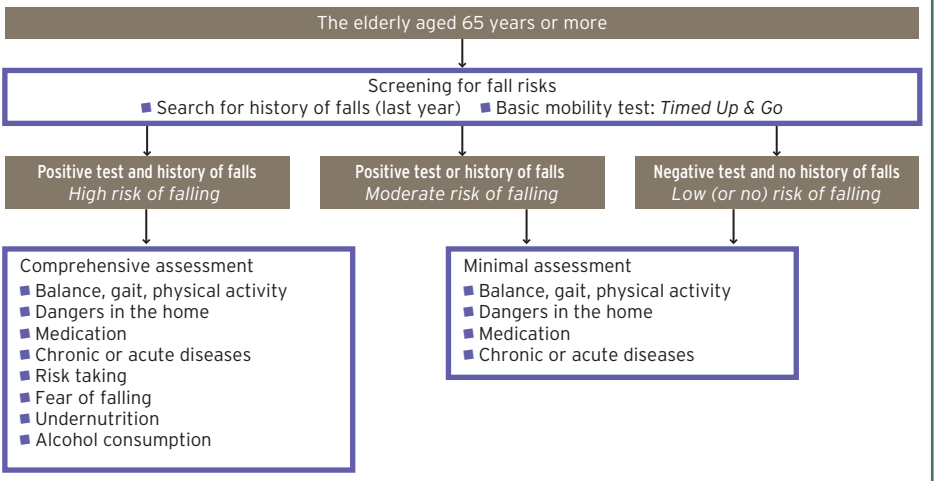
The screening tests and assessment tools discussed in this section are detailed in the section "For use in practice".

TIMED UP & GO (TUG)

The first step in screening is to quickly assess balance and gait. Several tests have been designed to screen the elderly for risks of falling by testing motor function capacity, which is one of the principal risk factors for falls (Franchignoni, Tesio *et al.*, 1998; Whitney, Poole *et al.*, 1998; Chiu, Au-Yeung *et al.*, 2003; Lin, Hwang *et al.*, 2004). These tests have different natures and endpoints. For example, some are designed to predict future "fallers" (good sensitivity*), others future "non-fallers" (good specificity*); some test several gait and balance aspects, others only a single aspect; some demand a certain amount of training to interpret their results, others are easy to use and interpret.

FIGURE 8

Screening for fall risks



Here, simplicity and rapidity have been privileged to facilitate the integration of fall risk screening in daily professional practice. The test proposed here, the Timed up & go (TUG) test, is both simple to use and provides satisfactory sensitivity* and specificity*. Furthermore, it has been validated in the elderly living at home (Podsiadlo and Richardson, 1991; Shumway-Cook, Brauer *et al.*, 2000; Bischoff, Stahelin *et al.*, 2003).

Ask the patient to rise from his or her chair without using a non-habitual aid, walk 3 meters, turn around and return to a seated position in the chair. Time the exercise using a watch with a second hand (or a stopwatch)[10]. Elderly individuals living at home who do not have balance or gait impairment should be able to complete this exercise in less than 14 seconds. A time superior to 14 seconds indicates reduced mobility and a risk of falling (Shumway-Cook, Brauer *et al.*, 2000).

HISTORY OF FALLING

A person who has already fallen presents a significantly higher risk of falling again compared to someone who has no history of falling (Campbell, Borrie *et al.*, 1989; Nevitt, Cumming *et al.*, 1989; Luukinen, Koski *et al.*, 1996; Friedman, Munoz *et al.*, 2002). However, elderly people will often not freely admit to falling to the people close to them or to their treating physicians (O'Loughlin, 1991).

The second step of the screening consists thus in questioning the patient on a history of falls over the last year (American Geriatrics Society *et al.*, 2001).

"Have you fallen during the last year? How many times?" These questions may be accompanied by an exploration of the context of the falls (location, activities and medication use when the falls happened, consequences). This questioning will provide more depth to the assessment.

INTERPRETING RESULTS

1. There is a history of one or more falls during the past year and balance and gait impairment is detected (TUG superior to 14 seconds).

The person presents a high risk of falling again and needs comprehensive assessment with accompanying counseling and exercises adapted to the detected factors (personalized multifactorial program). Comprehensive assessment is presented below.

2. The person:

- fell once or more during the past year but does not present balance and gait impairment (TUG inferior to 14 seconds);
- did not fall during the past year but does present balance and gait impairment (TUG superior to 14 seconds).

This person presents a moderate risk of falling or falling again. A minimal assessment of certain risk factors is recommended and any detected risk factors should be addressed with specific interventions. Moderate risk individuals may also be oriented toward multifactorial fall prevention programs.

3. There is no history of falls during the past year and balance and gait impairment is not detected (TUG inferior to 14 seconds).

This person presents a low (or no) risk of falling. A minimal assessment of certain risk factors is recommended and any detected risk factors should be addressed with specific interventions. Low risk individuals may also be oriented toward health promotion and safety programs, or toward primary prevention programs (see "Key definitions", p. 22) for fall risks.

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10. An in-depth description of the test is furnished in the section "For use in practice".

SCREENING AND COMPREHENSIVE ASSESSMENT FOR THE RISK OF FALLING

The screening tests and assessment tools discussed below are detailed in the section "For use in practice".

BALANCE AND GAIT IMPAIRMENT

Measures of motor function capacities, in particular gait and balance tests, are powerful predictors for risks of falling (Nevitt, Cumming *et al.*, 1989; Maki, Holliday *et al.*, 1994; Dargent-Molina, Favier *et al.*, 1996; Whitney, Poole *et al.*, 1998), fractures (Lee, Dargent-Molina *et al.*, 2002) and disability in the elderly (Guralnik, Ferruci *et al.*, 1995).

The steering committee recommends screening the elderly for balance and gait impairment as a first step in the management process. The steering committee recommends the Timed up & go (TUG) test (see page 60).

However, other tests are available for comprehensive assessment that may furnish healthcare and sociomedical professionals with supplementary information (American Geriatrics Society *et al.*, 2001; Tinetti, 2003; Gillespie, Gillespie, Robertson *et al.*, 2003) **[table VII]**.

Concerned population

- Assessment is highly recommended for the elderly who screened with a high risk of falling.
- Assessment is recommended for the elderly who screened with moderate or low (or no) risk of falling **[figure 8]**.

What should be done if an elderly individual presents balance and gait impairment?

See "Preserve or reestablish balance and gait with physical exercise", p. 84.

CHRONIC AND ACUTE DISEASES

Evaluation by a physician (generalist, internist or geriatrician), possibly with the assistance of other healthcare professionals (specialists — neurologists, psychiatrists, cardiologists, etc. —, nurses, physical therapist, occupational therapist, etc.), is recommended to diagnose chronic or acute diseases (Feder, Cryer *et al.*, 2000; American Geriatrics Society, 2001; Tinetti, 2003).

The medical evaluation should focus on those diseases mentioned earlier that

TABLE VII

Balance and gait impairment screening tests

Test	Tested function	Professional	Comments
Recommended			
Get up and go	Gait	Doctor or well-trained care provider	Requires certain clinical skills for interpretation
Other tests			
Unipedal (balance on one foot)	Balance	All care providers	Elderly are at risk if balance cannot be held for more than 5 seconds
Adapted Tinetti	Balance and gait	Physical therapist or well-trained care provider	Elderly are at risk if score is < 20

are associated with falls (see "Age-related diseases", p. 45) and include examination of (Feder, Cryer *et al.*, 2000; American Geriatrics Society *et al.* 2001; SSMG, 2001):

- cardiovascular function (rate, blood pressure, baroreceptor function);
- muscle function;
- visual acuity (near and far vision);
- reflexes and cerebellar function*;
- lower limb proprioception*;
- mental state (mood, depression, etc.);
- neurological and cognitive function (memory, orientation, etc.);
- urinary continence.

This evaluation can be done during an office visit or during post-fall hospitalization **[table VIII]**.

Concerned population

- Assessment is highly recommended for the elderly who screened with a high risk of falling.
- Assessment is recommended for the elderly who screened with moderate or low (or no) risk of falling **[figure 8]**.

Suggestions for evaluations

For orthostatic hypotension

Diagnosing orthostatic hypotension* may be difficult (Mader, 1989) as its effect on the patient will vary from one day to the next.

Also, the measure of blood pressure may be influenced by the time of day, how many hours have passed since the last meal, the time spent reclined before rising and the arm's position while blood pressure is being measured (Mader, 1989).

The fall in blood pressure may occur as much as 30 minutes after rising (Streeten and Anderson, 1992).

Thus, to measure orthostatic hypotension* the following is recommended (Hale and Chambliss, 1999):

- Have the person lie down for 5 minutes and measure blood pressure (BP) and pulse in the reclined position. This may be done in the morning or after a nap.
- Then tell the person to rise, wait 1 minute and retake BP and pulse with the person still in the standing position.

The screening for orthostatic hypotension is considered positive if the reduction in systolic pressure is greater than or equal to 20 mmHg or the reduction in diastolic pressure is greater than or equal to 10 mmHg, in the 3 minutes after rising.

Symptoms (weakness, unsteadiness, vertigo[11]) appearing when rising or in the following minutes are highly suggestive of inadequate cerebral blood flow.

For urinary incontinence

Urinary incontinence* can be a delicate subject and some elderly people may not wish to volunteer this type of information. The

11. Interpreting vertigo when rising or standing demands a differential diagnosis of vertigo due to inadequate cerebral blood flow or vertigo due to multiple sensory deficits (visual, proprioceptive, muscle weakness, drug effects), particularly frequent in the elderly (Warner, Wallach, Adelman et al., 1992).

TABLE VIII

Information sources for researching chronic or acute diseases

Information sources	Professional	Comments
Anamnesis*	Physician	See "Suggestions for evaluations", p. 63
Clinical evaluation	Physician	
Complementary exams	Physician	

healthcare professional should take the initiative to start the conversation. Tools may exist that are designed to aid the approach to this subject. For example, in France several tools exist:

- The Cres (comité régional d'éducation pour la santé) of Lorraine developed a tool called, *Les aînés, acteurs de leur santé*[12] that proposes several simple questions to gather information: "Do you sometimes experience urine leakage?" "Does it bother you in your daily activities or when out of your home?".
- The MSA (Mutualité sociale agricole) has integrated these questions in their action program, "Seniors, soyez acteurs de votre santé"[13], which provides a global approach to the health of the elderly.

Furthermore, a 24-hour micturition table can be used (indicating the time, place and activities when incontinence is experienced) to quantify and qualify incontinence, identify urinary disorders and underline certain correctable factors (e.g., certain drinks, not having toilets nearby). This will allow for the development of therapeutic strategies and the verification of their efficacy (CNEG, 2000).

Observation is only a first step; a medical consultation and possibly complementary exams are often needed, for example to diagnose and treat a urinary infection.

What should be done if the person presents an acute disease?

See "Treat and prevent chronic and acute diseases", p. 85.

MEDICATION

It is recommended (American Geriatrics Society *et al.*, 2001; Gillespie, Gillespie, Robertson *et al.*, 2003; Tinetti, 2003) to review the elderly person's medication (prescribed drugs and self-medication) **[table IX]** to determine possible roles for the following factors:

- use of four or more drugs;
- the use of drugs known to increase the risk of falling;
- indications and dose modification for the elderly person's state of health;
- experienced or possible secondary effects;
- the possibility of drug interactions.

It is also advised to question elderly people on their behavior concerning medications, in particular their understanding of prescriptions, their perception of the drugs they are taking and compliance*.

Screening for a medication-associated risk of falling may be done:

- as a follow-up to a consultation after a fall (clinic, physician's office);
- in the home, for example during a professional visit;
- at the pharmacy, when the person comes for prescriptions;
- by the doctor at the moment of prescription;
- when leaving the hospital.

Concerned population

- Assessment is highly recommended for the elderly who screened with a high risk of falling.
- Assessment is recommended for the elderly who screened with moderate or low (or no) risk of falling **[figure 8]**.

Suggestions for evaluations

The evaluator must have available a list of drug classes known to increase fall risks. The list must present the brand and generic names being used in the concerned country and be validated by a healthcare professional (pharmacist and/or physician) who has received training in fall prevention in the elderly.

In France and Quebec, some pharmacists have created "client-cards" as a way of providing therapeutic follow-up. The cards comprise the name of the prescribing physician,

12. "Senior citizens, actors in their own health".
13. "Seniors: be an actor in your health».

TABLE IX

Information sources for researching at-risk medication use

Information sources	Professional	Comments
Health records / shared medical files	Doctor or nurse	
Prescription registers / pharmacists' files	Pharmacist	
Verification of personal medicine chests and/or weekly or daily pill organizers	All care providers	Have the person explain his/her medications to you, estimate compliance
Management notebook	All care providers Elderly person and those close to him/her	Propose a notebook to the elderly person in which all prescribed and over the counter drugs will be noted. This will increase awareness in the elderly person and allow for better surveillance by care providers and those close to the elderly person.

the name of the prescribed drugs and their date of prescription, the quantities and date delivered to the patient. They also include patient-specific and treatment-specific contraindications. If there is a prescription error or confusion the pharmacist can contact the prescribing physician. If not, the pharmacist provides a written explanation for the refusal to deliver the prescribed medication. In France, this act is called "opinion pharmaceutique" (pharmaceutical opinion) (Fournier, 2002).

What should be done if the person is taking medication?

See "Reduce the number of medications and promote their correct use", p. 86.

RISK TAKING IN DAILY ACTIVITIES

During a consultation and/or during a visit to the home of an elderly person, in addition to asking for information on the conditions present during past falls, it is also recommended to assess the risks taken in the person's daily activities (Tinetti, 2003).

The following points may be explored:

- site of the fall and its characteristics (state of the floor, furnishings, lighting, etc.);
- clothing, eyewear and footwear being worn at the moment of the fall;
- use or absence of assistive devices;
- actions being done when the fall happened (getting up, kneeling down, walking, etc.);
- reasons for the fall (lack of attention, distraction, dangerous activity, environment);
- consequences of the fall (time spent on the ground, injury, etc.);
- means of getting help.

Risk taking in daily activities can also be determined in conjunction with an assessment of environmental risks (see "Dangers in the home", p. 67), as the risk level of some activities may be made worse by an unadapted environment (e.g., taking a bath, cooking).

Concerned population

- Assessment is recommended for the elderly who screened with a high risk of falling **[figure 8]**.

What should be done if the person is taking risks in his or her daily activities?

See "Prevent risk taking in daily activities", p. 88.

THE FEAR OF FALLING

The screening committee recommends assessing the fear of falling in the elderly.

This may be done after checking for a history of falls and analyzing the conditions present during any possible past falls. Scales exist for measuring activity limiting **[table X]** following a fall (Hill, Schwarz *et al.*, 1996; Robitaille *et al.*, 2002).

Concerned population

■ Assessment is recommended for the elderly who screened with a high risk of falling **[figure 8]**.

What should be done if the person is afraid of falling?

See "Prevent and reduce the fear of falling", p. 88.

CHRONIC UNDERNUTRITION AND VITAMIN DEFICIENCIES

The steering committee recommends assessing the risk of undernutrition and deficiencies in vitamin D and calcium **[table XI]** in the elderly who screen with a risk of falling or fractures.

Concerned population

■ Assessment is promising for the elderly who screened with a high risk of falling **[figure 8]**.

What should be done if the person presents with undernutrition and/or vitamin deficiencies?

See "Treat undernutrition and deficiencies in vitamin D and calcium", p. 89.

ALCOHOL CONSUMPTION

The steering committee recommends assessing the risk of abusive consumption of alcohol (chronic or acute) and the situa-

TABLE X

Information sources for researching a fear of falling

Information sources	Professional	Comments
ABC Scale	All care providers	
"Are you afraid of falling? On what occasions?" "Have you limited some of your activities because you are afraid of falling? Which ones?"	All care providers	

TABLE XI

Screening tests and other information sources for researching undernutrition

Tests	Professional	Comments
Mini Nutritional Assessment (MNA) (p. 108), abridged version	Physician, dietician, nurse	Elderly are at risk if score is ≤ 11 (continue assessment)
Payette Questionnaire (p. 109)	All care providers	Elderly are at risk if score is >3
The 12 malnutrition warning signs (p. 109)	Physician	Elderly are at risk if one sign or more is present, risk increases with the number of signs
Daily calcium intake estimation table (p. 110)	Physician, dietician, nurse	Elderly are at risk if score is <12
Information sources	**Professional**	**Comments**
Scale	All care providers Elderly person and those close to him/her	Elderly are at risk if weight loss is >2kg in 1 month or >4kg in 6 months

tions in which the consumption of alcohol could present a danger to the elderly who screened with a risk of falling **[table XII]**. In addition to screening for alcohol abuse, for which tests validated in the elderly exists (Buchsbaum, Buchanan *et al.*, 1992; Fingerhood, 2000), it is recommended to take into account:

- the presence of alcohol in past falls;
- the amount of alcohol habitually consumed;
- the frequency of consumption;
- the context of consumption;
- the presence of contraindications (medication, undernutrition, driving);
- the presence of depression.

Concerned population

- Assessment is promising for the elderly who screened with a high risk of falling **[figure 8]**.

What should be done if the person is abusing alcohol?

See "Prevent and treat alcohol abuse and dangerous use of alcohol", p. 89.

DANGERS IN THE HOME

Numerous tables exist for identifying fall risks in the homes of the elderly. In general, they are in the form of a room-by-room checklist of obstacles associated with falls and injury. Some are self-evaluations and others are meant to be used by various care providers **[table XIII]**. To date, research has not been able to demonstrate the predictive value of these tools, i.e., a link between the results of the home evaluation and falls (Stalenhoef, Diederik *et al.*, 1998).

Research (American Geriatrics Society *et al.*, 2001; Feder, Cryer *et al.*, 2000) suggests that it may be preferable to assess indi-

TABLE XII

Screening tests for alcohol abuse

Tests	Professional	Comments
Alcohol use disorders identification test (Audit) (p. 110)	Physician, nurse	Elderly are at risk of alcohol abuse if score is ⩽ 8 in men and ⩽ 7 in women
"Cage" questionnaire (p. 112)	Physician, nurse	Elderly are at risk of alcohol abuse if score is >1[a]
Information sources	**Care provider**	**Comments**
Exploration of context of alcohol consumption	Physician, nurse	

a. Taken from the Canadian manual, *Supporting Seniors' Mental Health: A Guide for Home Care Staff*, Canadian Mental Health Association. See also Adams, Barry *et al.* (1996).

TABLE XIII

Information sources for researching dangers in the home

Information sources	Professional	Comments
Sipa project	All care providers	Assessment of the presence of environmental risks in different rooms of the home.
Table, "Analytical approach to the home environment"	All care providers	Tool including a space for retained solutions and modification follow-up.
Assessment table for the home environment	All care providers	Standardized tool proposing a complete assessment of the home environment

viduals during their daily activities (moving about, bathing, dressing, cooking, etc.) in the home (see above). Actions intended to modify the home are thus more pertinent and result in improved fall prevention.

Proposing assistance for the implementation of these modifications will further increase their efficacy. The environment should be adapted to the capacities of the individual; environments that are too monotonous are just as detrimental as those that are too demanding. Assessment tools must take these interactions into account.

Certain environmental elements are innately dangerous (e.g., staircases, slippery ceramic flooring) and should not be underestimated, whatever the capacity level of the home dweller may be.

Several assessment tables are available on the Internet.

Concerned population

- Assessment is highly recommended for the elderly who screened with a high risk of falling.
- Assessment is recommended for the elderly who screened with moderate or low (or no) risk of falling **[figure 8]**.

Suggestions for evaluations

It is important to take into account the capacities of the concerned elderly persons when assessing the environment and to explain to them how to detect and manage the different risks that are present in the various environments that they confront (Cumming, Thomas *et al.*, 1999). The elderly should learn to identify, as a function of their capacities and state of health, activities that have become difficult or dangerous. They must also be attentive to and correct those things that cause them to lose balance, stumble or fall. The assistance of a professional healthcare provider (occupational or physical therapist, etc.) may be of use in complex situations.

Assessment of functional capacity* in the living environment is also highly recommended. This will allow for the verification of the adequacy of the environment to the elderly person's real capacities and for the assessment of material, human and financial needs for maintaining autonomy.

Several autonomy assessment tools can serve as a base for examining the risk of falling during daily activities. For example:

- Activities of Daily Living (ADL);
- Instrumental Activities of Daily Living (IADL);
- the functional autonomy measurement system (Smaf);
- Aggir, autonomy assessment scale.

What should be done if the person's home presents dangers?

See "Reduce dangers in the home", p. 90.

Effective programs and action strategies

KEY POINTS

It is highly recommended to take into account the state of health and the risk level of the elderly person before proposing a fall prevention program.

For the elderly who screen with a high risk of falling, a personalized multifactorial intervention is highly recommended.

For the elderly who screen with a moderate risk of falling, a non-personalized multifactorial intervention is recommended.

For the elderly who screen with a low (or no) risk of falling, an intervention involving a health or safety promotion program or a primary prevention program is promising.

Restricted interventions targeting isolated risk factors may be proposed to the elderly who present just those factors and who screen with a moderate or low risk.

Fall prevention programs must focus on risk factors that respond efficaciously to interventions, resulting in decreased falls.

Despite the extent of the problem of falls in the elderly and their sometimes disastrous consequences, there is room for optimism. Indeed, fall prevention programs have demonstrated their effectiveness: the elderly who benefit from these programs have significantly fewer falls than those who do not, the number of hospitalizations is reduced and they experience less loss of functional autonomy (Tinetti, Baker *et al.*, 1994; Campbell, Robertson *et al.*, 1997; Gillespie, Gillespie *et al.*, 2003).

The current state of knowledge allows for a relative consensus on the types of interventions that are effective, but is less helpful concerning the optimization of their content and initiation methods to obtain the best possible results. Also, although interventions targeting intrinsic factors have repeatedly demonstrated their effectiveness, those targeting behavioral or environmental factors are currently less well supported in the literature.

The recommendations in this Guide are

based on the most recent literature (Feder, Cryer *et al*., 2000; National Ageing Research Institute, 2000; American Geriatrics Society *et al*., 2001; SSMG, 2001; Campbell, 2002; Gillespie, Gillespie *et al*., 2003; Tinetti, 2003). In a public health perspective, the steering committee has also taken into account efficacy and feasibility criteria and has given priority to interventions that focus on the elderly presenting the highest risk of falling and that obtain the best results.

This position may occasionally create discrepancies with some conclusions presented in the literature. For example, Gillespie *et al* (2003) concluded that personalized multifactorial interventions were effective for fall reduction in both the elderly with known risk factors and the elderly with no known risk factors. The steering committee however recommends prioritizing this type of program only in the elderly with a high risk of falls. These interventions are difficult to establish and necessitate the coordination of several healthcare and sociomedical professionals; assessments have demonstrated that they can only be organized for a limited number of elderly each year. Proper identification of the most vulnerable elderly people will allow for the targeting of these interventions on those who need them the most.

EFFECTIVE PROGRAMS

The risk level and profile of the elderly person will determine the type of intervention to implement **[table XIV]**. It is therefore recommended to carry out a simple two step screening before orienting the elderly person toward any particular fall prevention program **[figure 8]**(American Geriatrics Society *et al*., 2001). This screening detects a history of falls and evaluates balance and gait. According to the results, the elderly person may be oriented toward a non-specific intervention for overall health, a fall-specific multifactorial intervention or an intervention restricted to specific risk factors **[figure 9]**.

HEALTH AND SAFETY PROMOTION, PRIMARY PREVENTION FOR FALL RISKS

People with no history of falling in the last year and a negative Timed up & go (TUG) present a low (or no) risk of falling. However, this does not mean that a fall will never happen in the future or that their situation will not evolve.

It is therefore recommended to **[figure 9]**:

- regularly reassess fall risks (once per year);
- survey and screen for certain important risk factors for which restricted intervention is recommended, such as:
  - medication,
  - dangers in the home,
  - chronic or acute diseases;
- engage these elderly and those close to them in health and safety promotion activities.

There are many intrinsic and extrinsic causes of falls. Thus, interventions designed for the elderly population with a low (or no) risk of falls should whenever possible target the elderly person's overall health **[figure 1]**.

Several strategies can be implemented to promote health and safety to the elderly population.

However, data on the impact of these different strategies is currently lacking, concerning both their influence on the overall health of the elderly and their influence on the reduction of accidents and falls.

Inform, counsel, orient

The elderly and those close to them should be provided with scientifically validated

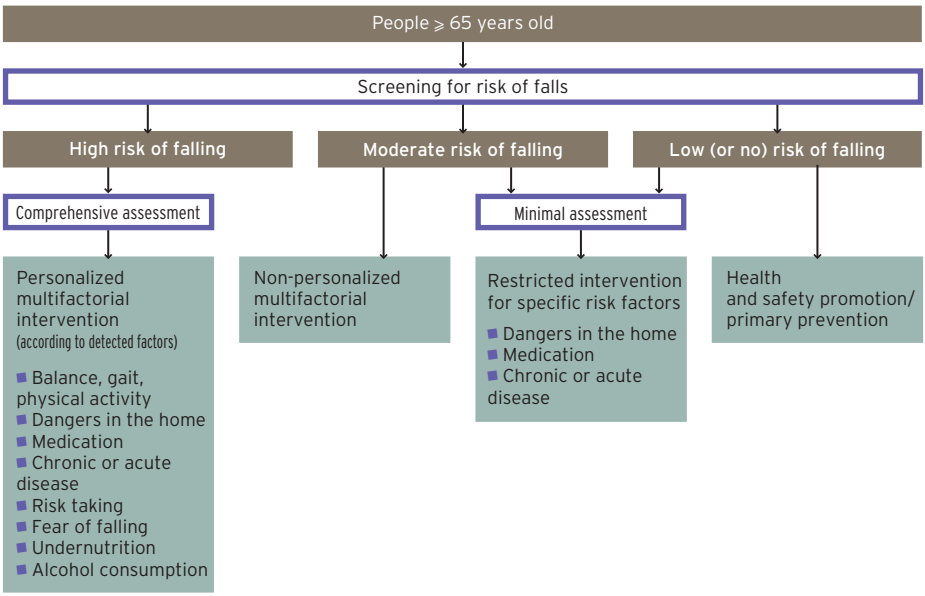
TABLE XIV

Levels of recommendation for different types of interventions

Type of intervention	Population: ⩾65 years of age		
	No risk of falling	Moderate risk of falling	High risk of falling
Personalized multifactorial	Not recommended	Recommended	Highly recommended
Non-personalized multifactorial	Not recommended	Recommended	Recommended
Restricted to isolated risk factors	Recommended	Recommended	Recommended
Health promotion / primary prevention	Promising	Promising	Not recommended

FIGURE 9

Interventions for the prevention of falls



information on fall risk factors and means of prevention, and be informed about health services that can provide counseling and orientation. Certain practices that have a positive effect on general health and fall prevention should be encouraged:

- physical exercise;
- a balanced diet with only small quantities of alcohol;
- correct use of medication;
- safety in the home.

Numerous communication tools on these themes that target the elderly population specifically have been created and can be used as supports or mediators during consultations. It is recommended however to use a variety of supports and wordings to better allow the elderly to appropriate the message.

To give a few examples, in France, INPES has produced two brochures entitled respectively, "Aménagez votre maison pour éviter les chutes"[14] and "Comment garder son équilibre après 60 ans"[15]. The former provides information on organizing the home to avoid falls and includes personal measures for maintaining balance and quality of life. The latter provides advice for maintaining proper diet and physical exercise. Furthermore, the Cres of Lorraine has produced, "Aînés, acteurs de leur santé"[16], an educational tool focused on promoting and improving global health and social activity in the elderly.

In French-speaking Switzerland, the OMSV (Office médico-social vaudois) of Lausanne has produced "Vieillir en harmonie, une question d'équilibre: prévenir les chutes"[17], which provides advice on balance and fall prevention in daily activities.

Educate and create actors in one's own health

Educational activities within the community can be used to favor the personal aptitudes of the elderly so that they can become actors in their own health and safety.

An educational approach must include the identification and integration of the perceptions, beliefs and aptitudes of the concerned population. Learning tools should be adapted to the profile of the population and be focused on information appropriation and the development of personal aptitudes.

These activities are implemented locally. They can be created and relayed by different entities, such as healthcare profes-

14. "Organizing your home to avoid falls".
15. "Keeping your balance after 60".
16. "Senior citizens, actors in their own health".
17. "Aging in harmony, a question of balance: preventing falls".

LEVEL OF RECOMMENDATION

- Highly recommended: a reduction in falls is continuously observed in high-quality studies that include the intervention.[a]
- Recommended: a reduction in falls is often observed in high-quality studies that include the intervention.
- Promising: there is expert consensus on the efficacy of the intervention for the reduction of falls.
- Not recommended: there is not sufficient evidence (no high-quality studies and/or no demonstration of association in existing studies and/or no expert consensus) that the intervention reduces falls efficaciously.

For detailed information on recommendation levels and numerical data, please see the specific references provided in the text as well as the following general references:

- American Geriatrics Society, British Geriatrics Society and American Academy of Orthopaedic Surgeons Panel of Falls Prevention. "Guideline for the prevention of falls in older persons". Journal of the American Geriatrics Society, 2001; 49 (5): 664-72.
- Feder G., Cryer C., Donovan S., Carter Y. "Guidelines for prevention of falls in people over 65: the Guidelines' Development Group." British Medical Journal, 2000; 321 (7267): 1007-11.
- Gillespie L.D., Gillespie W.J., Robertson M.C., Lamb S.E., Cumming R.G., Rowe B.H. "Interventions for preventing falls in elderly people". Cochrane Database of Systematic Review, 2003; 4; CD000340.
- Tinetti M.E. "Clinical practice: preventing falls in elderly persons". New England Journal of Medicine, 2003; 348 (1): 42-9.

a. Criteria for high quality studies are available in French in *Le Guide d'analyse de la littérature et gradation des recommandations*, produced by Anaes (now HAS) and available online (http://www.has-sante.fr/ "Toutes nos publications", "Methodologie").

sionals, health associations, social workers, support groups, etc. Health maintenance/education associations can provide support or contribute to the implementation of these activities.

Create favorable environments

The goal here is to create environments that favor health and safety be acting upon the material (in and out of the home) and socioeconomic settings of the elderly. Having knowledge of and acknowledging dangers in the home, both by the elderly and those close to them, can diminish not only falls but also other accidents (fires, electrocution, etc.).

Raising consciousness on the question of dangers in the home can also be extended to architects and constructors and may result in lodgings being better adapted to the needs of the elderly.

Vellas (1999) listed a series of possible interventions to limit the risk of falls outside of the home. These interventions necessitate the involvement of the local communities, who may use them as reference and orientation points when renovating the urban environment:

- take into account the mean walking speed of the elderly (estimated at 0.86 m/s. vs. 1.27 m/s for younger persons) when timing traffic lights;
- use non-slippery surfaces;
- eliminate bumps on sidewalks and roadways;
- indicate steps and other differences in surface heights;
- equip staircases with bilateral handrails;
- set escalators to a slow speed;
- construct walkways away from traffic;
- include seating in walking zones.

Bégin (2003) proposed a series of measures that may contribute to improving the socioeconomic situation of the elderly and help to prevent accidents and falls:

- improve the living conditions of the elderly (income, housing, access to social aid, etc.);
- improve the social environment of the elderly (social networks, etc.);
- offer high quality therapeutic and rehabilitation services.

Raising the consciousness of healthcare and sociomedical personnel on the specific problems of the elderly is also essential to the creation of environments that favor their health and safety. Enriching the initial and continuing education programs of these professionals is one possible way to increase their knowledge on the issue.

Example: ÉquilibreS (Gentilly)

Gentilly is a community of 17,000 inhabitants in the Parisian suburbs. Since 1996, the Gentilly health sector has organized and supported health promotion activities, in particular for the elderly population.

These activities started with the creation of "balance workshops" on an initiative of healthcare professionals. These workshops were held once weekly, lasted from one to two hours and comprised 10 participants at most. The workshops had the following characteristics:

- the participants lived close to one another whenever possible;
- the workshop comprised an appraisal at start and finish;
- admission required a medical certificate from the person's treating physician;
- the workshops were led by a specially trained physical therapist.

These workshops became very popular and developed quickly. The effort involved a multidisciplinary network including professionals from assorted medical fields.

Distance follow-up to check the evolution of acquired skills allowed for results evaluation, using the usual fall risk reduction tools. Participant satisfaction was also assessed. When needed, participants were

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re-enrolled in workshops or exercises outings in nature.

Conceived as a long-term program, these actions developed according to a community-oriented methodology that took into account the requests and needs expressed by the community. The program rapidly spread beyond fall prevention to encompass balance and autonomy improvements.

The issues addressed by the initiative were thus significantly enlarged, growing to include not only fall prevention, but also the physical and emotional consequences of falls, e.g., the fear of falling or leaving the house, or the progressive loss of autonomy.

It became evident that leaving the home, in particular for shopping, was an important issue to address and improve. To do so, meetings were held with bus drivers to discuss specificities for the transportation of the elderly, professional imperatives, adaptation of materials and driving methods, etc., and storekeepers to discuss labeling, specialized accommodations, packaging, etc.

These efforts resulted in the elaboration of a charter of quality for accommodating the elderly, the consideration of a pilot bus line and the organization of home aid training, among others. Knowledge sharing was organized and Tai chi workshops were created.

The future of the program will respond to expressed needs and may include such things as memory workshops or dietary workshops, the latter addressing subjects such as alcohol use, osteoporosis and eating well on a restricted budget. Professional chefs and nutritionists may be asked to give their feedback on recipe exchanges.

Furthermore, a newsletter and brochures on fall prevention have been created.

The recognition of individuals in their communities, the involvement of other generations, strategies of empowerment in community health and working within a network and within a "city health workshop" are all elements of this program.

MULTIFACTORIAL INTERVENTIONS

The elderly who have fallen in the last year and/or have balance and gait impairment present a moderate or high risk of falling **[figure 9]**.

However, these deficits observed in the elderly may not be irreversible (Campbell, Borrie *et al.*, 1989; Fiatarone and Evans, 1993; Buchner and Wagner, 1992; Wolfson, Whipple *et al.*, 1993; Judge, Lindsey *et al.*, 1993; Hageman, Leibowitz *et al.*, 1995; Whipple, Wolfson *et al.*, 1993; Aniansson, Hedberg, Henning *et al.*, 1986).

Programs focused on the main risk factors for falls in the elderly have demonstrated their efficacy in reducing both the risk factor and falls. These programs are being introduced in a growing number of countries.

To be effective, these programs must target several risk factors at once, in other words, be "multifactorial" (Feder, Cryer *et al.*, 2000; National Ageing Research Institute, 2004; Stevens, Holman *et al.*, 2001; Gillespie, Gillespie *et al.*, 2003). They must give priority to strategies that (American Geriatrics Society *et al.*, 2001; Feder, Cryer *et al.*, 2000; Campbell, 2002; Tinetti, 2003):

- improve balance, strength and gait through adapted exercise;

THE FIVE STEPS TO AN EDUCATIVE APPROACH TO HEALTH WITHIN A HEALTH PROMOTION PERSPECTIVE

1. Clarify the educational intent

The words of professionals involved in health education activities communicate values and also convey the professionals' own perceptions of health, disease and even the audience being addressed, in this case the elderly. Before beginning an educative action for health focused on this group, it is essential "*to reflect upon the values that one wishes to promote through the action, and to question oneself at the beginning on the outcomes to be pursued.*"[a] "*If one accepts the term 'health education', one can not be satisfied with providing information on a theme to people, or recommending healthy behavior.*" They should be assisted in constructing opinions, in discovering what influences their own behavior. With the use of appropriate activities, their capacities of analysis and expression will be developed. This empowers the participants to make educated choices concerning themselves or the collectivity. They will be "*more capable of facing difficult situations and life's dangers.*" "*It is an ethical questioning that we must explore for each educational situation and the response is never definitive.*"

2. Study the initial situation

This is *"a period of observing, listening, exchanging and reading"*, that will permit *"a precisely worded issue statement"* built upon a detailed analysis of needs and desires. *"From the beginning, one must get in the habit of noting everything that happens in a sort of logbook that will be filled out at each step of the action. It will serve as a journal and will allow for an analysis of the process at the end of the action."* Particular attention will be given to what the elderly – and those close to them – have to say concerning the notions of safety and balance: what they know, what they think, their beliefs and perceptions. Different techniques exist to gather this information (group discussions, Photolanguage®, etc.), but cannot be discussed here. This step will also allow for the definition of needed partnerships and available resources. Finally, this step implies as well a documentary research, not only on the elderly and the issue of falls, but also on the most effective intervention methods.

3. Implement actions

The educative action's objectives and the methods to attain them must be defined for this step. Implementation of actions is also included in this step. *"The main difficulty is finding the bridge between this step and the two preceding steps. The coherency of the objectives, methods and learning tools with the educational intent must be constantly verified, as does their applicability to the circumstances of the intervention."* The goal of listening to the elderly, of exploring their perceptions, was to be able to create actions based on what they expressed and that respond to their preoccupations.

4. Study the newly created situation

In health education, assessment is considered as a "*tool for assisting decisions*" for each step of the implementation of actions. It should be focused on describing, analyzing and judging simultaneously the course of the actions (quality of partnerships, adequacy of resources, analysis of needed course adjustments, etc.) and their results as a function of set objectives (evolution of beliefs and perceptions, evolution of relations with health professionals, improvements in living conditions, satisfaction with the actions, etc.)

5. Report on what was done

Publication and diffusion of information on what was done is rarely mentioned in the project approach. However, this is "*indispensable if one wishes to encourage progress in the ideas and practices of health education*".

a. All the quotes in this box are from Sandrin-Berthon (1997).

- address chronic or acute diseases;
- reduce the use of psychotropic drugs and the number of drugs in general;
- reduce environmental dangers;
- improve safe behavior (e.g., use of mobility assistive devices).

More largely, and with the goal of preventing fractures, programs may also include strategies intended to:

- provide supplementary vitamin D and calcium if needed;
- encourage a balanced diet;
- manage alcohol abuse and situations where alcohol consumption may create risks.

The elderly who do not undergo comprehensive assessment should be oriented toward a non-personalized multifactorial program. Those who do should be oriented toward a personalized multifactorial program **[figure 8]**.

Non-personalized multifactorial programs

A non-personalized multifactorial program comprises four or five themes chosen among the following strategies **[table XV]**:

- improving balance, strength and gait through adapted exercise;
- addressing chronic or acute diseases;
- reducing the use of psychotropic drugs and the number of drugs in general;
- modifying environmental dangers;
- improving safe behavior (e.g., use of mobility assistive devices);
- providing supplementary vitamin D and calcium if needed;
- encouraging a balanced diet;
- managing alcohol abuse and situations where alcohol consumption may create risks.

Non-personalized multifactorial programs are meant as a group activity for elderly individuals. All the people admitted in the program will not necessarily have all the risk factors that are addressed in the program's strategy.

For example, a non-personalized program may propose physical exercise (improving balance), assessment and modification of environmental dangers and dietary and medication counseling even though some of the participants are not suffering from undernutrition, taking medication, or exposed to environmental risks.

TABLE XV

Content of personalized or non-personalized multifactorial interventions

Risk factor	Level of recommendation for interventions on this factor	Evaluation tools (personalized intervention)	Action strategy
Intrinsic factors			
Balance and gait impairment	Highly recommended	p. 62	p. 84
Chronic or acute diseases	Recommended	p. 62	p. 85
Behavioral factors			
Medication	Highly recommended	p. 64	p. 86
Risks in daily activities	Recommended	p. 65	p. 88
Fear of falling	Recommended	p. 65	p. 88
Undernutrition	Promising	p. 66	p. 89
Alcohol consumption	Promising	p. 66	p. 89
Environmental factors			
Dangers in the home	Highly recommended	p. 67	p. 90

See box on "Level of recommendation", p. 72.

Examples

Ateliers Équilibre

The ateliers (workshops) Équilibre are an extension of the campaign, "L'équilibre, où en êtes-vous ?"[18], launched by the Cram (Caisse régionale d'assurance maladie) of Bourgogne-Franche-Comté (France) and its regional partners[19] for balance impairment prevention in the elderly. The campaign was then introduced in other administrative regions of France (Alsace, Bretagne, Champagne, Île-de-France, Martinique, Midi-Pyrénées, Pays-de-la-Loire, Provence-Alpes-Côte d'Azur, Rhône-Alpes and Lorraine) and in French-speaking Switzerland.

The program's objectives are to:

- reinforce postural stability and prevent loss of balance;
- diminish the psychological impact of the fall by teaching the elderly over the age of 55 how to get back up after a fall;
- favor a balanced diet and bolster mental and relational well-being;
- improve the social life of the elderly by offering group workshops;
- create effective local or regional partnerships to insure the durability of the program.

Thus the goal of the program is to preserve, improve and restore balance function and the autonomy of the elderly. The program's main axis is maintaining postural balance, but it also emphasizes the importance of balanced diet, mental and relational well-being and adapting the environment to the needs of the individual.

An atelier Équilibre comprises ten, weekly, 1-hour sessions with 10 to 14 participants aged 55 or older and provides adapted and personalized exercises.

Each workshop begins and ends with an individual assessment of physical capacities. Potential participants may seek the advice of their treating physicians before joining an atelier Équilibre.

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Session leaders are obligatorily trained by the FFEPGV (Fédération française d'éducation physique et de gymnastique volontaire).

An assessment of this program demonstrated long-lasting improvements in balance, improvements in body movement range, improved safety when moving about and improved social cohesion.

The cost of creating these workshops is estimated at €1,700, including materials and leader training and remuneration.

Programme PIED

The "PIED program" (Enriched Physical Exercise Program) was created in Quebec and is focused on preventing falls and fractures in the elderly (Trickey, Robitaille *et al.*, 1999a; Trickey, Robitaille *et al.*, 1999b).

It is intended for autonomous elderly people who are concerned about their balance or falling. It is not intended for people who already have balance or health problems that could be worsened by intensive exercise.

The program's objectives are to:

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18. "How's your balance?"

19. Centre hospitalier universitaire, Centre gérontologique de Champmaillot, Comité départemental d'éducation pour la santé, Direction régionale de l'Administration sanitaire et sociale, Direction régionale de la Jeunesse et des Sports, Mutualité française.

- improve the balance and muscle strength of the participants;
- teach them how to organize their home and adopt safe behavior;
- improve their feeling of self-esteem and confidence concerning falls;
- prevent osteoporosis;
- promote and maintain regular physical exercise.

The program comprises:

- group exercises (two one-hour sessions per week) focused on proprioception* and the vestibular system*, balance integration (obstacle courses, Tai chi*-inspired movements), strength (using elastic bands) and flexibility;
- home exercises (a half-hour session once per week);
- information sessions (half-hour sessions once per week) on different themes (the home, osteoporosis, footwear, medication, maintaining health).

The twelve-week program is given at community centers for the elderly. Each group counts approximately 10 to 15 participants.

Group leaders are professionals who have received special training in exercise for the elderly (e.g., physical educators, physical therapists, etc.).

A study has demonstrated relative improvements in balance for course participants when compared to non-participants (Trickey, Robitaille *et al.*, 1999b).

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Personalized multifactorial programs

Personalized multifactorial programs start with comprehensive assessment of fall risks of the elderly admitted to the program (see "Screening and assessing the risk of falling", p. 59). For each elderly person, the assessment should address some or all of the following risk factors **[table VIII]**:

- balance and gait impairment;
- chronic or acute diseases;
- medication;
- environmental dangers;
- risk taking in daily activities;
- undernutrition and vitamin and calcium deficiencies;
- abuse or misuse of alcohol.

Proposed interventions are then tailored as a function of each individual's personal risk profile. Interventions focusing on a maximum of four or five factors have demonstrated the best efficacy.

For example, an elderly person with certain diseases and a large number of medications would be proposed consultations with specialists and medication reduction whereas another who takes risk and has vitamin deficiencies would be proposed safe behavior sessions and calcium and vitamin D supplements.

One of the success factors for this type of program seems to be the specificity of strategies as a function of the concerned person's particular characteristics. Multidisciplinary assessment of the elderly, as a function of a range of risk factors, is thus essential before proposing intervention strategies (Steinberg, Cartwright *et al.*, 2000).

However, because of their complexity, personalized multifactorial programs should be reserved for the elderly with a high risk of falling, i.e. those who have a history of falling in the past year and present balance impairment (screening at risk in the two proposed tests) **[figure 1]**.

Examples of personalized multifactorial programs

A classic multifactorial program (Tinetti, Baker et al., 1994)

The multifactorial intervention created by Tinetti *et al.* in the United States was one of the first of its kind to demonstrate efficacy in terms of risk reduction, particularly for the elderly at high risk of falling.

The program comprised a multidisciplinary assessment (nurse and physical therapist) followed by targeted interventions according to the detected risk factors. Some of these interventions (medication, orthostatic hypotension*) necessitated the participation of the elderly person's treating physician. Home exercise programs with a weekly assessment of exercise by a physical therapist were proposed to the elderly with impairments in balance and gait.

The intervention phase lasted about three months after the initial assessment. At the end of the program and for the following six months, the participants were contacted monthly by the study staff to maintain and strengthen the effects of the intervention. A second assessment was proposed approximately four and a half months after the initial assessment.

The risk factors that were addressed during the intervention were:

- orthostatic hypotension*;
- use of psychotropic drugs;
- daily use of four or more medications;
- inability to enter a bathtub or to wash oneself;
- environmental risks;
- balance and gait impairment;
- lower limb strength and range of motion.

Comparison of the results obtained in the intervention group with those of a control group not receiving personalized counseling demonstrated efficacy for the following factors: medication, balance, gait, difficulty entering a bathtub or washing oneself.

Multifactorial programs in the CLSC (centres locaux de services communautaires) of Quebec

Programs based on existing recommendations and including multidisciplinary assessment followed by adapted counseling were created in several regions of Quebec (Bégin, 2003).

They are usually offered by the CLSC or day centers and integrate a network of various health professionals and sociomedical care providers for the elderly person.

In Estrie, the PAPA program (Programme de prévention de la perte d'autonomie chez les personnes aînées[20]), established in 1997 and financed by the Direction générale de la san-

20. "Program for preserving the autonomy of Senior Citizens".

KEY FEATURES OF MULTIFACTORIAL INTERVENTIONS

The key features of multifactorial interventions are:

- the support of a multidisciplinary team having received training on the question of falls;
- their focus on the elderly at risk of falling;
- the verification of the engagement of the participants;
- their focus on four or five known risk factors;
- their focus on proven or already tested risk reduction strategies;
- their duration in time (programs with demonstrated efficacy last on average from three to four months);
- the engagement for patient follow-up to assure comprehension of provided information and to reinforce motivation;
- results assessment in terms of fall reduction, risk factor reduction and satisfaction.

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té publique et de l'évaluation ("Department of Public Health and Assessment"), addresses the needs of the elderly living at home and presenting no severe diseases.

The program focuses on six risk factors associated with falls and loss of functional autonomy:

- medication;
- diet;
- physical activity (gait and balance);
- risk taking behavior;
- home environmental risks;
- orthostatic hypotension*.

Assessment of fall risks is proposed to the elderly who have recently been enrolled in a home support service. Each year, 1,000 people in the region benefit from the program. A qualified care provider (nurse, dietitian, occupational therapist, physical therapist, pharmacist), in collaboration with the treating physician, is assigned the management of the elderly person who presents at least one of these risk factors. The program is adapted to the needs of the individual and includes a follow-up period lasting several months after the completion of the intervention.

The assessment of program results is encouraging: for the people integrated in the program, the majority of home environmental problems are eliminated, a large proportion of medication-related problems are resolved and tangible improvements in gait and balance are observed in most cases (Boudreault, 2002).

Specialized multidisciplinary consultations for falls (France)

These consultations have been implemented in several French learning hospitals (CHU – Centres Hospitaliers Universitaires) (e.g., Lille, Nîmes, Saint-Étienne), using different modalities (Pollez, Puisieux *et al.*, 1999; Blanc, Blanchon *et al.*, 2000). The program in Lille (North of France), where between 75 and 100 elderly patients per year receive consultation, is exemplary at several levels (Puisieux, Pollez *et al.*, 2001).

The multidisciplinary consultation for fall prevention was integrated into the acute geriatric disease service of the CHU of the city of Lille. It is intended for the elderly who have fallen or who present balance and gait impairment and is focused on preventing new falls and the loss of autonomy while offering an alternative to hospitalization.

An elderly person needs only to feel that he or she is at risk of falling to receive consultation. The elderly may contact the consultation themselves or be addressed by their physician or by a hospital.

Once scheduled, the elderly person receives an initial assessment on several risk factors. The person is received for assessment by three specialists successively, a geriatrician-internist, a neurologist and a specialist in functional reeducation. The patient receives:

- clinical examination (examination of bone and joints, neuromuscular and cardiovascular function, and functional analysis);
- examination of visual and auditory acuity;
- review of medication;
- dietary evaluation;
- an investigation of the fear of falling.

The specialist in functional reeducation visits the person's home and performs a complete *in situ* functional assessment.

In its entirety, the initial assessment takes about three hours. The collected data is then sent to the treating physician with remedial proposals for the patient (physical therapy,

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confidence building, walking assistance, prescription modifications, etc.), those close to the patient and the patient's environment.

A follow-up visit with the geriatrician is scheduled in six month's time. This gives an opportunity to examine the changes that were made and to detect any new falls including possible injuries, and any hospitalizations or institutionalizations.

Assessment of the interventions was done after the first 150 patients. It demonstrated significant reductions for fall risks in the patients who received consultation: the mean number of falls for patients during the six months following the visit was 0.8, compared to a mean of 5.2 falls in the six months preceding consultation. Most of the patients express a high level of satisfaction concerning the intervention.

RESTRICTED INTERVENTIONS TARGETING CERTAIN ISOLATED FACTORS

It is only recently that restricted interventions targeting specific risk factors have demonstrated their efficacy in terms of fall reduction. Although multifactorial interventions remain the preferred strategy for fall reduction, recent studies have allowed for the identification of isolated interventions that reduce falls in the elderly efficaciously (American Geriatrics Society *et al.*, 2001; Gillespie, Gillespie *et al.*, 2003).

Interventions on the following risk factors are prioritized **[table XVI]**:

- balance and gait impairment;
- medication including psychotropic drugs;
- dangers in the home;
- chronic and acute diseases.

TABLE XVI

Content of restricted interventions

Risk factor	Level of recommendation for interventions on this factor	Evaluation tools	Action strategy
Intrinsic factors			
Balance and gait impairment	Highly recommended	p. 62	p. 84
Chronic or acute diseases	Recommended	p. 62	p. 85
Behavioral factors			
Medication	Highly recommended	p. 64	p. 86
Risks in daily activities	Not recommended	p. 65	p. 88
Fear of falling	Not recommended	p. 65	p. 88
Undernutrition	Not recommended	p. 66	p. 89
Alcohol consumption	Not recommended	p. 66	p. 89
Environmental factors			
Dangers in the home	Highly recommended	p. 67	p. 90

See box on "Level of recommendation", p. 72.

These interventions may be proposed to the elderly who have moderate or low (or no) risks of falling, but who do have balance impairments and/or multiple medications and/or dangers in the home and/or chronic and acute diseases that may result in an increased likelihood of falls **[figure 9]**. These interventions must be based on strategies with proven efficacy.

Reminder: the elderly with a positive TUG (i.e., who present balance and gait impairments) are already at moderate risk of falling. It is highly recommended to explore fall history before orienting them toward a particular intervention.

FRACTURE PREVENTION

The following approach is a summary of what good practice guides indicate for the prevention of fractures (Woolf and Akesson, 2003; American Geriatrics Society *et al.*, 2001; Brown, Josse *et al.* 2002).

Reduce the number of falls

- Implement fall prevention programs.

Reduce injuries associated with falls

- Reduce the rigidity of surfaces: favor the use of shock absorbing ground surface materials (floorings, roadways, sidewalks) and discourage the use of furnishings and fixtures that present a risk of injury.
- Favor effective protective responses when falling (physical exercise programs).
- Limit the time spent on the ground: teach the elderly how to get back up correctly and promote the use of smart sensors, wearable alarms and other security equipment (Bégin, 2003).

Maximize bone density

- Prevent osteoporosis*.
- Assure sufficient intake in calcium and vitamin D (with supplements when needed) for the elderly, particularly those in a fragile state and at high risk of falls.
- Prevent undernutrition and alcohol abuse.
- Encourage regular physical exercise and propose muscle strengthening exercises to the elderly at risk of fractures.

Hormonal therapy – currently very controversial – should be reserved only for postmenopausal women at high risk of osteoporosis (Woolf and Akesson, 2003; Euller and Breuil, 2002; National Institute of Health, 2000; Inserm, 1997).

Wearing hip protectors* to prevent fractures has demonstrated efficacy in institutions but has not demonstrated efficacy in the home. Also, they are somewhat unpopular among the elderly and thus should be reserved for those at high risk of fractures (Parker, Gillespie *et al.*, 2003).

KEY FEATURES OF INTERVENTIONS ON ISOLATED RISK FACTORS

- Perform a preliminary screening for fall risks, and, if needed, propose comprehensive assessment;
- Implement an adapted action strategy if a risk factor is detected;
- Assure follow-up of the participants;
- Assess the results in terms of the reduction of detected risk factors and participant satisfaction;
- Reassess fall risks once per year.

ACTION STRATEGIES

ADOPT AN EDUCATIVE APPROACH

Why?

The goals of patient education programs are to heighten awareness among the elderly of the potential consequences of falls and teach them how to recognize and correct their personal fall risk factors. The number of assessments for this type of intervention is currently low.

Patient education is considered a pertinent component of multifactorial programs (American Geriatrics Society *et al*., 2001; Tinetti, 2003). Studies have demonstrated its role in increasing risk factor knowledge and safe behavior (National Ageing Research Institute, 2000), in particular when it is focused on skills building in the elderly. Educative approaches may also play a major role in the acquisition and maintenance of preventive behavior (National Ageing Research Institute, 2000).

How?

The ethical and deontological choices that guide a patient education approach must integrate patients' rights to health protection and management, to information and the protection of their dignity, and to quality healthcare. Therapeutic patient education must be based not only on quality criteria, but also on values (respect, autonomy, fairness, accessibly).

In 1998, WHO proposed quality criteria for patient education (WHO, 1998):

- *"Therapeutic patient education is a systemic, patient-centred learning process.*
- *It takes into account the patient's adaptation processes (coping with the disease, locus of control, health beliefs, and sociocultural perceptions) and subjective and objective needs of patients, whether expressed or not.*
- *It is an integral part of treatment and care.*
- *It concerns the patient's daily life and psychosocial environment, and it engages as much as possible the patient's family and other close relatives and friends.*
- *It is a continuous process, which has to be adapted to the course of the disease and to the patient and the patient's way of life; it is part of the long-term care of the patient.*
- *It has to be structured, organized and systematically provided to each patient through a variety of media.*
- *It is multiprofessional, interprofessional and intersectoral, and includes networking.*
- *It includes an evaluation of the learning process and its effects.*
- *It is provided by health care providers trained in the education of patients."*

This educative approach is built upon the establishment of an educative, psychological, cultural and social diagnosis. Concerning falls, this diagnosis must allow the healthcare professional to:

- identify the patient's perceptions, beliefs, attitudes and knowledge concerning falls,

KEY POINTS

In general, it is important that the content, intensity and length of the interventions be sufficient and adapted to the problem of falls. A comprehensive educative approach allows the practitionner to understand all patient perceptions and behaviors that may play a role in falls (medication, nutrition, risk-taking, environmental dangers, fear of falling). Follow-up for elderly patients participating in a fall prevention program is essential. Encouraging maintenance of safe behavior, verifying the changes implemented by the patient and anticipating risky situations should all be integrated in this follow-up.

their consequences, the concerned organic systems and treatments;
- identify the type of "control" or "management" of fall risks that the patient has: This may be internal, meaning that the "causes" of falls are perceived as being linked more so to personal or modifiable factors, which allows for an active attitude, or external, meaning that the "causes" of falls are perceived as being linked to external or unmodifiable factors, resulting in a passive attitude. It should be noted that this depends heavily on certain variables, such as sex, sociocultural levels, social insertion, family circle, etc.;
- identify the patient's stage of acceptance concerning the risk of falling;
- identify and understand the patient's priorities.

The relationship should not be limited to the care provider and the patient, but also include family members whenever possible. The diagnosis should also allow patients to better know themselves and what they can expect from their educators.

PRESERVE OR REESTABLISH BALANCE AND GAIT WITH PHYSICAL EXERCISE

Why?

Gait and balance problems are considered to be among the reversible factors for which interventions have the greatest promise for preventing falls (Feder, Cryer *et al.*, 2000). Studies indicate that exercise programs focused on balance, gait and muscle strengthening may prevent falls (Gardner, Robertson *et al.*, 2000; Campbell, Robertson *et al.*, 1997; Province, Hadley *et al.*, 1995; Gillespie, Gillespie *et al.*, 2003) and even slow loss of bone mineral density in the elderly (Brown, Josse *et al.*, 2002).

International consensus exists on the health benefits (for cardiovascular diseases, cancer, diabetes, hypertension, depression, well-being, etc.) of regular physical exercise (approximately 30 minutes per day) (National Ageing Research Institute, 2000; Kino-Quebec, 2002; HCSP, 2000).

Several authors (Gillespie, Gillespie *et al.*, 2003; Gardner, Robertson *et al.*, 2000; American Geriatrics Society *et al.*, 2001) think that physical exercise programs are among the most promising strategies for preventing falls and related trauma because they may improve:
- balance, strength and reaction speed;
- bone density;
- the quality and quantity of soft tissue around bone;
- self confidence.

It is recommended to assess the physical capacities of the person screening with a risk of falling and personalize the exercises according to the findings (Brown, Josse *et al.*, 2002).

This type of program has demonstrated its efficacy in reducing falls in the elderly (Feder, Cryer *et al.*, 2000; Gillespie, Gillespie *et al.*, 2003; Skelton and Beyer, 2003).

How?

Many program options exist, for example specific exercises, group programs, or exercise at home or in the gym. However, for the reduction of falls, the form of the program seems to be less important than its content, intensity and duration.

The content

To be effective, exercises should develop motor function capacity and balance, which are essential in preventing falls. Effective exercise programs must thus comprise (Feder, Cryer *et al.*, 2000; King, Rejeski *et al.*, 1998; National Ageing Research Institute, 2000):
- exercises for limberness. Tai chi* in particular is recommended for its impact on balance, but other exercises focused on improv-

ing proprioception may also be proposed (e.g., picking up marbles with one's toes);
- muscle strengthening and balance training exercises. These include activities involving weights and resistance to improve strength and balance and reduce loss of bone density* (e.g., Leg lifts with ankle weights, wall push ups);
- rapid walking sessions to slow the loss of bone density*.

Intensity

To have a positive effect on falls, authors agree that programs should (Skelton and Dinan, 1999; Campbell, 2002):
- have sufficiently frequent sessions: two to three one-hour sessions per week;
- be adapted to the physical capacities of the participants: exercises should be more demanding than their habitual activities (e.g., use of supplementary weight or resistance) and become more difficult as the elderly participants' capacities improve. For this, personalized assessment and follow-up of each program participant must be assured, whatever the program form (group or individual, in a gym or at home).

Duration

Duration must be sufficient to insure program efficacy; ten or twelve weeks seems to result in significant reductions in falls.

Currently, the duration of the effects of exercise programs is unknown. Some indications suggest that attenuation of effects may be rapid once the subject stops exercising.

Program developers must thus create strategies for encouraging perseverance during the exercise program and maintenance of the benefits of exercise. For example:
- propose varied and appealing exercises;
- adapt the exercises to the needs and desires expressed by the participants;
- check on those who missed a session by telephone, and have a letter that can be sent in case of repeated absences.
- provide post-program follow-up by telephone.

To be avoided

General exercise programs or cardiovascular training are not recommended as their effectiveness for preventing falls has not been demonstrated.

Although the exercise programs are personalized, they must nonetheless be given by trained professionals to avoid accidents.

Furthermore, it is highly recommended that the elderly receive medical authorization before participating in an exercise program. This can be obtained during comprehensive assessment (see "Screening and comprehensive assessment for the risk of falling", p. 62) for those who screened with a high risk of falling. Otherwise, program developers should provide a detailed description of program contents and objectives to the participants' treating physicians to assure that all who can benefit from physical exercise do.

TREAT AND PREVENT CHRONIC AND ACUTE DISEASES

Why?

Treating diseases identified during consultation or during a fall risk assessment is effective for reducing falls (American Geriatrics Society *et al.*, 2001). Identification and appropriate treatment of diseases known to constitute fall risk factors should thus be a prerequisite to all multifactorial interventions for fall prevention.

How?

The elderly patient should be referred to his or her treating physician or a general practitioner familiar with the question of fall prevention for assessment and appropriate

treatment of diseases. Other healthcare professionals or care providers (physical therapist, occupational therapist, nurses, nutritionists, etc.) may be called upon according to the detected diseases.

Examples

*Urinary incontinence**

After identification of incontinence type, targeted treatment should be provided. For example, exercises to strengthen the pelvic floor (Kegel exercises) will help women to progressively regain awareness and voluntary control of these muscles. Other treatments exist (drugs, surgery), but in all cases the incontinence type must be determined before prescribing a particular treatment (see *Les aînés, acteurs de leur santé*[21], Cres of Lorraine, document in French).

There are a number of medications that are efficacious for the treatment of urge incontinence. These treatments diminish the frequency of day and nighttime urinating (Brown, Vittinghoff, 2000).

Once the underlying medical aspects of urinary incontinence have been dealt with, attention should be turned to optimizing the interaction of the elderly patient with the environment. This may include (CNEG, 2000):

- having or gaining knowledge on available facilities, particularly when out of the home;
- having accessible means of calling for assistance;
- dressing in convenient clothing;
- being able to call upon family and friends for assistance.

Conversely, the environment should also be adapted to the capacities of the elderly person.

*Orthostatic hypotension**

Several simple interventions are usually recommended (Rubenstein, Robbins *et al.*, 1990; Tinetti, Baker *et al.*, 1994) to reduce falls associated with orthostatic hypotension:

- reduce or even temporarily stop medication (with the prescriptor's participation) that may be responsible for orthostatic hypotension (diuretics, hypotensive drugs, etc.);
- increase dietary salt intake (if there are no contraindications);
- provide advice on how to change position (when getting out of bed, pause in the seated position before standing; verify balance in the standing position before walking);
- encourage moving the legs and feet about before standing up;
- in cases of major orthostatic hypotension, modification of medications with hypotensive effect may be considered (antihypertensives, vasodilators, antipsychotics, anxiolytics, antidepressants and antiparkinsonian drugs). If the problem persists the use of certain vasoconstrictors may be considered;
- encourage the use of compression stockings;
- raise the head of the bed.

To be avoided

Vasoconstrictors should not be added to a drug regimen without modifying hypotensive treatment.

REDUCE THE NUMBER OF MEDICATIONS AND PROMOTE THEIR CORRECT USE

Why?

Reducing the number of medications and controlling the use of psychotropic drugs are effective strategies for preventing falls (American Geriatrics Society *et al.*, 2001) and also help in avoiding undesirable effects caused by overuse of medication in the elderly.

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21. "Senior citizens, actors in their own health".

How?

Reducing the number of medications being used is probably one of the most difficult fall prevention strategies to implement (Tinetti, 2003); the drugs implicated in falls are used to treat real health problems and their modification is thus delicate.

However, reducing their number in elderly patients does seem possible. In some programs (Tinetti, Baker *et al.*, 1994), simply providing advice to physicians led to a reduction of multiple medication use and a decrease in falls.

Reducing the use of psychotropic drugs also seems possible, although the long-term effectiveness of these interventions has yet to be demonstrated (Brymer and Rusnell, 2000; Campbell, Roberston *et al.*, 1999). The several studies on the subject were not sufficient to verify the efficacy of specific interventions on the various classes of psychotropic drugs, which have very specific indications. Finally, additional interventions need to be developed, focused on assisting the elderly during medication weaning and providing them with long-term follow-up, thus diminishing the progressive return to psychotropic drugs.

Raising the awareness of healthcare professionals (physicians and pharmacists), the elderly, and those close to them on the good use of medications is essential in reducing the number of medication being used and improving use of psychotropic drugs.

For professionals

Several methods are possible to raise awareness in healthcare professionals of the problem of medication use in the elderly.

- Integrating good drug use guidelines into initial and/or continued education programs will allow general practitioners to (Le Bot, 1999):

– have a more precise diagnostic approach;
– prioritize therapies;
– define therapeutic objectives that are compatible with the quality of life and the risk of falling of the elderly patient;
– take into account age-related changes in pharmacokinetics* and pharmacodynamics*;
– inform and educate elderly patients and/or those close to them;
– propose alternatives to hypnotics and anxiolytics;
– instigate attentive and adapted follow-up.

- Use of learning tools:

For example, *Medication matters: How you can help seniors use medication safely*. This tool was created by the Aging and Seniors Division of Health Canada to aid healthcare professionals and care providers in informing the elderly on safe medication use (available from the Health Canada website: http://www.hc-sc.gc.ca/).

For the elderly and those close to them

- Suggest management and observance tools (for example, daily pill organizers or medication reminder clocks) to increase medication awareness in the elderly person and permit follow-up by a healthcare professional.

Examples:
– The program, "Seniors, soyez acteurs de votre santé"[22] of the MSA;
– Medication notebooks (Pharmaceutical Manufacturers Association of Canada);
– Detailed daily and hourly journals included in the patient's medical record (Switzerland).

- Use of guides to increase awareness among the elderly and/or those close to them of good use of medications.

Examples:
– "Caution: Medications!", Expression (Bulletin of the National Advisory Council on Aging), vol. 15, n° 1, 2001-2002. [http://dsp-psd.pwgsc.gc.ca/Collection/H71-4-1-15-1E.pdf]

22. "Seniors: be an actor in your health".

– "Seniors, Sleeping Pills and Tranquillizers", Health Canada. [http://www.phac-aspc.gc.ca/seniors-aines/pubs/sleeping_tranq/seniors_sleep/seniors_sleeping_1e.htm]
– The Canadian Association for Community Care offers a training program for care providers involved in home care of the elderly: Safe Medicines for Seniors. A Workshop for caregivers; Facilitator's Manual. [http://www.von.ca/safemedicinesproject/english/pdf/seniors/SafeMedicines-Guide-ENGlish%20(FINAL%20Apr%2023-07).pdf]

PREVENT RISK TAKING IN DAILY ACTIVITIES

Why?

Studies have demonstrated the benefits of multifactorial programs that include counseling on assistive devices (bed alarms, canes, walkers, hip protectors) (Tinetti, 2003). Several programs integrate counseling on types of footwear, exercising caution, etc., although assessment has not been done for them.

How?

■ Suggest walking aids: walking aids are a regularly used intervention for the elderly at risk of falling. It is important to distinguish people for whom this type of aid is appropriate from those who will need or who will benefit from actions focused on the root factors of the balance and gait impairment. Thus, it seems important to accompany the intervention with information on the reasoning behind the prescription of walking aids and on their use (National Ageing Research Institute, 2000).
■ Suggest medical alarms: Medical alarms give the elderly rapid access to assistance. They are recommended for the elderly at risk of falling, particularly those with limited social contacts, as they provide reassurance, and should a fall occur they reduce the time spent on the ground without help. Studies have demonstrated better subjective perceptions of health as well as reduced scores for anxiety and depression in elderly people benefiting from the use of a medical alarm and in their care providers (National Ageing Research Institute, 2000).
■ Advise appropriate eyewear: It is preferable to use two different pairs of glasses instead of a single pair of bifocal glasses, as the latter may increase the risk of falling. A yearly consultation and checkup with an ophthalmologist is recommended for the elderly at risk of falling.
■ Advise well-fitted footwear that is adapted to the activity, climatic conditions and any possible medical conditions. Closed shoes with no or only small heels are recommended, even in the home, to avoid increasing the risk of falling. A podiatry consultation or a pedicure may be advised to the elderly with painful feet or having difficulty taking care of their feet.
■ Suggest the use of hip protectors* to the elderly presenting both a high risk of falling and a risk of fractures. This intervention has not demonstrated its efficacy for preventing falls, but does attenuate the risk of hip fractures and the fear of falling (Parker, Gillespie and Gillespie, 2003; American Geriatrics Society *et al.*, 2001).

PREVENT AND REDUCE THE FEAR OF FALLING

Why?

Although few studies have been done to assess their efficacy in actually reducing falls, interventions focused on reducing the fear of falling are effective for their intended endpoint and increase mobility.

How?

To reduce the psychological impact of the event and get support, it is very important

for the elderly to speak about their falls to those close to them or to a healthcare professional.

Interventions focused on the fear of falling that have demonstrated benefits for mobility and activity maintenance (Tennstedt, Howland *et al.*, 1998; Brouwer, Walker *et al.*, 2003) comprise:

- a general education approach including instructions for getting up off the ground;
- and/or physical exercise.

Learning techniques for falling and getting back up may prevent trauma in recurrent falls and also reduce the psychological impact of the accident.

Example: INPES brochure, "Aménagez votre maison pour éviter les chutes"[23] (provides advice on getting up after a fall).

TREAT UNDERNUTRITION AND DEFICIENCIES IN VITAMIN D AND CALCIUM

Why?

Documentation is currently poor for interventions on nutrition in the elderly, with the goal of reducing falls. Nevertheless, undernutrition and deficiencies in micronutrients favor the apparition of sarcopenia* and increase the risk of fracture. As part of a multifactorial program, correcting undernutrition may thus contribute to reducing the seriousness of falls. The medico-economic benefits of supplements to insure protein and energy intake in the elderly living at home, with the goal of preventing fractures, has been demonstrated (Arnaud-Battandier, Beaufrère *et al.*, 2001; Payette, Boutier *et al.*, 2002).

How?

Following acute disease, a program of nutritional management during the entire recovery period (three times the acute episode) should be assured to reconstitute muscle reserves (Lesourd, 1995) and prevent accumulative weight loss.

The daily diet for the elderly should include 1,500 mg of calcium and 800 IU of vitamin D. If dietary intake of these elements is insufficient, calcium and vitamin D supplements are recommended to prevent fractures (Ullom-Minnich, 1999; Woolf and Akesson, 2003; Euller and Breuil, 2002).

For more information on this subject please refer to good practice guides for the prevention and treatment of osteoporosis and fractures (Woolf and Akesson, 2003; Cranney, Waldegger *et al.*, 2002; Inserm, 1997).

Simple advice may also be provided to the elderly to prevent undernutrition and dehydratation. The numerous guides on this subject may be used as supports during educative sessions or during consultations. Care providers can contact various nutrition information organizations, for example, the Cerin (Centre de recherche et d'informations nutritionnelles) in France (89, rue d'Amsterdam, 75008 Paris).

Documentation is often free and available on demand (for example, from INPES in France or from the OMSV in Lausanne Switzerland).

PREVENT AND TREAT ALCOHOL ABUSE AND DANGEROUS USE OF ALCOHOL

Why?

Currently, there are no assessed interventions focused on alcohol problems to reduce falls or fractures. However, alcohol abuse, in addition to its negative impact on morbidity and mortality in the elderly, is significantly associated with fractures. As part of a multifactorial program, an intervention addressing problematic use of alcohol may thus contribute to the reduction of injury in falls.

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23. "Organizing your home to avoid falls".

How?

It is important to remind the elderly of the recommended alcohol thresholds for maintaining good health and preventing health complications. A maximum of 3 servings per day for men and 2 for women are recommanded. For those over the age of 65, it is recommended to limit alcohol consumption to 7 servings per week, i.e. 1 serving per day for habitual consumption and two servings per day for exceptional occasions (National Institute on Alcohol Abuse and Alcoholism, 1998; O'Connell, Chin *et al.*, 2003). The elderly should also be reminded about situations where alcohol consumption is contraindicated (certain medications, driving, undernutrition).

An adequate diet plays a role in limiting the toxicity of alcohol. Taking these two elements (diet and alcohol) into account in an action strategy may be useful.

Finally, different therapeutic and educational approaches may be offered to the elderly who present at-risk alcohol consumption (Health Canada, 2002; O'Connell, Chin *et al.*, 2003). If accepted by the patient, brief interventions may be carried out by different professionals. Studies have demonstrated positive results for these types of interventions in the elderly (Copeland, Blow *et al.*, 2003; Health Canada, 2002; Fleming, Manwell *et al.*, 1999). Brief interventions are patient-centered "motivational interviews" (Rollnick, Mason, Butler, 1999; Sobell and Sobell, 2004) with the objectives of:

- integrating alcohol into the themes that occur naturally during the consultation, without value judgments concerning the behavior or choices of the patient;
- proposing to evaluate the patient's alcohol consumption (helping him or her to take stock of the situation) and to place it in relation to risk thresholds;
- arousing the patient's desire to change and providing him or her with accompaniment.

The recommendations concerning the attitudes to be adopted by healthcare professionals during a motivational interview are summarized in the acronym "FRAMES" and presented in the box below.

In France, INPES has made available to general practitioners a French-language health education intervention tool called, "Alcool : ouvrons le dialogue"[24] for those wishing to implement a patient education approach. The complete kit is free of charge and can be ordered from INPES under the reference number: 65-03153-PT.

French-language brochures for the general public on this subject are also available from INPES.

REDUCE DANGERS IN THE HOME

Why?

Interventions targeting the assessment and modification of dangers in the homes of the elderly have demonstrated efficacy for reducing risks (Feder, Cryer *et al.*, 2000; American Geriatrics Society *et al.*, 2001; Gillespie, Gillespie *et al.*, 2003). In-home actions also allow for the participation of the elderly and those close to them in fall risk prevention. With this intervention, care providers may observe the elderly in their daily home activities, which provides valuable information on their real capacities and allows for detecting other risk factors (balance impairment, risk-taking, fear of falling, etc.).

How?

- Coordinated with medical healthcare, professional assessment of the home, when accompanied by modification of the detected environmental risks and follow-up of these modifications, is an effective strategy

24. "Alcohol: Let's talk".

for the reduction of falls in the elderly who present fall risk factors (Gillespie, Gillespie *et al.*, 2003).

- Disability assessment in the home, combined with an educative approach to risk factors and referral to health professionals as resources for information, seems to hold promise as a strategy for reducing the risk of falling. Thus, this is recommended despite a currently unestablished level of evidence.
- The assessment of factors that the home dweller feels are bothersome for carrying out activities of daily living (e.g., bad lighting, difficult to use furnishings, hard to access storage spaces) is a promising strategy, as these factors are significantly associated with a risk of falling in the home (Nevitt, Cummings *et al.*, 1989).

Support and assistance, when requested by the elderly person, should be provided for assessment organization and any ensuing modifications of the home environment.

A study found that the elderly actually implemented less than half of recommended home security measures (Devor, Wang *et al.*, 1994). To improve this, it is recommended to:

- act on the cognitive determinants of behavioral change, such as knowledge, beliefs, the perception of benefits of actions and the feeling of personal vulnerability, through an educative approach (Becker, Haefner *et al.*, 1977), see "Adopt an educative approach", p. 83;
- plan for a follow-up of recommendations;
- ease access to resources and technical aids.

Several assessment tools for fall risks in the home have been developed for use by the elderly themselves, for example:

- *The Safe Living Guide–A guide to home safety for seniors*: This illustrated brochure addresses safety in several topics. The first section, "Keeping your home safe", comprises a series of checklists for addressing home dangers and tips for organizing the home and activities to increase safety. The brochure also contains information on aging and injuries and gives advice on physical activity and medication, among others (http://www.phac-aspc.gc.ca/seniors-aines/pubs/safelive/index.htm [July 2008]).
- *Bruno and Alice: A love story in twelve parts about seniors and safety*: This illustrated brochure presents twelve measures for preventing accidents, including falls. The measures concern mainly home organization and risk-taking (http://www.phac-aspc.gc.ca/seniors-aines/pubs/bruno_and_alice/foreword_e.htm or http://www.phac-aspc.gc.ca/seniors-aines/pubs/bruno_and_alice/pdf/Bruno_Alice_e.pdf [July 2008]).
- *You can prevent falls: By having a safe home and lifestyle!* (http://www.phac-aspc.

RECOMMENDED ATTITUDES TO BE ADOPTED FOR BRIEF INTERVENTIONS: "FRAMES"

- *Feedback:* the therapist provides patients with feedback concerning their alcohol consumption in terms of relative frequency and quantity.
- *Responsibility:* patients, not therapists, are exclusively responsible for changing their own behavior.
- *Advice*: the therapist explicitly advises stopping or reducing drinking to patients.
- *Menu:* a menu, or choice, of different options concerning for example the quantity, the timing or the pacing of alcohol consumption is given to patients.
- *Empathy:* the therapist shows empathy and valorizes the efforts and successes of patients while avoiding condescension and value judgments.
- *Self-efficacy:* the therapist attempts to strengthen the patients' own personal resources to favor change.

Sources: Bien, Miller, Tnogan, 1993.

gc.ca/seniors-aines/pubs/Falls_Prevention/fallsprevtn2_e.htm [July 2008]).

- *Prévenir les chutes à domicile : quelques conseils utiles25 (Bégin* et al., *1994)*: This French-language tool provides advice on preventing falls in the home. Available from the CLSC of Joliette; Direction de la santé publique/Régie régionale de la santé et des services sociaux of Lanaudière. CLSC of Joliette, 1994, 7 pages.
- *La prévention des accidents domestiques : faire attention chez soi, c'est faire attention à soi*[26]: This French-language, web-based resource gives general injury prevention advice, including for falls (other subjects are burns, intoxications, etc.). In the second half, "Votre sécurité à la maison (...)"[27], the main home dangers are presented and advice is given to reduce them. http://www.prevention.ch/faireattentionchezsoi.html [July 2008].

To be avoided

- It is not recommended to assess the homes of the at-risk elderly without providing follow-through actions (documented recommendations or direct intervention) intended to correct the identified problems. Studies have repeatedly found that assessment of home risks alone does not reduce the risk of falling, probably because few people implement the recommendations.

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25. "Preventing falls in the home: A few useful tips".
26. "Prevention of home accidents: paying attention at home is paying attention to yourself".
27. "Your safety at home".

FOR USE IN PRACTICE

Gait and balance

"TIMED UP & GO"

- **Tested functions:** rising and walking.
- **Description**: clinical instrument for measuring basic functional mobility (rising from a chair, walking, turning and returning to a seated position in the chair) in the elderly (60 to 90 years).
- **Material:** a stopwatch, a standard height (44-47 cm) chair with armrests.
- **Test duration**: 5 minutes.
- **Instructions**

Initial position: subjects are correctly seated in the chair, with the back solidly against the backrest. They should be wearing their habitual shoes and may use any normally used assistive walking device (e.g., a cane), but must not receive any other assistance. Arms should be on the armrests and normal assistive devices should be within reach.

1. On the assessor's signal ("Go") the elderly subject rises, walks at a comfortable and safe pace to a line indicated on the ground (3 meters away), turns around and returns to a seated position in the chair.

2. The test should be rehearsed once to familiarize the person with it and make sure that the instructions have been understood correctly. Let the person rest as needed before proceeding to the actual test. There is thus a "rehearsal" followed by the "official" test, for the final score.

- **Results:** The assessor starts timing when "Go" is pronounced and stops when the person has returned to the seated position.

The time in seconds is retained as the final score. The test is positive (mobility impairment, risk of falling) if the score is greater than 12 to 14 seconds.

- **Source:** Bischoff, Stahelin *et al.*, 2003; Podsiadlo and Richardson, 1991.

"GET UP & GO"

"Get up & go" is the original, untimed version of "Timed up & go". A certain level of experience is needed to correctly interpret results (Mathias, Nayak and Isaacs, 1986).

Any difficulties or abnormalities are observed during the exercise (rising from the chair, static balance, gait, turning around, returning to a seated position).

Elderly subjects are at a high risk of falling if they are incapable of rising from a chair with armrests without pushing with their arms.

UNIPEDAL STANCE TEST (BALANCE)

This test is a valid and reliable measure of balance for the elderly with no known deficiencies (Bohannon, Larkin *et al.*, 1984; Briggs, Gossman *et al.*, 1989; Vellas, Wayne *et al.*, 1997; Franchignoni, Tesio *et al.*, 1998). It is fast and easy to administer. The assessment of the quality and the duration of the unipedal stance (on one leg) is usually included in most gait and balance tests.

PREPARATION

- Position subjects at an arm's distance from a wall.
- Ask them to place their hands on their hips and to keep them there throughout the test.
- Explain to subjects that they are to balance themselves on own foot (of their choice) while holding the other at mid-calf height for as long as possible without using a support (demonstrate the action). The foot that is lifted should not touch the calf of the other leg.
- Verify that the lifted foot is truly off the floor (the knee is bent).

MEASUREMENT

- Start timing when the foot is raised off the ground.
- Stop timing if subjects put the lifted foot back on the ground, change the position of their arms or when they pass 5 seconds.
- Perform the exercise two or three times.

Subjects who cannot maintain balance on one foot for 5 seconds are at a higher risk of falling.

TINETTI BALANCE TEST

Source: Tinetti (1986), adapted by the Gerontology and Geriatrics Research Center, Youville hospital, Sherbrooke, Quebec.

GENERAL INSTRUCTIONS

Explain to the elderly subjects that they will be asked to perform several movements that are similar to those frequently used in daily life. Tell them that at any time, they can refuse to do any particular movement. Reassure them that you will be close by and that you will not ask them to do dangerous movements.

The assessment comprises two components: a balance component, followed by a gait component. The examiner records the results of each evaluated function in a table. The scores obtained in each component are added together to establish the total score.

The elderly who have a total score inferior to 20 present balance and gait impairments.

BALANCE

1. Sitting balance.

2. Arises: subjects are asked to cross their arms on the chest and rise from their chair. If they are incapable, they may use their arms to push on the chair or use a technical aid (e.g., a cane). The maximum score (2) is given only to patients who can stand with their arms in the crossed position, i.e. without pushing on the chair or using a technical aid.

3. Attempts to arise: each effort is counted as an attempt (for example, advancing to the edge of the chair is counted as an attempt). Subjects receive a score of 2 only if they rise in one attempt.

4. Immediate standing balance: subjects rise and remain standing as described above. They receive a score of 2 only if they are steady in the immediate standing position without using a support (technical or other).

5. Standing balance: allow subjects to reestablish their balance if need be, then ask them to put their feet as close together as possible. Repeat the request if needed. Subjects receive a score of 2 only if they can stay standing in a narrow stance without support.

6. Nudged: subjects are standing with their feet close together. The examiner pushes lightly with the palm of the hand on the subject's sternum for about 2 seconds. The pressure is constant, not abrupt and the examiner repeats the exercise three times. Subjects receive a score of 2 only if they remain stable despite the nudging.

7. Neck mobility: subjects are asked to turn their head to each side and upwards as far as possible. The examiner should demonstrate the movement. A reduction of range of motion is noted for subjects who cannot turn their head more than halfway to one side or the other (or if they are largely incapable of looking upwards). To receive a score of 2, subjects must have sufficient neck mobility for complete lateral (left and right) and vertical neck movement, without experiencing symptoms (vertigo, dizziness, feeling of a loss of balance, etc.).

8. Eyes closed: subjects are standing with the feet close together. Subjects receive a score of 1 only if they are stable (no swaying, pronounced trunk movement, or movement of the feet, without assistance or support).

9. Turning 360 degrees: The examiner should demonstrate the movement. Subjects receive a score of 0 if steps are discontinuous, i.e., subjects place the leading foot flat (heel and toes touching the ground) before pickup up the following foot. They receive a score of 2 if they remain stable during this movement.

10. Standing on one leg: Subjects receive the maximum score if they can remain balanced on one leg for 5 seconds, then on the other.

11. Back extension: Subjects are asked to extend the back as far as possible. The examiner is prepared to provide assistance if needed but must not provide physical support. The examiner should demonstrate the movement. Only the degree of back extension is taken into account; knee bending is not included. This is a subjective evaluation and necessitates comparisons with other evaluated subjects.

12. Reaching with the arms: Subjects need to raise their arms sufficiently high to cause them to stand on their toes. For example, ask subjects to retrieve an object on a high kitchen shelf. Placing one hand on the countertop does not lower the score, as long as the subject manages to grasp the object with the other hand. Stability is judged by the ability to raise the arms to grasp an object without swaying or seeming unstable.

13. Bending forward: Subjects must bend over and pick up an object from the ground. They receive the maximum score if they succeed without becoming unstable.

14. Sitting down: To obtain a score of 2, subjects must be able to sit down in a safe,

smooth movement, without using their arms or a support.

GAIT

A large space free of obstacles is chosen. Explain to subjects that you wish to observe their normal walking behavior; they can use their habitual assistive devices. If the space is not sufficiently large, ask the subject to cross the space several times. However, take into consideration only the middle part of the course (exclude the first and last steps).

For all the exercises, the examiner accompanies the elderly person.

1. Initiation of gait: this is evaluated immediately after the subject is told to go. Subjects who hesitate or need several attempts to start walking receive a score of 0.

2. & 3. Step length and height: start observing after three or four steps. Observe each foot for 5 steps. Results are based on the worst performance: if in one out of the 5 steps, a foot does not pass the other, the subject receives 0 for step length. If in one out of the 5 steps, a foot does not completely clear the floor, the subject receives 0 for step height. Try to observe only one side at a time.

4. Step symmetry: A score of 0 is given if gait length appears asymmetrical in at least 3 of the 5 cycles.

5. Step continuity: begin observing continuity after having determined symmetry. Observe continuity for 5 cycles. Subjects receive a score of 0 if they put the entire foot on the ground (heel and toes) before lifting the other. To obtain a score of 1, the subjects must start lifting the following foot as the leading foot touches the ground.

6. Path: Path is best observed in relation to a straight line on the ground over about ten steps. If there is no line to refer to, the examiner must evaluate path deviation subjectively. Path deviation is assessed by observing one foot. Subjects who can follow a straight path without using a walking aid receive a score of 2.

7. Trunk: The examiner walks behind the subject and observes the amount of lateral trunk sway, the amount of flexion of the knees and back and the use of arm movement to maintain balance. To receive a score of 2, there should be no back sway, no knee or back flexion and the arms should stay close to the body.

8. Walking stance: the examiner stands behind the subject and observes the subject's feet through 5 cycles. Subjects receive a score of 1 if their heels almost touch while walking.

9. Turning.

10. Increasing walking speed: The examiner asks subjects to walk as fast as they can while still feeling safe. Subjects receive the maximum score if they are genuinely capable of doing this exercise.

Balance assessment

Instructions: Subjects are seated in a hard chair without armrests. The following movements are examined:

1. Sitting balance:
- leans or slides in chair 0
- steady, safe 1

2. Arises:
- unable without help 0
- able, uses arms to help (pushes on chair, technical aid) 1
- able without using arms 2

3. Attempts to arise:
- unable without help 0
- able, requires more than 1 attempt 1
- able to arise in one attempt 2

4. Immediate standing balance:
- unsteady (staggers, sways) 0
- steady but uses a cane or grabs other objects for support 1
- steady without cane, or other support 2

5. Standing balance:
- unsteady 0
- steady but wide stance or uses cane or other support 1
- narrow stance without support 2

6. Nudged:
- begins to fall 0
- staggers, grabs, catches self 1
- steady 2

7. Neck mobility (describe symptoms if score=0):
- symptoms or staggers during lateral or vertical neck movement 0
- reduction of range of motion, no symptoms or staggering 1
- satisfactory moderate range of motion, steady 2

8. Eyes closed (same position as in question 6):
- unsteady 0
- steady 1

9. Turning 360 degrees:

a.
- discontinuous steps 0
- continuous steps 1

b.
- unsteady (swaggers, grabs) 0
- steady 1

10. Standing on one leg (5 seconds):

a. right leg
- unable without support 0
- able 1

b. left leg
- unable without support 0
- able 1

11. Back extension:
- refuses to attempt or no extension or uses an aid 0
- attempts but little extension 1
- good extension 2

12. Reaching with the arms:
- unable or unsteady, needs to hold on to something 0
- able and steady 1

13. Bending forward:
- unable or unsteady 0
- able and steady 1

14. Sitting down:
- unsafe (misjudges distance, falls into chair) 0
- uses arms or not a smooth motion 1
- safe, smooth motion 2

Balance score = / 24

Gait assessment

Instructions: Subject stands with examiner. The subject walks down a hallway or across the room, first at usual pace, then back at a rapid, but safe pace (± a cane or usual walking aid).

1. Initiation of gait:
- hesitancy or multiple attempts to start 0
- no hesitancy 1

2. Step length and height: right swing foot
a.
- does not pass left stance foot 0
- passes left stance foot 1

b.
- right foot does not clear floor completely 0
- right foot completely clears floor 1

3. Step length and height: left swing foot
a.
- does not pass right stance foot 0
- passes right stance foot 1

b.
- left foot does not clear floor completely 0
- left foot completely clears floor 1

4. Step symmetry:
- right and left step length not equal (estimate) 0
- right and left step length appear equal 1

5. Step continuity:
- stopping or discontinuity between steps 0
- steps appear continuous 1

6. Path:
- marked deviation 0
- moderate deviation or uses walking aid 1
- straight without walking aid 2

7. Trunk:
- marked sway or uses walking aid 0
- no sway but flexion of knees or back, or spreads arms out while walking 1
- no sway, no flexion, no use of arms, and no use of walking aid 2

8. Walking stance:
- heels apart 0
- heels almost touching while walking 1

9. Turning:
- staggering, unsteady 0
- discontinuity but does not stagger or does not use a cane or other aid 1
- steady, continuity without walking aid 2

10. Increasing walking speed:
- unable 0
- able 1
- very able 2

Gait score = /16

Balance + gait score = /40

Signature:

Date:

The elderly who have a total score inferior to 20 present balance and gait impairments.

Behavior

ACTIVITIES OF DAILY LIVING

The Katz Index of Activities of Daily Living is a fast and easy to use table that reliably measures the autonomy of the elderly living at home. It does not take into account mobility issues (Katz, Dowtn *et al.*, 1970).

Each activity performed autonomously receives a score of 1; a score of 6 indicates complete autonomy. The elderly with a score inferior to 3 are considered dependant.

In addition to their interest for autonomy, measuring these activities in the subject's home may provide valuable information for adapting the home environment to the abilities of the elderly person.

Katz Index of Activities of Daily Living

Activity	Definition of activity independence	Independent	
		Yes	No
Bathing	Bathes self completely or needs help in bathing only a single part of the body	1	0
Dressing	Gets clothes from closets and drawers and puts on clothes and outer garments complete with fasteners (may have help tying shoes)	1	0
Toileting	Goes to toilet, gets on and off, arranges clothes, cleans genital area without help (may use an object for support such as a cane or a walker, may use bedpan or commode during the night)	1	0
Transferring	Moves in and out of bed or chair unassisted (mechanical transfer aids are acceptable)	1	0
Continence	Exercises complete self control over urination and defecation (occasional accidents may be ignored)	1	0
Feeding	Gets food from plate into mouth without help (preparation of food may be done by another person)	1	0
	Score		

INSTRUMENTAL ACTIVITIES OF DAILY LIVING

The Instrumental Activities of Daily Living (IADL) scale as a short tool for evaluating the behavior of the elderly concerning the use of common instruments in daily life. Any care provider can give the test after being trained (Lawton and Brody, 1969).

A score of 8 indicates complete autonomy for instrumental activities of daily living

Instrumental activities of daily living scale (Lawton)

Activity	Score
1. Ability to use telephone	
Operates telephone on own initiative; looks up and dials numbers	1
Dials a few well-known numbers	1
Answers telephone, but does not dial	1
Does not use telephone at all	0
2. Shopping	
Takes care of all shopping needs independently	1
Shops independently for small purchases	0
Needs to be accompanied on any shopping trip	0
Completely unable to shop	0
3. Food preparation	
Plans, prepares, and serves adequate meals independently	1
Prepares adequate meals if supplied with ingredients	0
Heats and serves prepared meals or prepares meals but does not maintain adequate diet	0
Needs to have meals prepared and served	0
4. Housekeeping	
Maintains house alone with occasional assistance (heavy work)	1
Performs light daily tasks such as dishwashing, bed making	1
Performs light daily tasks, but cannot maintain acceptable level of cleanliness	1
Needs help with all home maintenance tasks	1
Does not participate in any housekeeping tasks	0
5. Laundry	
Does personal laundry completely	1
Launders small items, rinses socks, stockings, etc.	1
All laundry must be done by others	0
6. Mode of Transportation	
Travels independently on public transportation or drives own car	1
Arranges own travel via taxi, but does not otherwise use public transportation	1
Travels on public transportation when assisted or accompanied by another	1
Travel limited to taxi or automobile with assistance of another	0
Does not travel at all	0
7. Responsibility for own medications	
Is responsible for taking medication in correct dosages at correct time	1
Takes responsibility if medication is prepared in advance in separate dosages	0
Is not capable of dispensing own medication	0
8. Ability to handle finances	
Manages financial matters independently (budgets, writes checks, pays rent and bills, goes to bank); collects and keeps track of income	1
Manages day-to-day purchases, but needs help with banking, major purchases, etc.	1
Incapable of handling money	0
Score	

and a score of 0 indicates total dependence. Versions adapted to the sex of the subject exist (CNEG, 2000). Items 2, 4, and 6 in the table reveal a loss of mobility and thus a risk of falling. Items 1, 2, 6 and 7 test possible dementia-related executive function impairments.

THE FUNCTIONAL AUTONOMY MEASUREMENT SYSTEM (SMAF)

This instrument, originally conceived in French, is designed to be used with the elderly living at home (Hébert, Carrier *et al.*, 1988a; Hébert, Carrier *et al.* 1988b). It assesses 29 functions in 5 categories: activities of daily living, mobility, communication, mental functions, and instrumental activities of daily living. The resources available to the elderly person to overcome disabilities are assessed for each item, thus establishing a handicap score.

Functions Assessed disabilities
Activities of daily living
1. Eating
2. Washing
3. Dressing
4. Grooming
5. Urinary incontinence
6. Fecal incontinence
7. Using the bathroom
Mobility
1. Transfers (bed to chair and vice-versa)
2. Walking inside
3. Putting on prosthesis or orthosis
4. Moving around in a wheelchair
5. Using the stairs
6. Walking outside
Communication
1. Seeing
2. Hearing
3. Speaking
Mental functions
1. Memory
2. Orientation
3. Understanding
4. Judgment
5. Behavior
Instrumental activities of daily living
1. Cleaning the house
2. Preparing meals
3. Shopping
4. Doing the laundry
5. Using the telephone
6. Using public transportation
7. Taking medications
8. Managing the budget

Each item is assessed for:

- **degree of disability**
  - 0 = autonomous
  - –0.5 = autonomous with difficulty
  - –1 = needs supervision or stimulation
  - –2 = needs help
  - –3 = dependent
- **resources**

  What human resources are available to the subject (aid or surveillance) to overcome the disability?
  - subject him/herself
  - family
  - neighbor
  - employee
  - aide
  - nurse
  - volunteer
  - other
- **the stability in time**

ASSESSMENT TABLES

Gerontology and Geriatric Research Centre
Functional autonomy measurement system
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THE AGGIR AUTONOMY ASSESSMENT SCALE

Aggir (Autonomie gérontologique groupes iso-ressources) is a French-language tool. It is officially recognized by French law for assessing loss of autonomy in order to determine if an individual qualifies for dependence benefits (an APA, "allocation personnalisée d'autonomie"). Only those with a Gir (groupe iso-ressources) 1, 2 or 3 may receive APA benefits.

THE AGGIR INDICATOR

The Aggir indicator is a multidimensional tool for measuring autonomy. It comprises 10 variables (Bontout, Colin *et al.*, 2002):

- coherence: speaking and/or behaving in a logical and sensible manner;
- orientation: situating oneself in time, space and the period of the day;
- bathing: assure one's own personal hygiene;
- dressing: choose one's clothes, get dressed and undressed;
- eating: serving oneself and eating prepared food;
- toileting: assure one's own urinary and fecal elimination hygiene;
- transfers: getting up, sitting or lying down;
- getting about inside the dwelling or institution (possibly with a cane, walker or wheelchair);
- getting about outside: starting at the door, on foot or in a wheelchair;
- distance communication: using means of communication (telephone, alarm, bells).

For each variable, three descriptions are possible: A: performs task totally, regularly and correctly alone; B: performs task partially, or irregularly or incorrectly; C: does not perform task.

Responses are calculated and a Gir is attributed. There are 6 Girs that group people with the same needs in terms of hours of care, although the may have different disabilities.

- Gir 1: bed- or wheelchair-bound people who have lost mental, physical, locomotor and social autonomy, thus necessitating the continuous presence of a care provider;
- Gir 2: either bed- or wheelchair-bound people whose mental functions remain partially intact but who need assistance for most activities of daily living (ADL), or people who have altered mental function but have conserved motor function capacity;
- Gir 3: people with conserved mental autonomy and partial locomotor autonomy, but who need assistance for physical autonomy (bathing, dressing, elimination hygiene) several times per day;
- Gir 4: either people who are mobile in the home, but need assistance for transfer, bathing and dressing, or people with intact locomotor autonomy but who need assistance for physical activities and meals;
- Gir 5: people who get about, eat and dress alone, but who may need occasional assistance for bathing, meal preparation or housecleaning;
- Gir 6: people who have not lost autonomy for ADL.

ACTIVITIES-SPECIFIC BALANCE CONFIDENCE (ABC) SCALE

Proposed by Powell and Myers (1995), the ABC scale is a table designed to assess confidence levels in 16 daily activities (walking, going up or down staircases, bending over, stretching, etc.) and provide a confidence score.

For more information on the ABC scale:

- **Powell L.E., Myers A.M.**
The Activities-specific Balance Confidence (ABC) Scale
Journals of gerontology, Series A, Biological Sciences and Medical Sciences 1995; 50A [1]: M28-34.

Nutrition

MINI NUTRITIONAL ASSESSMENT (MNA)

The MNA identifies patients who are at risk of malnutrition or who are already malnourished using body measurement, dietary and functional data. It provides very good sensitivity (96%) and specificity (98%). Here, only the simplified screening version is presented.

Body measurement, dietary and functional data	Score
Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties[a]?	
Severe loss of appetite	0
Moderate loss of appetite	1
No loss of appetite	2
Weight loss during the last 3 months	
Weight loss greater than 3 kg (6.6 lbs)	0
Does not know	1
Weight loss between 1 and 3 kg (2.2 and 6.6 lbs)	2
No weight loss	3
Mobility	
Bed or chair bound	0
Able to get out of bed/chair but does not go out	1
Goes out	2
Has suffered psychological stress[b] or acute disease in the past 3 months	
Yes	0
No	2
Neuropsychological problems[c]	
Severe dementia or depression	0
Mild dementia	1
No psychological problems	2
Body Mass Index (BMI)*	
BMI less than 19	0
BMI 19 to less than 21	1
BMI 21 to less than 23	2
BMI 23 or greater	3
Screening score (subtotal max. 14 points)	

Score obtained	Nutritional risk
12 points or greater	Normal – not at risk – no need to complete assessment
11 points or below	Possible malnutrition – continue assessment (physician)

a. To assess loss of appetite, the examiner may ask the following questions: "Have you eaten less than usual during the last 3 months?" "If so, was it because of a loss of appetite?" "Difficulties chewing or swallowing?" "If so, did you eat a lot less than normal or just a little bit less than normal?"
b. Examples of psychological stress: bereavement, moving to a new area (oneself or someone close), etc.
c. This information may be obtained from someone close to the patient or a professional or family care provider.

THE 12 MALNUTRITION WARNING SIGNS

The following 12 items are warning signs for malnutrition. As a questionnaire, they provide good sensitivity* (78%) and specificity* (77%) (Ferry, Alix *et al.*, 2002).

1. Insufficient financial resources
2. Loss of physical or psychological autonomy
3. Death of spouse, solitude, depression
4. Oral/dental problems
5. Restrictive diet
6. Swallowing disorders
7. Only two meals per day
8. Constipation
9. More than three medications per day
10. Weight loss of ≥ 2 kg over the previous month or ≥ 4 kg over the last six months
11. Serum albumin < 35 g/l or cholesterol < 1.60 g/l
12. Any severe acute disease

PAYETTE QUESTIONNAIRE (TO ASSESS THE NEED FOR DIETARY HELP IN THE ELDERLY)

This questionnaire was developed to identify the elderly needing assistance for assuring and improving correct diet and nutrition. It is designed to be used by home assistance personnel. It comprises 10 questions to assess the need for dietary help. The elderly subjects respond to nine of the questions themselves, one question requires a subjective assessment by the interviewer ("The person is very thin"). Sensitivity is 78% and specificity is 77% (Payette, Guigoz *et al.*, 1999).

Name:

Weight:

Adult height:

The person is very thin	yes	2
	no	0
Have you lost weight in the past year?	yes	1
	no	0
Do you suffer from arthritis to the point where it interferes with your daily activities?	yes	1
	no	0
With your glasses, is your vision ...?	good	0
	medium	1
	poor	2
Do you have a good appetite?	often	0
	sometimes	1
	never	2
Have you recently suffered a stressful life event (e.g., personal illness/death of loved one)?	yes	1
	no	0
What do you usually eat for breakfast?		
Fruit or fruit juice	yes	0
	no	1
Eggs or cheese or peanut butter	yes	0
	no	1
Bread or cereals	yes	0
	no	1
Milk (1 cup or more than ¼ cup in coffee)	yes	0
	no	1
	Total	

Total score	Nutritional risk	Recommendations
6-13	high	Help with meal and snack preparation AND Referral to a dietician
3-5	moderate	Regular monitoring of diet (checking on food intake, providing advice and encouragement)
0-2	low	Regular monitoring for appearance of risk factors (i.e., change in situation or weight loss)

DAILY CALCIUM INTAKE ESTIMATION TABLE

This table was designed to assess daily calcium intake in the elderly. It is based on dietary habits in France. To date, sensitivity and specificity have not been evaluated (Jeandel and Kramkimel, 2002).

"Yesterday, did you eat or drink..."

Milk	
No	0
1 glass (125 ml)	1
1 bowl (250 ml)	3
2 bowls (500 ml)	5
Yogurt	
No	0
½ a yogurt	1
1 yogurt	2
2 yogurts	4
Fromage blanc	
No	0
100 g (3 soup spoons)	1
200 g (6 soup spoons)	2
400 g (12 soup spoons)	4
Camembert	
No	0
30 g	1
60 g	1.5
Petit suisse	
No	0
1	0.5
2	1
4	2
Swiss cheese	
No	0
20 g (grated)	2
40 g	4
60 g	6
Cheese spread	
No	0
1 portion	1.5
2 portions	3

Total score	Calcium content
Insufficient intake	
From 1 to 5 points	From 100 to 500 mg
Sufficient intake	
12 points (or more)	1200 mg (or more)

ALCOHOL USE DISORDERS IDENTIFICATION TEST (AUDIT)

AUDIT is a suitable tool for detecting risky or excessive drinking behavior (Isaacson, 1994). WHO recommends its use as a first step in brief interventions (Saunders, Aasland *et al.*, 1993; Michaud, Gache *et al.*, 2003). It is also recommended for use with the elderly (Health Canada, 2002).

It defines three groups:

- non-drinkers and low-risk drinkers;
- excessive drinkers;
- dependant drinkers.

All types of alcohol are taken into consideration in AUDIT, but what is considered a standard drink and alcohol equivalencies must be established prior to use for the particularities of the concerned country. For example, in France, the standard drink is a glass of wine. The questionnaire can be administered to patients during consultations or be filled-out by the patients themselves.

A score is established for each response and their total is used to classify the patient. This classification will vary according to cultural norms and sex. WHO recommends the fol-

lowing as guidelines (Babor, Higgins-Biddle *et al.*, 2001):

- scores between 8 and 15: simple advice focused on the reduction of hazardous drinking;
- scores between 16 and 19: suggest brief counseling and continued monitoring;
- scores of 20 or above: warrant further diagnostic evaluation for alcohol dependence.

1. How often do you have a drink containing alcohol?	
Never (Skip to Qs 9-10)	0
Monthly or less	1
2 to 4 times a month	2
2 to 3 times a week	3
4 or more times a week	4
2. How many drinks containing alcohol do you have on a typical day when you are drinking?	
1 or 2	0
3 or 4	1
5 or 6	2
7, 8, or 9	3
10 or more	4
3. How often do you have six or more drinks on one occasion?	
Never	0
Less than monthly	1
Monthly	2
Weekly	3
Daily or almost daily	4
Skip to Questions 9 and 10 if Total Score for Questions 2 and 3 = 0	
4. How often during the last year have you found that you were not able to stop drinking once you had started?	
Never	0
Less than monthly	1
Monthly	2
Weekly	3
Daily or almost daily	4
5. How often during the last year have you failed to do what was normally expected from you because of drinking?	
Never	0
Less than monthly	1
Monthly	2
Weekly	3
Daily or almost daily	4
6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	
Never	0
Less than monthly	1
Monthly	2
Weekly	3
Daily or almost daily	4
7. How often during the last year have you had a feeling of guilt or remorse after drinking?	
Never	0
Less than monthly	1
Monthly	2
Weekly	3
Daily or almost daily	4

8. How often during the last year have you been unable to remember what happened the night before because you had been drinking?	
Never	0
Less than monthly	1
Monthly	2
Weekly	3
Daily or almost daily	4
9. Have you or someone else been injured as a result of your drinking?	
No	0
Yes, but not in the last year	2
Yes, during the last year	4
10. Has a relative or friend or a doctor or another health worker been concerned about your drinking or suggested you cut down?	
No	0
Yes, but not in the last year	2
Yes, during the last year	4

"CAGE" QUESTIONNAIRE

"Cage" is a simple and rapid questionnaire that can be used by any healthcare provider to screen for excessive alcohol consumption with the goal of early prevention and treatment of alcohol-related problems (Seppa, Lepisto *et al.*, 1998). Its use has been validated in elderly populations (Buchsbaum, Buchanan *et al.*, 1992; Adams, Barry *et al.*, 1996; Canadian Mental Health Association, 2002; Health Canada, 2002) and it may also be auto-administered for a personal analysis of alcohol use.

In younger populations, two positive responses indicate excessive alcohol consumption. In the elderly, a single positive response is sufficient to indicate a problem with alcohol.

During the last 12 months...	Yes	No
1. Have you ever felt you should cut down on your drinking?		
2. Have people annoyed you by criticizing your drinking?		
3. Have you ever felt bad or guilty about your drinking?		
4. Have you ever had a drink first thing in the morning (as an "eye opener") to steady your nerves or get rid of a hangover?		
Score		

Environment

ANALYTICAL APPROACH TO THE HOME ENVIRONMENT

An analytical assessment of the home and the safe practices and capacities of the elderly individual is an effective method for reducing fall risks associated with an unsafe home environment.

The following home assessment table was designed to ease this approach.

The table comprises four columns:

Elements

All elements necessary for a safe home environment are listed and categorized by room/area. (example: exterior stairs; nonslip surface).

Yes, No, Not applicable (NA)

The presence, absence or non-applicability of the environmental element is noted in this column.

Retained solutions (specify)

The decided upon solution is indicated in this column. For example, if the exterior stairs do not have a nonslip surface, the retained solution would most probably be to add a nonslip surface to the stair steps (e.g., adhesive nonslip strips, nonslip paint, etc.).

Modification follow-up

This column is used to note if the modifications have been done, are underway, or have not been done.

The goal of this environmental risk inventory/screening is to increase overall safety for activities of daily living (ADL) and domestic activities of daily living (DADL). The table thus provides a room by room environmental assessment, in conjunction with safe practices instructions for the elderly person; problems are addressed as a function of ADL and DADL. The participation of the elderly person is essential to arouse his or her interest in managing existing risks. Additionally, the evaluator should

provide information on safe practices to the homeowner throughout the assessment to increase knowledge on how falls happen and how to prevent them and encourage safe behavior, including the use of aids when needed.

Source: PAPA program, Direction de la santé publique et de l'évaluation, Établissements et organismes de maintien à domicile, Estrie, Quebec.

Elements	Yes	No	NA
Exterior stairs	1: principal. 2: secondary.		
Surface is nonslip	☐1 ☐2	☐1 ☐2	☐1 ☐2
Handrails (bilateral, solid, continuing beyond first and last steps) and railing are present	☐1 ☐2	☐1 ☐2	☐1 ☐2
Steps are uniform (angle, wear, etc.)	☐1 ☐2	☐1 ☐2	☐1 ☐2
Adequate lighting is present	☐1 ☐2	☐1 ☐2	☐1 ☐2
Indicators for first and last steps are present	☐1 ☐2	☐1 ☐2	☐1 ☐2
Steps are free of objects	☐1 ☐2	☐1 ☐2	☐1 ☐2
Steps are closed face, and riser is painted in contrasting color	☐1 ☐2	☐1 ☐2	☐1 ☐2
Mail box is not in stairway and at a suitable height	☐1 ☐2	☐1 ☐2	☐1 ☐2
Table or shelf is available close to the door for depositing objects	☐1 ☐2	☐1 ☐2	☐1 ☐2
Winter maintenance of stairs: person responsible:	☐1 ☐2	☐1 ☐2	☐1 ☐2
Provide information on safe practices concerning exterior stairs.			
Interior stairs	1: principal. 2: secondary.		
Surface is nonslip	☐1 ☐2	☐1 ☐2	☐1 ☐2
Handrails (bilateral, solid, continuing beyond first and last steps) are present	☐1 ☐2	☐1 ☐2	☐1 ☐2
Steps are uniform (angle, wear, etc.)	☐1 ☐2	☐1 ☐2	☐1 ☐2
Indicators for first and last steps are present	☐1 ☐2	☐1 ☐2	☐1 ☐2
Steps are free of objects	☐1 ☐2	☐1 ☐2	☐1 ☐2
Steps are closed face, and riser is painted in contrasting color	☐1 ☐2	☐1 ☐2	☐1 ☐2
Door opens toward interior of room	☐1 ☐2	☐1 ☐2	☐1 ☐2
Provide information on safe practices concerning interior stairs.			
Bathroom	1: principal. 2: secondary.		
Nonslip, solid grab-bars for entering/exiting bathtub are available	☐1 ☐2	☐1 ☐2	☐1 ☐2
Bathtub is standard size (depth: 15 inches)	☐1 ☐2	☐1 ☐2	☐1 ☐2
Nonslip surface for exiting bathtub is present	☐1 ☐2	☐1 ☐2	☐1 ☐2
Handshower is accessible	☐1 ☐2	☐1 ☐2	☐1 ☐2
Toilet and hygienic tissue are accessible	☐1 ☐2	☐1 ☐2	☐1 ☐2
Bathtub stopper is easy to use	☐1 ☐2	☐1 ☐2	☐1 ☐2
Sink is accessible	☐1 ☐2	☐1 ☐2	☐1 ☐2
Nonslip mat is in bathtub	☐1 ☐2	☐1 ☐2	☐1 ☐2
Storage space and towel rack are accessible	☐1 ☐2	☐1 ☐2	☐1 ☐2
Provide information on safe practices concerning the bathroom.			

Retained solutions	Modification follow-up		
	done	underway	not done
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
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	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐

Elements	Yes	No	NA
Kitchen	1: principal. 2: secondary.		
Frequently used items are accessible	☐1 ☐2	☐1 ☐2	☐1 ☐2
Counter workspace is available	☐1 ☐2	☐1 ☐2	☐1 ☐2
Stable, nonslip stool or stepladder is accessible (if used)	☐1 ☐2	☐1 ☐2	☐1 ☐2
Distances are short between refrigerator, range, sink and table	☐1 ☐2	☐1 ☐2	☐1 ☐2
Cupboards are accessible	☐1 ☐2	☐1 ☐2	☐1 ☐2
Electrical outlets are accessible	☐1 ☐2	☐1 ☐2	☐1 ☐2
Provide information on safe practices concerning the kitchen.			
Living room	1: principal. 2: secondary.		
Electrical and telephone cords are safely arranged	☐1 ☐2	☐1 ☐2	☐1 ☐2
Armchairs are suitable (firm, with arm rests, seat at approx. 45 cm)	☐1 ☐2	☐1 ☐2	☐1 ☐2
No coffee table in middle of living room	☐1 ☐2	☐1 ☐2	☐1 ☐2
Provide information on safe practices concerning the living room.			
Bedroom	1: principal. 2: secondary.		
Bed is at suitable height (approx. 45 cm)	☐1 ☐2	☐1 ☐2	☐1 ☐2
Mattress is firm	☐1 ☐2	☐1 ☐2	☐1 ☐2
Telephone, lamp, illuminated clock and flashlight are on nightstand close to bed	☐1 ☐2	☐1 ☐2	☐1 ☐2
Storage spaces are accessible	☐1 ☐2	☐1 ☐2	☐1 ☐2
Chair for dressing is present	☐1 ☐2	☐1 ☐2	☐1 ☐2
Provide information on safe practices concerning the bedroom.			
All rooms/Areas	1: principal. 2: secondary.		
All door thresholds (main entrance, rooms) are level or not abrupt	☐1 ☐2	☐1 ☐2	☐1 ☐2
Flooring is free of slip hazards (carpets correctly fixed, no wet or waxed surfaces)	☐1 ☐2	☐1 ☐2	☐1 ☐2
Flooring is free from glare, carpets are unicolor	☐1 ☐2	☐1 ☐2	☐1 ☐2
Floor is level (no tears, curling, loose pieces of flooring)	☐1 ☐2	☐1 ☐2	☐1 ☐2
Pathways are clear (no electric cords, furniture is non-encumbering and out of the way)	☐1 ☐2	☐1 ☐2	☐1 ☐2
Adequate lighting is available in all rooms, corridors and at the top and bottom of interior stairs	☐1 ☐2	☐1 ☐2	☐1 ☐2
Functional light switches are accessible at the entry of all rooms	☐1 ☐2	☐1 ☐2	☐1 ☐2
Nightlights are used in pathways (bedroom, hall, bathroom, stairs)	☐1 ☐2	☐1 ☐2	☐1 ☐2
Telephone is accessible	☐1 ☐2	☐1 ☐2	☐1 ☐2
Provide information on safe practices concerning all rooms and areas of the home.			
Other observed risks (basement, laundry room, nonslip footwear, clothing too long or ample, presence of small animals in the home, etc.)			
Referral to occupational therapist is needed	☐1 ☐2	☐1 ☐2	☐1 ☐2
Eligible for PAPA program subsidy (Quebec-specific)	☐1 ☐2	☐1 ☐2	☐1 ☐2
In your opinion, what types of modifications are needed in your home to make your daily activities safer and easier?			
Risks Total:			

Retained solutions	Modification follow-up		
	done	underway	not done
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
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	☐	☐	☐
	☐ ☐	☐ ☐	☐ ☐
	☐	☐	☐
	☐	☐	☐
	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
Modifications Total:			

ASSESSMENT TABLE FOR THE HOME ENVIRONMENT

This standardized table and the definitions of terms were adapted from Gill, Williams *et al.* by Bégin *et al.* for a pilot program for fall prevention in the elderly in the Lanaudière region of Quebec (Rodriguez, Baughman, Sattin *et al.*, 1995; Bégin, 2002) ("CLSC" (centres locaux de services communautaires) and "NIP" (numéro d'identification personnel, personal identification number) are Quebec-specific terms).

Home environment	Last and first name: CLSC No.: 1☐ 2☐ 3☐ 4☐ 5☐ 6☐ File No: Date of Birth: Assessment No.: 1☐ 2☐ 3☐ 4☐ 5☐ 6☐	NIP:
Type of residence[a]: Individual house ☐ Town house ☐ Apartment ☐ Private residence ☐ Other:		

Evaluation of environmental risks – rooms and areas of the home[b]	Indicate answer with a check[c]				
	Yes	No	Refusal	DNK	NA
1. Kitchen					
Dim lighting, shadows, or glare					
Light switches not clearly marked, cannot be seen in the dark					
Pathways not clear; small objects, liquids, cord, or tripping hazards present					
Frequently used items stored where there is a need to bend over or reach up					
Step stool not sturdy					
Table not sturdy or moves easily					
Chair not sturdy, moves easily, or needs repair					
Comments:					
2. Entrance, corridors or passages					
Dim lighting, shadows, or glare					
Loose throw rugs in pathways (hallways, etc.), runners, mats, slip or trip hazard					
Carpet edges curling or tripping hazard					
Area slippery, if noncarpeted					
Pathways not clear; small objects, liquids, cord, or tripping hazards present					
Comments:					
3. Living room					
Dim lighting, shadows, or glare					
Loose throw rugs in pathways (hallways, etc.), runners, mats, slip or trip hazard					
Carpet edges curling or tripping hazard					
Area slippery, if noncarpeted					
Pathways not clear; small objects, liquids, cord, or tripping hazards present					
Chair not sturdy, moves easily, or needs repair					
Use of low chair that is difficult to get out of					
Comments:					
4. Bedroom					
Dim lighting, shadows, or glare					
Loose throw rugs in pathways (hallways, etc.), runners, mats, slip or trip hazard					
Carpet edges curling or tripping hazard					
Area slippery, if noncarpeted					
Pathways not clear; small objects, liquids, cord, or tripping hazards present					
Bed height inappropriate					
Information was: observed (write 1 under "Yes"); reported (write 2 under "No")					
Comments:					

Evaluation of environmental risks – rooms and areas of the home[b]	Indicate answer with a check[c]				
	Yes	No	Refusal	DNK	NA
5. Bathroom					
Dim lighting, shadows, or glare					
Loose throw rugs in pathways (hallways, etc.), runners, mats, slip or trip hazard					
Area slippery, if noncarpeted					
Bathtub/shower surface slippery; nonskid mat or abrasive strips not present					
Grab-bars not present in tub/shower					
Toilet seat too low or wobbly					
Information was: observed (write 1 under "Yes"); reported (write 2 under "No")					
Comments:					
6. Stairs (interior or exterior)					
Dim lighting, shadows, or glare					
Switches not at top and bottom					
Night light not present or not near stairway					
Handrail not present, not sturdy, or does not extend full length of stairway					
Some steps narrower, higher, or lower than others					
Steps in need of repair; loose treads or carpeting					
Comments:					

Results	Interpretations	Recommendations (to participant)
Response "No" to all home elements	Low risk	No reference
Response "Yes" to at least one home element Write the number of problem elements Total: / 37	Moderate to high risk	Proceed to recommended corrective measures. If needed, refer participant to occupational therapist
Evaluator's signature:	**Date:**	

a. Individual house: individual and undivided house, may be duplexed, or in rows sharing walls, or mobile; **Town house**: building with distinct entries for each living unit (unique mailing address for each living unit, with or without apartment number); **Apartment**: building with a main entrance and several living units (units have a unique apartment number but share a single mailing address); **Private residence**: residence offering a range of services to occupants (dining room, living room or other services); **Other**: Room, etc., specify.
b. When there is more than one bedroom, bathroom or other area (stairs, etc.) in the home, only those used most frequently by the participant are assessed. Also, if a room or area is not present in the home (no bedroom, stairs, etc.), the corresponding dangers are noted under "NA" (not applicable) and are not calculated in the results.
c. Refusal: participant refuses the verification; **DNK**: does not know; **NA**: not applicable.

DEFINITIONS / INSTRUCTIONS FOR SEVERAL HAZARDS AND OTHER TERMS

Environmental hazard

Any condition that when present may cause:
1. exaggerated positioning of the body or a loss of balance;
2. the possibility of slipping or stumbling;
3. bearing weight on a material incapable of supporting it, leading to falls and injury.

Rooms

Bathroom

A room comprising at least one of the following elements: bathtub, shower, washbasin or toilet. If the house has more than one bathroom, evaluate the one that is most frequently used by the participant.

Bedroom

A separate room or space furnished with a bed and mainly intended for sleep. Evaluate the participant's bedroom only.

Corridors and passages (hallways)

A walkway that connects one room to another. Circle "Yes" if a hazard is present in any corridor or passage.

Kitchen

A separate room or area furnished with equipment and appliances for cooking.

Living room or lounge

A separate room or area used for social activities such as watching television. This area is not used as a bedroom.

Specific elements

Bathroom

Bath mat

A rubber mat with suction cups on one side. The mat is placed on the bathtub or shower stall floor before bathing to prevent slipping.

Grab-bars

Rails used as an aid in getting in or out of the bathtub or shower or to change position in the tub or shower. Towel racks and wall-mounted soap dishes are not considered grab-bars. Grab-bars located on the back wall (wall furthest from the entry side) of the tub are not considered adequate grab-bars. Grab-bars may also be near the toilet to assist in moving on and off the toilet.

Nonslip surfacing

A material of rubbery or gritty consistency used on the floor of a bathtub or shower. The material prevents a person's skin from sliding along the wet surface.

Raised toilet seat

A toilet seat that is at least 5 cm higher than standard toilet seats. This elevation can be built into the toilet or accomplished by adding a device that effectively raises the rim of the toilet.

Kitchen

Frequently used items

Frequently used items include canned goods and other food, eating and cooking utensils, etc. These items are considered to be stored too high if hyperextending the neck, climbing onto something or standing on the toes is required to reach them. They are considered stored too low when they are below waist-level.

Living room

Armchair

Evaluate the participant's most frequently-used armchair. An armchair is considered too low if the buttocks of the seated person are lower than his/her knees.

Bedroom

Inappropriate bed height
Position changes (sitting-standing / standing-sitting) should be easy; the bed must be neither too high nor too low for the participant. When seated on the bed, the participant's feet should be flat on the ground.

General hazards

Carpet fold
A crease or ridge on a carpet surface at least 1 cm in height. May by caused by carpet wear, unlevel flooring or inadequate installation.

Chair (hazardous)
A chair that can tip or move unexpectedly as a person tries to get up or sit down. Often caused be joint wear. A chair is also hazardous if there is a tripping hazard within 1 foot of the front of it.

Clutter
A crowded or confused collection of objects that limits movement through the walking area of a room. Any object in the walking area that is not considered furniture, is not a throw rug, and not part of the floor surface itself can be considered clutter (e.g., paper, shoes, books).

Chair legs, coffee tables or other elements that reduce the walking area are considered clutter.

Cords/Wires
Exposed electrical wiring (extension cords, lamps or telephone cords) within the walking area of a room.

Glare
A bright, unpleasant light that may blind temporarily or cause squinting while the eyes accommodate. The sun reflecting off glass or other reflective surfaces or passing through windows is the most frequent cause.

Nightlight
A light kept on throughout the night or whenever it is dark. The light from a TV screen does not qualify as a nightlight.

Throw rug
A piece of carpet on the floor that is smaller than the walking area. Any throw rug in the walking area is considered a hazard. This includes doormats and any small woven rugs and throw rugs that change the height of the walking surface and/or lack nonslip (rubber or other) backing material.

Other stumbling hazards
Any floor or object (rug, extension cord) characteristic that may cause falling or loss of balance. This is often found in floor or flooring irregularities and includes changes in walking surface height or resistance that may catch the toe or heel of a shoe. The object or irregularity must be situated in the walking area to constitute a hazard. Several examples: Rug/carpet edges, door thresholds, alternating rough and smooth floor tiles, hidden holes in yards, bumps and holes in driveways.

Source: Gill T.M., Williams C.S., Robinson J.T., Tinetti M.E. (1999).

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Glossary

Definitions are given here for the words marked with an asterisk in the text. The definitions were taken and translated from the printed or web-based French-language terminological sources listed below or were proposed by the members of the steering committee.

Sources

Robert de la langue française, 2001 edition.
Dictionnaire médical, Masson, 2001.
Larousse médical, 2003.
Manuel Merck de diagnostic et de thérapeutique, Editors: Mark H. Beers and Robert Berkow, 3rd French edition.
Glossaire européen de santé publique (http://www.bdsp.tm.fr/Glossaire/).
Swiss Council for Accident Prevention (http://www.bpa.ch/).

Anamnesis: information obtained on the history and details of disease through interviews with patients themselves or those close to them (≈patient history).

Arrhythmia: abnormal heart rhythm.

Balance: in this guide, balance describes "postural control". Sensory information provided by vision, the vestibular system of the inner ear and proprioception (notably from the lower limbs) to the brain and cerebellum provoke a motor response that allows the person to stand and move normally.

Body Mass Index (BMI): index for assessing weight (expressed in kg) relative to height (expressed in cm^2). WHO defines obesity by a BMI superior to 30 and underweight by a BMI inferior to 18.5. For the elderly in a fragile state, a BMI inferior to 23 may indicate undernutrition.

Bone density: density of bone and protein matrices of skeletal tissue (bone microarchitecture). Bones become fragile and fracture easily

when density diminishes. Osteoporosis is a pathological reduction of bone density (associated with age, menopause, various diseases, some medications, physical inactivity).

Carotid sinus hypersensitivity (syndrome): alteration of carotid sinus baroreceptor (located in the upper part of the neck) function that may result in arrhythmia and fainting.

Cataract: opacity of the lens (located between the anterior and vitreous chambers of the eye) resulting in reduced visual acuity. Often age-related.

Cerebellar function: brain functions controlled by the cerebellum, a brain structure located in the occipital region of the skull that is responsible for balance, postural tonus and coordination of movement.

Cerebral perfusion: blood flow to the brain. Reduction of cerebral perfusion beyond a certain threshold may affect brain function (e.g., malaise, vertigo, loss of consciousness).

Chronic disease: disease that evolves over an extended period, often associated with invalidity (functional limitations or disability) or with the possibility of serious complications that may negatively affect the patient's quality of life (e.g., diabetes, asthma, etc.).

Cognitive impairment: disturbances in cognitive functions, as occur in certain anxiety and mental disorders (e.g., schizophrenia, obsessive-compulsive disorder, phobias), degenerative diseases (e.g., Alzheimer's disease), dementia or following head injury. The term also covers "memory problems" that may evolve to dementia.

Cognitive: of or relating to the ability of knowing (≈ "intellectual").

Compliance: in the context of public health and health promotion, the act of agreeing to the prescriptions/instructions of a physician or any other medical specialist (medications and/or diet/lifestyle regimens). Adherence (compliance after agreement) strengthens the treatment process and helps to balance the power between concerned parties and improve participation.

Cutaneous sensation: ability of cutaneous receptors to detect pressure, temperature and pain (in contrast to proprioception).

Deconditioning: in this context, the loss of physical abilities due to lack of use.

Dementia: loss of intellectual (or cognitive) ability due to global deficits in higher brain functions including memory, orientation, coordination of movement, recognition of objects and people, language. Dementia is usually the result of Alzheimer's disease or a series of minor strokes (vascular dementia).

Dependence: loss of functional autonomy, see "Functional autonomy".

Depth perception: ability to perceive perspective and evaluate distances. Requires binocular (or "stereo") vision.

Disorder: state of morbidity, disease.

Dyskinesia: any abnormalities in movement or organ mobility independent of cause — lack of coordination, spasm.

Etiology: the causes of disease (more correctly the study of the causes of disease)

Explosive power: ability to rapidly employ a large muscular force.

Exteroception: perception of exterior stimuli. It may be tactile, painful, thermal or sensory in nature.

Extrinsic factor: risk factor present in the indoor (flooring, lighting, obstacles, etc.) or outdoor (sidewalks, ice, etc.) environments.

Fainting: brief loss of consciousness (less than three minutes), usually caused by a lack of sufficient blood flow to the brain due to slowing of heart rate and/or excessive reduction of blood pressure (see "Vasovagal syncope").

Functional autonomy: independence in daily life functions. These include "physical" activities (e.g., eating, bathing, dressing, going to the toilet, rising from bed, attending to one's appearance), mobility activities (with or without mobility aids) and more complex "instrumental" activities (e.g., shopping, getting about outside the home, preparing meals, managing finances or medications).

Functional capacity: see "Functional autonomy".

Glaucoma: ocular disorder characterized by a large increase in intraocular pressure, hardening of the eye, atrophy of the optic disc and significant reduction in visual acuity.

Hip protector: garment with shock absorbing inserts (hard or soft) placed laterally over the hip area to reduce hip fracture risks in falls.

Hypoglycemia: abnormally low amount of glucose in the blood; may result in muscular fatigue.

Hypokalemia: abnormally low amount of potassium in the blood; may increase the risk of arrhythmia.

Hyponatremia: abnormally low amount of sodium in the blood; may increase the risk of lethargy and confusion.

Iatrogenic: disorder or disease that is a result of medical treatment (drugs or other).

Incidence (incidence rate): number of new cases of a disease or health problem in a defined population and in a defined period (cf. "Prevalence"). Incidence rate measures the risk of becoming sick. It is calculated by dividing the incidence by the number of people in the population at the beginning of the defined period.

Intrinsic factor: risk factor inherent to the individual (certain diseases, balance and gait impairment, muscle weakness, etc.)

Macular degeneration: degenerative lesion of the retina, and in particular the macula, leading to loss of central vision. Frequent cause of blindness in the elderly.

Muscle-tendon receptors: see "Proprioception".

Neuritis: inflammatory, and usually degenerative, disorders of one or more nerves, characterized by pain and sensory or motor disturbances or loss of muscle bulk according to the affected nerve.

Neuropathy: generic term describing all disorders of the central or peripheral nervous system.

Orthostatic hypotension: reduction in arterial blood pressure, with or without associated vertigo due to reduced cerebral perfusion, when moving from a reclined to standing position.

Osteoporosis: diffuse or localized pathological loss of bone tissue. See also "Bone density".

Pharmacodynamics: study of the mechanisms of action of medications in the body.

Pharmacokinetics: study of the evolution of medications in the body (absorption, distribution, metabolism, elimination).

Polyneuropathy (or polyneuritis) (peripheral): neuritis affecting several sensory and motor nerves of the limbs, usually symmetrically. The most frequent causes in the elderly are nutritional (vitamin) deficiencies and toxic events (alcohol, diabetes).

Postprandial hypotension: reduction in arterial blood pressure, with or without associated vertigo due to reduced cerebral perfusion, following a meal.

Prevalence: number of total cases of a disease or health problem in a defined population and in a defined period (cf. "Incidence").

Proprioception: discernment of position and movement of body elements by receptors in the muscles, tendons and joints.

Risk factor: in epidemiological terms, a risk factor is any variable statistically related to an event (disease or any other health situation). It can be any individual or collective characteristic that is associated with an increase in the incidence of

a disease or health problem in a population and thus with an increase in the probability of the disease or health problem in an individual.

Saccades: rapid corrective movement of the eyes when following a moving object.

Sarcopenia: loss of muscle mass and related muscle quality and strength.

Screening: use of simple, rapid, large-scale tests, examinations or other procedures to detect asymptomatic disease, abnormalities or risk factors. Screening tests are used in populations that may have the disease or risk-factor. Screening is not sufficient for diagnosis. Individuals with positive or indeterminate screening results should be referred to a physician for diagnosis and treatment.

Sensitivity: a. in screening: ability of a diagnostic or screening tool to correctly identify individuals with the concerned disease or health problem. Sensitivity represents the probability of the test being positive in a person with the disease. b. in epidemiology: number of sick people correctly identified by the test in relation to the total number of sick people. (cf. "Specificity")

Specificity: a. in screening: ability of a diagnostic or screening tool to correctly identify individuals without the concerned disease or health problem. Specificity represents the probability of the test being negative in a person without the disease. b. in epidemiology: number of healthy people correctly identified by the test in relation to the total number of healthy people. (cf. "Sensitivity")

Tai chi: type of exercise originating in China comprised of slow and very precise movements. Sometimes called "tai chi chuan".

Urinary incontinence: involuntary loss of urine. There are three types:
- stress incontinence (when laughing, sneezing, etc.),
- urge incontinence (may indicate urinary infection),
- overflow incontinence (due to incomplete bladder emptying).

Vasovagal syncope: non-pathological fainting due to the association of peripheral vasodilation and sudden slowing of heart rate, which results in low arterial blood pressure; often provoked by emotions or severe pain.

Vestibular system: system of the inner ear involved in balance maintenance.

Documentary resources

Further documentary information is available from the following websites:

- **Health Canada**

http://www.hc-sc.gc.ca/hl-vs/seniors-aines/index-eng.php

- **Santé et services sociaux du Quebec**

http://www.msss.gouv.qc.ca/en/index.php

http://www.msss.gouv.qc.ca/en/sujets/groupes/seniors.php

- **Swiss Council for Accident Prevention**

http://www.bfu.ch/English/Pages/default.aspx

- **Éduca Santé, Belgium**

http://www.educasante.org/outilsressources/ (currently in French only)

- **Institut national de prévention et d'éducation pour la santé**

http://www.inpes.sante.fr (currently in French only)

- **Dass of the Direction générale de la Santé, Republic and Canton of Geneva, Switzerland**

http://www.geneve.ch/maisonsante/fr (currently in French only)

Organization names in French

The translations given here (presented in quotation marks) are largely literal and intended only to provide the reader with an overall idea of the purpose of the organizations. When a "literal" translation is not illustrative, a brief explanation is provided (in parentheses).

Name of organization	Country	"Translation" (Explanation)
Agence nationale d'accréditation et d'évaluation en santé (Anaes)	France	"National health assessment and accreditation agency"
Caisse nationale d'assurance maladie des travailleurs salaries (Cnamts)	France	"National health insurance agency for employed workers"
Caisse régionale d'assurance maladie (Cram)	France	"Regional health insurance agency"
Centre de recherche et d'informations nutritionnelles (Cerin)	France	"Nutritional information and research center"
Centre local de services communataire (CLSC)	Quebec, Canada	"Local community services center"
Collège national des enseignants de gériatrie (CNEG)	France	"National academy of Geriatricians"
Comité départemental d'éducation pour la santé	France	"Department[a] committee for health education"
Comité régional d'éducation pour la santé (Cres)	France	"Regional committee for health education"
Coordination nationale des réseaux de santé	France	"National coordination of health networks"
Département de l'action sociale et de la santé (Dass)	Switzerland	"Department of social and health affairs"
Éduca Santé	Belgium	(Name of the organization)
Fédération française d'éducation physique et de gymnastique volontaire (FFEPGV)	France	(A sports federation)

a. Here, "Department" refers to the geographical administrative divisions of France.

Name of organization	Country	"Translation" (Explanation)
Haut Comité de la santé publique (HCSP)	France	"High committee for public health"
Haute Autorité de santé (HAS)	France	(Independant national authority for health issues (ex-Anaes))
Institut de la statistique Québec (ISQ)	Quebec, Canada	"Quebec statistics institute"
Institut national de la santé et de la recherche médicale (Inserm)	France	"National institute of health and medical research"
Institut national de la statistique et des études économiques (Insee)	France	"National institute of statistics and economic studies"
Institut national de prévention et d'éducation pour la santé (INPES)	France	"National institute for prevention and health education"
Institut national de santé publique du Québec	Quebec, Canada	"National institute of public health of Quebec"
Institut national de statistique (INS)	Belgium	"National institute of statistics"
Institut national d'études démographiques (Ined)	France	"National institute of demographic studies"
Mutualité française	France	(Governing group for insurance mutuals in France)
Mutualité sociale agricole (MSA)	France	(Mutual specialized in complementary insurance for agricultural entities)
Office fédéral de la statistique (OFS)	Switzerland	"Federal office of statistics"
Office médico-social vaudois (OMSV)	Switzerland	"Socio-medical office of Vaud"
Promotion santé Suisse	Switzerland	"Health promotion Switzerland"
Réseau francophone de prévention des traumatismes et de promotion de la sécurité	International	"Francophone network for injury prevention and safety promotion"
Réseau francophone international de promotion de la sécurité	International	"International Francophone network for safety promotion"
Santé et services sociaux du Quebec	Quebec, Canada	"Health and social services of Quebec"
Société française d'alcoologie (SFA)	France	"French alcohology society"
Société scientifique de médecine générale (SSMG)	Belgium	"Scientific society of general medicine"
Union régionale des caisses d'assurance maladie (Urcam)	France	"Regional union of health insurance"

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