THE INCIDENCE AND RISK FACTORS FOR FALLS AND FALL-RELATED INJURY AMONG ELDERLY PERSONS LIVING IN THE COMMUNITY

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ABSTRACT

To determine the frequency of and risk factors for falls and fall-related injury, a one-year prospective follow-up study of 417 community-dwelling persons aged 65 years or older was conducted. Following an initial at-home interview, each subject was telephoned every four weeks for 48 weeks to collect data on falls experienced since the last contact. Data were also collected on exposures which could fluctuate over time. The response rate to the initial interview was 75%, and 90% or more of study participants completed each of the 12 follow-up interviews. Twenty-nine percent of subjects fell during follow-up; 61% of fallers fell once and 39% fell two or more times. The majority of falls resulted in no injury or in minor injury only. A total of 28 independent predictors of falls and fall-related injury were identified in multiple logistic-regression analyses. These included a wide range of sociodemographic, lifestyle and health characteristics, and reflect the multifactorial and complex etiology of falls in the elderly. The strongest predictors of increased fall and fall-injury rates were similar for falls and fall-related injury, and included dissatisfaction with health, dissatisfaction with social life and dizziness.

RÉSUMÉ

Afin de déterminer la fréquence et les facteurs de risque des chutes et des blessures liées aux chutes, une étude prospective d'un an a été menée auprès de 417 personnes âgées de 65 ans ou plus vivant dans la communauté. Après une première entrevue à domicile, chaque sujet a été rejoint par téléphone à toutes les quatre semaines, durant 48 semaines, afin d'obtenir de l'information sur les chutes survenues depuis le dernier contact. Des données concernant les facteurs de risque potentiels pouvant fluctuer dans le temps ont également été recueillies lors de ces entrevues téléphoniques. Le taux de réponse est de 75 % à l'entrevue initiale, et de 90 % ou plus pour chacune des 12 entrevues de suivi. Vingt-neuf pour cent des sujets sont tombés au cours des 48 semaines de l'étude; 39 % d'entre eux ont fait deux chutes ou plus. La majorité des chutes n'ont pas entraîné de blessures, ou seulement des blessures mineures. Parmi les facteurs de risque des chutes et des blessures liées aux chutes qui ont été étudiés, 28 prédicteurs indépendants ont été identifiés, en utilisant les analyses de régression logistique. Ces prédicteurs incluent une grande variété de caractéristiques socio-démographiques, de comportement et de santé, et ils traduisent la diversité de facteurs et la complexité de l'étiologie des chutes chez les personnes âgées. Les prédicteurs les plus puissants sont les mêmes pour les chutes pour et les blessures liées aux chutes, soit l'insatisfaction par rapport à sa santé, l'insatisfaction par rapport à sa vie sociale et le fait de ressentir des étourdissements.

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This thesis is dedicated to the memory of Joan Louise Sproule.

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ABBREVIATIONS

DSC : Département de santé communautaire (Department of Community Health)

MGH : Montreal General Hospital

NDG : Notre-Dame de Grâces

CI : Confidence interval

CLSC : Centre local de services communautaires (Local Community Service Centre)

COPD : Chronic obstructive pulmonary disease

FU : Follow-up

SDAT : Senile dementia of the Alzeimer's type

INTRODUCTION

Reports on falls among the elderly first appeared in the literature in the 1940s. Sheldon's (1948) pioneering work and later that of Droller (1955) provided the first estimates of the frequency of falls among community-dwelling elderly, and the first descriptions of the characteristics of those at higher risk of falling. Since these early studies and up until the late 1970s, there were surprisingly few publications on falls among community-dwelling elderly. However, interest in this area of research has increased substantially in the last ten years, and reflects a growing concern in what has become a major public health problem. As the population ages, awareness of the impact of falls on morbidity, mortality, and utilization of health and social services by the elderly has increased. It is now well recognized that falls among the elderly are a common and important cause of serious morbidity, often leading to lethal complications (Gryfe et al. 1977).

By far the majority of falls in the elderly result in either no injury, or in minor soft tissue injury such as sprains, strains, contusions, lacerations, bruises or abrasion. Among the more serious consequences of falls are head injuries, spinal cord injuries, internal injuries, joint dislocation, severe laceration, and fractures of the wrist, forearm, humerus, pelvis and hip. Each year an estimated 200,000 elderly Americans suffer hip fractures associated with falls. Of those, 40,000 die of complications within six months and another 40,000 require lifelong nursing homecare (Houk in Hingson & Howland, 1987). Despite these potentially serious consequences, only a small proportion of falls actually come to medical attention. Wild et al. (1981b) estimated that the incidence of falls among the elderly is 20 times higher than the incidence of falls which come to medical attention. Gabell et al. (1985) reported that less than half of all falls among the elderly actually come to medical attention, and Sorock (1988) estimated that the ratio of medically reported to nonreported falls at home is 1:14. The rate of fall injury events coming to medical attention increases exponentially with age (Sattin et al., 1990).

Even when there is only minor injury or no injury at all, the psychological trauma resulting from a fall (sometimes termed the "postfall syndrome") may be severe, leading to a loss of self-confidence in the ability to perform the daily routine, social withdrawal, depression or confusion. These, in turn, can lead to self-imposed restriction in activity, decreased mobility, and increased dependence (Nevitt, 1987). Tinetti et al. (1988) reported that 48 percent of elderly fallers were afraid of falling again, and 26 percent had curtailed activities such as shopping or housekeeping, because of their fear of falling. Nevitt et al. (1989) found that about one-quarter of falls caused subjects to limit their normal activities, either because of injury (16.9 percent) or because of fear of falling again (10.4 percent). For the family, a fall can lead to unnecessary institutionalization of the elderly or restrictive surveillance and, for the physician, a fall can be perceived as an emergency that leads to unwarranted admission (Albarede et al., 1989).

Although few falls actually result in injury, accidents and injury are the fifth leading cause of death in people over the age of 65 in the United States (Brummel-Smith, 1989), and the primary cause of death from injury in persons aged 65 years and over is falls and fall-related injury (CDC, 1989)[1]. In the United States, although the elderly comprise only 12 percent of the total population, they account for 70 percent of all deaths due to falls (National Safety Council, 1987). About 9,500 elderly people in the United States die each year from

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[1] A critical concern regarding statistics on fall-related deaths among the elderly is that death certificate data may substantially underestimate the number of deaths in which a fall is a contributing factor (Iskrant & Joliet, 1968; Waller, 1978; Rockett & Smith, 1989). For elderly people, only about 40 percent of death certificates that mention a fall injury code the underlying cause of death as a fall (Fife, 1987). Lack of consistency and standardization in the reporting of fall-related deaths is due, in part, to the inadequacy of the nomenclature covering falls as an external cause of injury in the International Classification of Diseases (Nevitt, 1987).

fall-related injuries (Tinetti & Speechley, 1988). In Canada, in 1986, 1,639 elderly persons died as a result of a fall (Statistique Canada, 1986) and in Quebec, death certificate data for 1985-87 show that 303 of 378 fall-related deaths annually are among persons aged 65 and over (O'Loughlin & Robitaille, 1991). Fall death rates among the elderly rise dramatically after the age of 75, so that by age 85 and over, approximately two-thirds of reported injury-related deaths are due to falls (Baker, 1984). Table 1.1 shows that in 1987, elderly men in Quebec had higher age-specific death rates from falls than elderly women, possibly because more men severely injure themselves in falling than do women (Sorock, 1988).

Similar to trends observed in the United States (Nickens, 1985) and Canada (Robitaille & O'Loughlin, 1988), there has been a substantial decrease in Quebec in fall-related deaths among the elderly over the past 30 years or more. In males aged 65 years or older, the death rate decreased from 100 to 60 per 100,000, and in females, it declined from 140 to 50 per 100,000. Sorock (1988) suggested that this decline may be due to lower case-fatality rates for hip fracture because of improved surgical and postoperative procedures, such as early ambulation after surgery. Improvements in living and housing conditions and greater access to medical care may also have contributed to the decline (Robitaille & O'Loughlin, 1989).

In addition to the decreasing death rate, a change in the sex ratio for fall-related deaths took place between 1951 and 1986 in Quebec (Figure 1.1). In 1951 the death rate for elderly women was about 40 percent higher than for men. The rate declined more rapidly for women than for men between 1951 and 1986 (64 percent versus 40 percent), so that by 1986, the rate for men was 17 percent higher than for women. One explanation for the more rapid decline in women is that if the severity of fall-related injury is greater in males (e.g. falls from greater heights, more head injuries), women might have benefitted more than men from improved surgical and postoperative procedures for hip fracture (Robitaille & O'Loughlin, 1989).

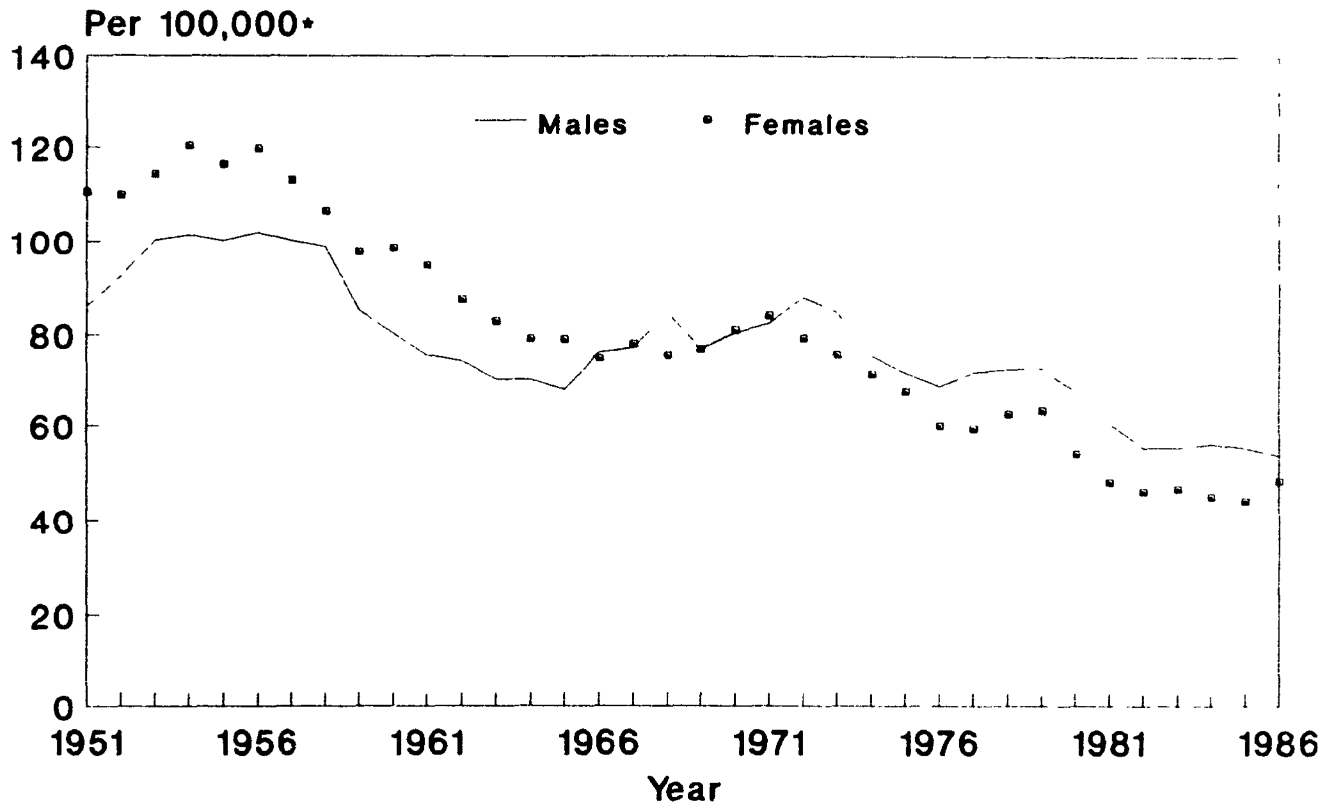
TABLE 1.1

DEATH RATES FOR ACCIDENTAL FALLS BY AGE GROUP AND SEX AMONG PERSONS AGED 65 YEARS AND OVER, QUEBEC, 1987

Age Group (years)	Males		Females		Total	
	N	Rate per 100,000	N	Rate per 100,000	N	Rate per 100,000
Total	**114**	**43.2**	**180**	**46.5**	**294**	**45.2**
65 - 69	8	7.9	8	6.3	16	7.0
70 - 74	18	23.8	10	9.6	28	15.6
75 - 79	25	51.9	23	30.4	48	38.7
80 - 84	19	76.2	46	97.6	65	90.2
≥ 85	44	312.8	93	281.2	137	290.7

Source: O'Loughlin & Robitaille, 1991.

Figure 1.1
Fall death rate by sex in persons aged 65 years and over, Quebec, 1951-1986



*Three-year moving average

Source: O'Loughlin & Robitaille, 1991.

Falls are the leading cause of injury-related hospitalizations among the elderly. Hospital separation data for Quebec for 1987-88 show that, although they comprise only 10.1 percent of the total population, the elderly account for 39.5 percent of 19,907 fall-related hospitalizations annually (O'Loughlin & Robitaille, 1991). In addition they account for 73 percent of 175,015 fall-related hospitalization days, reflecting the much longer lengths of hospital stay in the elderly due to higher rates of severe injury such as hip fracture. The average length of stay for fall-related injury among those aged 65 and over was 33.8 days, compared to 8.4 days among those less than 65. Table 1.2 shows that the rate of hospitalization for fall-related injuries in Quebec is higher among females than males (1,457 per 100,000 compared to 723 per 100,000), and increases dramatically with age (589 per 100,000 among persons aged 65-74 compared to 2,096 per 100,000 among those aged 75 years and over).

Both the significant fall-related mortality rates among the elderly and the high cost of medical care associated with fall-related hospitalizations provide a primary rationale for studying falls in the elderly, and in particular for studying how to prevent falls. However, despite the recent increased interest in falls, there are only a few well-designed studies which provide estimates of the incidence rate of falls and fall-related injuries among community-dwelling elderly. Similarly there are remarkably few controlled studies which examine the risk factors for falling among community-dwelling elderly, and almost no studies which systematically evaluate the impact of an intervention on the prevention of falls and their consequences.

In 1984, the Department of Community Health of the Montreal General Hospital (DSC-MGH) identified the prevention of falls among the noninstitutionalized elderly as a priority intervention area. The DSC-MGH is one of eight DSCs in Montreal, and one of 32 DSCs across the province of Quebec, each serving a population of approximately 200,000 persons.

TABLE 1.2

HOSPITALIZATIONS FOR ACCIDENTAL FALLS BY AGE GROUP AND SEX AMONG PERSONS AGED 65 YEARS AND OVER, QUEBEC, 1987-88

Age Group (years)	Males		Females		Total	
	N	Rate per 100,000	N	Rate per 100,000	N	Rate per 100,000
Total	**1,996**	**723**	**5,870**	**1,457**	**7,866**	**1,157**
65 - 74	799	433	1,690	709	2,489	589
≥ 75	1,197	1,302	4,180	2,539	7,866	2,096

Source : O'Loughlin & Robitaille, 1991.

The mandates of the DSCs include, among others, to monitor the health of their respective populations in order to identify priority health problems, and to design and evaluate public health interventions to reduce the incidence of the health problems identified.

The proportion of elderly persons living in the DSC-MGH is much higher than the Quebec and Canadian proportions of elderly. In 1986, there were 28,155 persons aged 65 years or older living in the DSC-MGH territory, representing 12.9 percent of the total population. In Quebec and Canada, the proportions of persons aged 65 years or older were 8 and 9 percent, respectively (Statistics Canada, 1986). Each year, there are approximately 500 fall-related hospitalizations (Ministère de la Santé et des Services sociaux, Fichier Med-Echo, 1988-90) and 16 fall-related deaths (Ministère de la Santé et des Services sociaux, Fichier des décès, 1985-87) among the elderly living in the DSC-MGH territory. The impact of falls on loss of autonomy and institutionalization has not yet been estimated.

Because a detailed review of the literature revealed little consistent information on the incidence and risk factors for falls among community-dwelling elderly and in particular, almost no information on the effectiveness of community-oriented fall prevention interventions, the DSC-MGH decided to undertake an epidemiological study of falls among the elderly living in its territory. It was considered essential to obtain accurate and relevant data on the incidence and risk factors for falls among the elderly, prior to instituting and evaluating a community-based fall prevention intervention.

This thesis describes the study that was undertaken. It is divided into six chapters. The first chapter reviews existing publications on falls among the elderly. Although it focuses on reports of community-dwelling elderly, it also reviews the evidence on the frequency and risk factors for falls among the institutionalized elderly, as well as among those studied in clinical settings. The second chapter describes the objectives of this research. The methods and procedures used to study the incidence and risk factors for falls among community-dwelling elderly are described in Chapter Three. Specifically, the methods of data collection, the variables studied, and the methods of data analysis are presented. The results of the study are described in Chapter Four. Chapter Five discusses the results and their implications for the prevention of falls among community-dwelling elderly and Chapter Six presents a summary of the research and recommendations for future research on falls among the elderly.

CHAPTER 1 - REVIEW OF THE LITERATURE

1.1 - INTRODUCTION

Publications on falls among the elderly can be subdivided into three categories based on the source of the study population. Community-based studies are those in which older persons living at home in the community constitute the main source of study subjects. Clinic-based studies refer to those which include elderly patients seen at hospital outpatient clinics or emergency rooms, or in private practices. Lastly, institution-based studies include elderly persons living in institutional settings such as nursing homes and homes for the aged, or acute, chronic, geriatric, convalescent and rehabilitation hospitals. Although most studies on falls can be categorized into one of these three types, some studies include a mix of study populations. For example, several community-based studies include the elderly living in institutional or residential settings (Overstall et al., 1977; Campbell et al., 1981; Campbell et al., 1989) and those seen in outpatient clinics (Nevitt et al., 1989). Similarly, clinic-based studies sometimes include both community-dwelling and institutionalized elderly who seek treatment in outpatient clinics, emergency rooms, or physicians' offices (Wild et al., 1981a,b,c,d; Waller, 1978).

Because their sociodemographic and health characteristics are often widely different, it is important to take the source of the study populations into account when comparing the incidence and risk factors for falls across studies. Accordingly, this literature review differentiates between findings on the frequency of falls reported and the risk factors identified in community-, clinic-, and institution-based studies of falls in the elderly. The first section of the literature review presents findings on the frequency of falls and fall-related injury among the elderly. The sociodemographic, lifestyle, mental and physical health, and the environmental factors which have been studied as risk factors for falls and fall-related injury in the elderly are presented in the next two sections. The last section of this chapter describes the rationale for the methodology selected for the current study. Before beginning, two general issues which affect the quality of the falls literature will be discussed, including the wide variability between studies in the definition of falls and in the methods used to collect and analyze data on the frequency and risk factors for falls.

1.1.1 - DEFINITION OF FALLS

Few reports on falls among the elderly provide a definition of falls. Often falls appear to be defined implicitly as "when the subject reports a fall". Among reports which do provide a definition, falls are usually defined either operationally or with reference to presumed etiology (Table 1.3). In general, operational definitions describe the method of identifying when a fall has occurred or the end result of a fall, while etiologic definitions provide insight into possible causal mechanisms. With the exception of Tinetti et al. (1988), none of the reports which provided etiologic definitions described how they were actually operationalized. It is clear from Table 1.3 that definitions of falls which do exist vary considerably across studies in content, completeness, and applicability. This discrepancy in terminology has undoubtedly contributed to the variability noted in reported studies of fall frequency, causation, and outcomes (McVey & Studenski, 1988). Although the development of standard methods for defining and recording fall frequency and outcomes has been recommended (Kellogg International Work Group, 1987), none has yet been widely accepted as standard.

In addition to the lack of, or differing definitions of falls, comparison between reports is sometimes difficult when researchers restrict their studies to include only certain kinds of falls. For example, some researchers study only those falls which result in injury and require medical treatment in hospital (Lucht, 1971; Waller, 1978; Cook et al., 1982) or in a physician's office (Wild et al., 1981a,b,c,d; Stegman, 1983). Others include trivial falls for

TABLE 1.3
DEFINITIONS OF FALLS REPORTED IN THE LITERATURE

OPERATIONAL DEFINITIONS	ETIOLOGIC DEFINITIONS
Gryfe et al (1977); Fernie et al (1982) "A fall was defined by the following criteria: a) resident seen to fall by a responsible observer, without differentiation of whether it was spontaneous, a slip, a trip or a shove; b) resident found otherwise unaccountably on the floor or ground, c) resident reported own fall"	Schested & Severin-Nielsen (1977) "A sudden, unexpected change in position in which the static and fixation mechanisms fail and voluntary or reflex responses for correcting imbalance are inadequate"
Morris & Isaacs (1980) "A fall was defined as an untoward event in which the patient came to rest unintentionally on the floor. This definition included patients slipping down from the chair onto the floor, and patients found lying on the floor unable to account for themselves"	Sim (1984) "Physiologically, a fall may be defined as the failure on the part of the body's postural mechanisms to maintain the upright posture in the face of internal or external destabilising influences"
Campbell et al (1981) "Only falls in which the subject came in contact with the ground were considered"	Isaacs (1985) "A fall is an uncorrected displacement It is a displacement of the body that occurs and that is not corrected in the time available. There are two kinds of displacements the ones you intend and the ones you don't"
Wild et al. (1981b) "Untoward events terminating in the patient's lying inadvertently on the ground. Episodes of staggering against the wall or falling into a chair or onto a bed were excluded".	Tinetti et al. (1986) "Unintentional change in position occurring under circumstances in which a fit person would have resisted the external hazard, if one was present"
Vellas et al. (1987) "Falls among old people may be defined as events that cause subjects to fall to the ground against their will"	Kellogg International Work Group (1987) "A fall is an event which results in a person coming to rest inadvertently on the ground or other lower level and other than as a consequence of the following sustaining a violent blow; loss of consciousness, sudden onset of paralysis, as in a stroke; an epileptic seizure"
Sorock & Shimkin (1988) "An unintentional contact with the floor, or contact with an object below the level of the hip, without coming to rest on the floor, for example, falling onto a coffee table without landing on the floor. A seizure-related fall was excluded, as was rolling out of bed while asleep".	Tinetti et al. (1988) "A subject's unintentionally coming to rest on the ground or at some other lower level, not as a result of a major intrinsic event (e.g., stroke or syncope) or overwhelming hazard An overwhelming hazard was defined as a hazard that would result in a fall by most young healthy persons, on the basis of a consensus of three physicians and three physical therapists".
Nevitt et al. (1989) "Falling all the way down to the floor or ground, or falling and hitting an object like a chair or stair. The following were not included as falls: a controlled or intentional movement to a chair or bed; a "near fall" in which the participant caught himself or herself before hitting the floor, ground, or object, and being knocked down by a substantial external force, like a moving vehicle".	Wolfson et al (1990) "Fallers were defined as residents who had experienced at least two unexplained falls during the previous year Unexplained falls are defined as endogenous in nature and not attributable to environmental hazards Exogenous precipitants included environmental hazards such as surfaces, footwear, lighting, eyeglasses, and clothing"
Mayo et al. (1989) "Any unplanned "touch-to-the-floor" of any part of a patient's body excluding the feet".	Chandler et al. (1990) "Any disturbance of balance that results in a failure to maintain upright posture during routine activities"
Robbins et al. (1989) "A sudden, involuntary, and unexpected landing on the ground or assumption of the horizontal position with or without loss of consciousness or injury, reported either by the faller or a witness".	
Campbell et al. (1989) "Any unintended contact with the ground".	
Wright et al. (1990) "An abrupt change to horizontal, knees, or sitting position".	
Myers et al. (1991) "Events in which the staff filed an incident report citing a "fall". These included a variety of circumstances in which there was displacement of the resident's body to the floor. They included any fall such as out of bed, out of chair, or while walking or transferring."	

which there are no apparent consequences (Campbell et al., 1981; Prudham & Evans, 1981; Perry, 1982a; Tinetti et al., 1988). Some researchers exclude falls resulting from obvious overwhelming intrinsic or environmental causes such as motor vehicle accidents or violence (Tinetti et al., 1988), or those resulting from syncope (loss of consciousness) or sudden paralysis (Sorock & Shimkin, 1988; Nevitt et al., 1989). Still others are primarily interested in recurrent falls (Tinetti et al., 1986; Nevitt et al., 1989). Falls may be restricted to those occurring during specific activities such as ambulation or bed-related activities (Clark, 1985), or they may include only those occurring in specific locations such as on stairs (Svanström, 1974) or in the home (Lucht, 1971; Wild et al., 1981a,b,c,d).

Several investigators do not define falls at the outset of their studies, but do classify falls that occurred during the study. Theoretically at least, categorization of falls could enhance understanding of risk relationships by allowing researchers to link specific risk factors or biologic measurements to specific types of falls. This, in turn, could guide preventive efforts (Nevitt, 1987). Classification systems are usually based on the subjects' self-reports of the reason for the fall (or occasionally on the researcher's or a physician's assessment of cause), on the activity in which the subject was engaged at the time of the fall, or on the severity of injury sustained as a result of the fall (Table 1.4). Although as shown in the table, several investigators have attempted to classify falls according to cause, others question the usefulness of this approach since fall victims often give unreliable information about their falls. Wild (1981c) felt that "the concept that a fall in old age has a (single) cause is inadequate". Tinetti et al. (1988) suggested that there is no reliable system for separating falls into discrete, reproducible categories based on cause, since many intrinsic, activity-related, and environmental factors are mentioned by subjects as contributing to most falls. Accordingly, falls are sometimes classified according to the activity in which the subject was engaged at the time of the fall. For example, Wild et al. (1981c) suggested that falls result from an uncorrected displacement of the body from its support base, and proposed that information

TABLE 1.4

CLASSIFICATIONS OF FALLS

CLASSIFICATIONS BASED ON SEVERITY OF INJURY	CLASSIFICATIONS BASED ON CAUSAL MECHANISM	CLASSIFICATIONS BASED ON ACTIVITY AT TIME OF FALL
Gryfe et al. (1977) "A negligible fall was one in which no injury was observed or there was trivial soft tissue injury not requiring dressing or requiring simple dressing only. A severe fall was defined as a fall in which there was soft tissue injury requiring suture for opposition or haemostasis or fracture".	Sheldon (1960) Drop attacks are unexpected and sudden falls unrelated to dizziness or loss of consciousness	Isaacs (1985) The activity at the time of a fall can be classified as basic, extended, or extreme. Basic movement is something done frequently every day and involves a minimal amount of displacement or at least a familiar degree of displacement (getting up from a chair, walking, turning, sitting down, getting on and off a toilet). An extended movement involves a greater degree of displacement of the body (reaching up to a high shelf, bending down to a low shelf). An extreme movement is riding a bike, climbing a ladder, running or doing something very rapidly. If a fall occurs during basic movement, then the mechanism for protecting against displacements is severly deficient. If the subject was doing something involving speedy or extensive dangerous movements, then his capacity to perform complex movements is not impaired, and he or she is not so ill.
Tinetti (1987) "Serious injury from a fall was defined as all nonvertebral fractures, all other injuries resulting in stay in the emergency room for more than 24 hours (not for purpose of X-ray alone), admission to acute hospital, bedrest for more than 48 hours, or restriction in activity for more than 72 hours"	Naylor et al. (1970) "Drop attacks was the term used to describe those patients whose falls occurred without warning, were not associated with loss of conciousness, and in whom there were no new permanent neurological deficits".	Wild et al. (1981c) "Falls resulted from uncorrected displacement of the body from its support base. Displacements can be of two types and two degrees". Initiated displacements (those which the subject induces himself) can be ordinary (rising from a chair, walking) or extraordinary (skating, skiing). Imposed displacements (those which come unexpectantly from the outside world) can also be ordinary (irregularities in the ground surface) or extraordinary (slipping on an unseen patch of moisture)
Brody et al. (1984) "The falls were divided into three groups: a) no apparent injury; b) relatively minor injury; and c) hospital treatment necessary (e.g. fractures)".	Overstall et al. (1977) "Falls were classified as either trip falls or postural falls. A trip fall is an accident that can happen to anyone. Postural falls were due to giddiness, drop attacks, loss of balance, turning the head, or rising from a bed or chair. Other falls occurred for unknown reasons or because of poor eyesight, weak legs or collisions with furniture. A fall was classified as a drop attack if there was a clear history of an unexpected fall without loss of consciousness where no precipitating factor could be identified"	Tinetti et al (1988) "The amount of displacement of the body's center of gravity outside the base of support in an activity was classified as mild, moderate, or marked according to the concensus of three physical therapists who reviewed all activities engaged in by subjects at the time of a fall".
	Campbell et al. (1981) "Pattern falls were those which, on history and examination, were assessed as arising from only minimal external upset and primarily from a disorder of balance or postural stability in the subject. Occasional falls were those which had arisen under circumstances which would be liable to cause a fit person to fall".	
	Sobel & McCart (1983) "Environmentally induced falls include those falls that occurred because of slipping in stool or urine, objects on the floor, tripping on falling out of bed"	
	Campbell et al. (1989) "External falls were those in which there was a major external contribution judged to be sufficient to cause a fit, active person to fall, such as a fall off a ladder, or a fall while jumping over a ditch. Internal falls were those in which there was no or minimal external contribution to the fall, and the person fell primarily from a disorder of stability or balance. A trip on a hazard such as a hearth rug or step while walking was considered a minor external contribution to a fall, and the fall was classified as internal. When the circumstances were unclear, the fall was classified as internal".	

about events at the time of the fall makes possible a classification based on the nature and magnitude of the causal displacement. These investigators suggested that this classification may be of some help in guiding the prevention of falls, and proposed a possible program of action based on the classification.

Although classification of falls according to activity engaged in at the time of the fall might represent an improvement over classification according to cause, its utility for risk assessment and guiding preventive efforts remain to be proven. Nevitt (1987) suggested that work on classifying falls is still developmental and may prove to be of limited value in understanding and preventing falls. Perhaps of more use, Nevitt (1990) described falls in terms of three phases, each of which is a potential focus for prevention. The first phase involves "an initiating event that displaces the body's center of mass beyond its base of support. Initiating events involve extrinsic factors such as environmental hazards; intrinsic factors such as unstable joints, muscle weakness and unreliable postural reflexes; and physical activities in progress at the time of the fall". The second phase results from "a failure of the systems for maintaining upright posture to detect and correct this displacement in time to avoid a fall. This failure is generally due to factors intrinsic to the individual, such as loss of sensory function, impaired central processing, and muscle weakness". The third phase involves the "impact of the body on environmental surfaces, usually the floor or ground, which results in the transmission of forces to body tissues and organs". Nevitt (1990) also described a fourth phase which "although not part of a fall, concerns the medical, psychological, and health care sequelae of the fall and attendent injuries. These sequelae affect the degree of damage and disability resulting from the fall".

1.1.2 - METHODS USED TO STUDY FALLS

A wide variety of research designs have been used to study the frequency and risk factors for falls among the elderly. The majority of studies are cross-sectional, that is, studies in which exposure information is ascertained simultaneously with the information on the outcome (Rothman, 1986). For example, many community-based studies obtain data on the frequency of falls in the past year and on potential risk factors for falls during a single personal interview with elderly subjects. These studies probably underestimate the frequency of falls because of recall bias, a problem which might be particularly severe among older persons (Nickens, 1985; Duthie, 1989). Failure to recall falls might be associated with cognitive impairment (Cummings et al., 1988). It might also be due to a tendency to forget an event which is considered mundane or which causes anxiety and distress (Nevitt, 1987), or it might reflect a belief that falls are an inevitable consequence of aging (McVey & Studenski, 1988). Nickens (1985) suggested that the psychological need among older persons to deny that physical competence is diminishing combined with ordinary forgetfulness, ensures underreporting of falls among the elderly in community-based surveys. Falls which are remembered may be those which are more traumatic either physically or mentally, to the exclusion of trivial falls for which there are no serious sequelae. In a study to determine how accurately elderly subjects recall recent falls, Cummings et al. (1988) found that, depending on the time period of recall, 13 to 32 percent of subjects with confirmed falls did not recall falling during the specific period of time. There were only weak correlations (r=0.28 to 0.59) between the number of falls that were documented and the number of falls that the subjects recalled for the preceding three, six, or 12 months. The researchers concluded that methods other than long-term recall should be considered for ascertaining and counting falls over specific periods of times.

In addition to the problem of recall bias in the measurement of the frequency of falls, identification of risk factors for falls in these studies might be subject to error because the temporality of exposure cannot be established. For example, impairments in gait or postural stability might have precipitated a fall, or they might have been caused by a fall-related injury. A cross-sectional study cannot always establish the temporal sequence of these events with certainty. Also many studies do not include a control group, so that the characteristics of subjects who fell cannot be compared with the characteristics of subjects who did not fall.

Institution- and clinic-based studies often rely on data collected through review of medical records. The quality of data collected from medical records is dependent on the policies of the institutions regarding which data are routinely recorded and the care taken by the staff completing the records, and is therefore very variable. Also data on potential risk factors for falls or on factors which confound the association between risk factors of interest and falls might not be routinely recorded.

Few studies follow cohorts of subjects forward in time to enable calculation of the incidence rate of falls. Although follow-up studies[1] minimize the problems of recall bias and establishing the temporality of exposure, they are costly and time-consuming. Also, among the follow-up studies which do exist, potential risk factors are usually measured only at baseline and then related to the occurrence of falls during the follow-up period, so that changes in these factors during follow-up are not taken into account. Failure to accurately determine the nature of an association between a particular factor and falls might depend on the degree of variability in that factor over time. For example, use of antihypertensive

[1] A follow-up study is one in which two or more groups of people that are free of disease and that differ according to extent of exposure to a potential cause of the disease are compared with respect to incidence of the disease in each of the groups (Rothman, 1986).

medication is probably relatively consistent over time, whereas use of analgesics to relieve arthritic pain could vary substantially from day to day.

Studies vary considerably in the measure of the frequency of falls reported. These include estimates of the number of falls per 1,000 persons at risk during a specified period of time, the number of falls per 1,000 person-days, and the proportion of persons who fell among all study subjects during a specified period of time. Comparison between reports is difficult when investigators do not provide data which enable calculation of the same measures of the frequency of falls.

Finally, studies vary in the methods of data analysis used to identify risk factors for falls. As indicated earlier, many studies do not include a control group, and the majority of those which do rely on simple univariate analyses comparing the characteristics of subjects who fell to those of subjects who did not fall. Few researchers have evaluated the strengths of suspected associations using odds ratios or relative risks, and few have used multivariate analyses to examine the independent associations between potential risk factors and falls.

1.2 - FREQUENCY OF FALLS IN THE ELDERLY

1.2.1 - COMMUNITY-BASED STUDIES

Compared to studies of institutionalized elderly or outpatient studies, community-based studies of falls in the elderly are difficult to perform and expensive, requiring considerable outreach and extensive interviewing in the home (Nickens, 1985). The majority of community-based studies are cross-sectional surveys, in which the presence of a positive fall history is elicited from the subject during a single personal interview. Mossey (1985) emphasized that use of the cross-sectional design in studies of falling in community elderly is problematic because study subjects are survivors who remain in the community. Those who sustained serious fall-related injury such as hip fractures have high rates of institutional placement and mortality, and will not be available for study. In addition, as discussed earlier, the frequency of falls in these studies may be significantly underestimated because of recall bias. None of the community-based studies reviewed below included validation of self-reports of falls through review of medical dossiers or interrogation of a witness.

Table 1.5 describes the study populations, the method of ascertainment of falls, and the results on the frequency of falls in ten cross-sectional and five follow-up community-based studies. In spite of methodological differences between studies, estimates of the frequency of falls are remarkably similar in studies of community-dwelling elderly, and indicate that about one-third of community-dwelling elderly fall each year (Perry, 1982b; Nickens, 1985). Between 8 and 17 percent of community-dwelling elderly sustain multiple falls each year and, of those with a history of falls, one-quarter to one-half fall repeatedly each year (Table 1.6). Estimates of the number of falls per 1,000 persons at risk per year range between 625 and 976 falls. In most studies, the proportion of fallers is higher among females than males and increases with age, although some investigators have noted a decline in the frequency of falls among the very elderly. McVey & Studenski (1988) suggested that a decreasing incidence of falls in the eighth and ninth decade of life may be attributed to an attrition of those at higher risk through death or confinement to a more protective setting.

Estimates of the frequency of fall-related injuries from community-based follow-up studies suggest that about 7 percent of community-dwelling elderly sustain serious fall-related injury such as fracture, joint dislocation, sprain, or laceration requiring suture each year (Table 1.7). This represents about 20 percent of those who fall. Only 1 to 3 percent of falls in community-dwelling elderly result in hip fracture.

TABLE 1.5

FREQUENCY OF FALLS AMONG THE ELDERLY IN COMMUNITY-BASED STUDIES

Investigator and study population	Method of ascertainment of falls	Prevalence proportion of fallers[1] Sex: Males %	Females %	Age group (years): 65-74 %	75-79 %	80+ %	Total %
CROSS-SECTIONAL STUDIES							
Sheldon (1948) One in 30 sample of 279 people aged 65 years or older living at home in Wolverhampton, England.	Self-reports of liability to fall.	21.1	43.4	28.5	42.9	62.2	36 2
Droller (1955) 476 people aged 65 years or older in Sheffield, England who were living in their own homes and had participated in a social survey in 1948	Self-reports of falls since retirement.	23.4	52.1	36 9	44 6		39 4
Overstall et al (1977) 243 subjects aged 60-96 years living at home were either seen at a social centre or were participants in a nutrition survey conducted in the London Borough of Islington	Self-reports of falls (no specific reference period).	-	-	-	-	-	60 1
Waller (1978) In a case control study on risk factors for fall injuries, 150 neighbourhood and nursing home controls aged 60 years or older in Chittenden County, Vermont were interviewed	Self-reports of falls in the past 12 months.	-	-	-	-	-	32.0
Prudham & Evans (1981) 2,497 persons aged 65 years or older living at home in North East England.	Self-reports of falls in the past 12 months.	19.0	34 4	24.9	31.4	38.4	28 0
Campbell et al. (1981) Stratified population sample of 553 persons aged 65 years or older in Gisborne, New Zealand	Self-reports of falls in the past 12 months.	-	-	25.0	44.3	46.5	34 0
Cook et al. (1982) 968 people aged 65-95 years living in their own homes, who had participated in a nutrition survey sponsored by the Department of Health and Social Security.	A history of falls during the preceding year was obtained.	21.0	41.0	-	-	-	30.0
Blake et al. (1988) A locally and nationally representative sample of 1,042 persons aged 65 and over living at home, randomly selected from the Nottinghamshire Family Practitioner Committee's records.	Self-reports of falls in the year preceding the survey.	24.3	41.6	32.2	33.3	41.6	34.8
Wickham et al (1989) A random sample of 983 males and females aged 65 years and over was selected from Family Practitioner Committee lists in eight areas in England, Wales, and Scotland.	Self-reports of the circumstances of any previous falls (no specific reference period).	22.1	42.0	25.7	32.7	39.8	31 0
Winner et al. (1989) A random sample of 2,000 males (341 aged 65 or older) and 2,000 females (456 aged 65 or older) from Oxford city was selected from the 1988 and 1986 electoral registers.	Self-reports of falls in the last year.	18.2	26 8	18.0	25.3	33.7	23.1

TABLE 1.5 (continued)

Investigator and study population	Method of ascertainment of falls	Prevalence proportion of fallers[1] Sex Males %	Females %	Age group (years) 65-74 %	75-79 %	80+ %	Total %
Tobis et al. (1990) 60 community-dwelling, independently functioning adults aged 60 years or older selected randomly from an ongoing project on the psychobiology of aging	Self-reports of falls within the past year.	-	-	15.2	40.7		26.7
58 blind older persons selected among persons using the dining facility of the Anaheim Braille Institute or the Los Angeles Braille Institute	Self-reports of falls within the past year.	-	-	46.7	60.7		53.5
47 deaf older adults selected from an apartment building which housed over 100 deaf elderly	Self-reports of falls within the past year.	-	-	15.8	46.4		34.0
FOLLOW-UP STUDIES							
Perry (1982a) 64 residents aged 65 years or older living in a high-rise, publicly-supported apartment for the elderly in Seattle.	Self-reports of falls in the past year, one year after the initial interview.	25.0	43.2	50.0	33.3	37.0	37.5
Tinetti et al. (1988) A representative sample of 336 persons aged 75 years or older, all ambulatory and living in the community. Subjects were participants in the Yale Health and Aging Project.	Data on falls were obtained during telephone calls every other month for 12 months.	29.1	34.6	-	26.2	38.4	32.0
Sorock & Shimkin (1988) A convenience sample of 169 of 1,036 English-speaking, non-wheelchair-bound tenants aged 60-94 years, in six senior citizens buildings in New Jersey	Data on falls in the past month were collected in monthly telephone interviews for an average 5.6 months.	-	-	-	-	-	34.0
Campbell et al (1988, 1989, 1990) 761 people aged 70 years or older registered at the Mosgiel Health Centre near Dunedin, New Zealand.	Subjects recorded all falls during one year and were contacted monthly by the research nurses.	28.4	39.6	-	-	-	35.2
Nevitt et al. (1989) 266 women and 59 men aged 60 years or older with a history of falls in the past 12 months, were recruited from senior centres, senior residences, churches, and university-affiliated outpatient clinics in San Francisco.	Participants recorded falls in the past 7 days each week for 52 weeks on postage-paid postcards.	-	-	-	-	-	56.6

Note: [1] Where possible, when percentages were not reported, they were calculated from data presented in the article.

TABLE 1.6

FREQUENCY OF MULTIPLE FALLS AMONG THE ELDERLY

Investigators	Total number of subjects n	Subjects who fell n	Repeat Fallers All subjects n	Repeat Fallers All subjects %	Repeat Fallers Fallers %
COMMUNITY-BASED STUDIES					
Prudham & Evans (1981)	2,357	660	304	12.9	46.1
Perry (1982a)	64	24	6	9.4	25.0
Tinetti et al. (1988)	336	108	58	17.3	53.7
Sorock & Shimkin (1988)	169	57	14	8.3	24.5
Nevitt et al. (1989)	325	184	101	31.0	55.0
CLINIC-BASED STUDIES					
Wild et al. (1981d)	116[1]	36	18	15.5	50.0
Gabell et al. (1985)	98[2]	15	5	5.1	33.3
Craven & Bruno (1986)	99	60	37	37.4	61.7
INSTITUTION-BASED STUDIES					
Sehested & Severin-Nielsen (1977)	511	134	54	10.6	40.3
Gryfe et al. (1977)	441	198	136	30.8	68.7
Berry et al. (1981)	-	-	-	-	50.9
Fernie et al. (1982)	205	86	42	20.5	48.8
Venglarik & Adams (1985)	-	221	152	-	68.8
Blake et Morfitt (1986)	-	72	48	-	66.6
Tinetti et al. (1986)	79	32	25	31.7	78.0
Mayo et al. (1989)	1,805	356	141	7.8	39.6

Notes: [1] Excludes eight control subjects who died during the one-year follow-up.
[2] Excludes two subjects who died during the observation year (without suffering a fall before their deaths).

TABLE 1.7

ESTIMATES OF FALL-RELATED INJURY SUSTAINED ANNUALLY[1] BY COMMUNITY-DWELLING PERSONS AGED 65 YEARS OR OLDER

	Subjects with fall-related injury		Falls which resulted in injury	
	Minor %	Serious[2] %	Minor %	Serious %
Perry (1982a)	12.5	7.8	-	-
Tinetti et al. (1988)	-	7.7	-	11.0
Nevitt et al. (1989)	-	-	55.9	4.5
Campbell et al. (1990)	-	7.9	-	10.0

Notes: [1] When percentages were not reported, they were calculated from data presented in the article.
[2] Definitions of serious injury differed between studies but generally included fracture, dislocation, and laceration with suture.

1.2.2 - CLINIC-BASED STUDIES

Compared to community-based studies, clinic-based studies are relatively easy to conduct and less expensive. They make use of readily available study populations (Perry, 1982b) and they allow investigators to focus their resources and to probe more deeply into the more serious cases of falling (Nickens, 1985). However, caution must be exercised in interpreting and generalizing their results. Nickens (1985) pointed out that clinic-based studies select for the more ill fallers and more serious falls, and therefore limit our appreciation of the nature and scope of falling in the general population. Perry (1982b) also suggested that clinic-based studies are likely to result in an underestimation of the overall frequency of falling, since the study populations include the ill or more severely injured. He reported that the rates of treated falls ranged from 3 to 220 per 1,000 subjects per year depending on the characteristics of the populations studied. The usefulness of data from clinic-based studies might also be limited by the variation in access the elderly have to medical care, so that elderly persons with unencumbered access may seek treatment for more trivial injuries (Perry, 1982b).

Comparison between results on the frequency of falls in clinic-based studies is difficult because the objectives, study populations, and methods are so varied (Nickens, 1985) and because measures of the frequency of falls reported vary considerably between reports. Table 1.8 describes the study populations, methods and results of nine clinic-based studies which provide estimates of the frequency of falls among the elderly. Three of the nine studies interviewed study participants about falls sustained during the year preceding the interview, while the other six were follow-up studies. One study was a retrospective follow-up study (in which data on falls and past exposures were based on review of medical records), while the

TABLE 1.8

FREQUENCY OF FALLS AMONG THE ELDERLY IN CLINIC-BASED STUDIES

Investigator	Study population	Method of ascertainment of falls	Frequency of falls[1]: No. falls per 1,000 persons per year[2]	No. falls per 1,000 person-days[3]	Prevalence proportion of fallers
CROSS-SECTIONAL STUDIES					
Waller (1978)	150 persons aged 60 years or older who were treated for fall-related injuries at the Medical Center Hospital in Chittenden County, Vermont.[4]	Self-reports of falls in the past 12 months.	-	19	40
Cook et al. (1982)	310 patients aged 65 to 100 years with fracture of the proximal femur admitted to two hospitals in London and three in Manchester[5]	A history of falls in the preceding year was obtained.	-	-	57.7
Craven & Bruno (1986)	Convenience sample of 99 ambulatory elderly persons who received health care at the university-affiliated medical centre in Seattle. Subjects were selected consecutively from emergency room and outpatient appointments on data collection days.	Self-reports of falls in the past year.	-	-	60.6
FOLLOW-UP STUDIES					
Retrospective					
Stegman (1983)	All 1,002 patients aged 65 years or older diagnosed with essential hypertension who had even attended one of six Family Practice Residency Program clinics affiliated with the University of Iowa.	Data on falls treated at the clinic during the mean 3.91 years of follow-up were abstracted from medical charts.	-	38	-
Prospective					
Lucht (1971)	472 patients aged 60 years or older treated in the casualty or surgical department at Odense Hospital after falling in the home, during a one-year observation period.	Subjects or next of kin were questionned about the fall upon arrival at the hospital.	-	14	-
Wild et al. (1981 a,b,d)	125 persons aged 65 years or older from six general practices in Birmingham, who visited their general practitioner after falling at home during a one-year observation period. 125 age and sex-matched controls were drawn from the same six practices.	After an initial interview at home within two weeks of the index fall, data on further falls were obtained in follow-up visits three and 12 months later.	- 512 (controls)	20 -	52 (cases) 29 (controls)
Gabell et al. (1985)	100 healthy persons aged 65-85 years in two general practices in Great Britain. Persons diagnosed as having major disorders likely to affect gait (arthritis, stroke, disabling foot conditions, blindness) and those requiring walking-canes were excluded.	Subjects reported all falls during one year on fall-report cards with stamped, addressed envelopes.	220	20	15.0
Buchner & Larson (1987)	157 ambulatory community-dwelling patients aged 62-93 years, with Alzheimer-type dementia referred from the Geriatrics and Family Services Program at the University of Washington.	Three years after an initial clinic visit data on new falls were collected in questionnaires completed by the patient or care giver.	-	-	31
Morris et al. (1987)	44 cases with senile dementia of the Alzheimer's type (SDAT) and 56 cognitively healthy controls aged 65-82 years were recruited through the media from a metropolitan area. All were white and living in the community.	Information on falls which required immediate medical attention or directly resulted in death, was obtained at entry and at 15 to 13-month intervals for 50 months.	- -	120 (SDAT) 34 (controls)	36 (SDAT) 11 (controls)

Notes :
[1] Where possible, when the frequency of falls was not reported, it was calculated from data presented in the article.
[2] Censored subjects not taken into account.
[3] Censored subjects taken into account.
[4] Data for 150 neighbourhood controls were reported in Table 1.5.
[5] Data for 968 comparison subjects were reported in Table 1.5.

other five studies collected data prospectively[1]. The data indicate that between 40 and 60 percent of elderly clinic patients report having fallen in the past year. Depending on the population studied and the length of follow-up, the number of falls per 1,000 persons at risk ranged between 220 and 512 falls and the number of treated falls per 1,000 persons at risk ranged between 14 and 38 falls. Estimates of the frequency of multiple falls indicate that between 5 and 37 percent of elderly persons in clinic-based studies fell repeatedly. Among those with a history of falls, between one- and two-thirds sustained multiple falls (Table 1.6).

1.2.3 - INSTITUTION-BASED STUDIES

Compared to community- and clinic-based studies, publications on falls in institutional settings are relatively common. Because of ready access to study populations and lower costs associated with data collection, it is often relatively easy and convenient to study falls among elderly persons in institutional settings. However the results from these studies may not be generalizable to the 90 percent of elderly who are community-dwelling. Compared to elderly persons living at home, populations in institutions tend to be more infirm, older, and carefully protected from many of the hazards of home life such as stairs and kitchens (Nickens, 1985). They are not as frequently exposed to hazards outside the house such as icy sidewalks, walking to and from stores and crossing streets. However, as Nickens (1985) pointed out, what is striking about this population is that despite their protection from many extrinsic factors and despite their activity limitation, half or more fall each year. Perry (1982b) in a

[1] Rothman (1986) labelled a study in which both exposure and disease are historical, as any of a retrospective cohort study, a retrospective follow-up study, or an historical cohort study. Retrospective refers to follow-up which covers a time period before the study, whereas prospective refers to follow-up which covers a period of time after the initiation of the study.

review of the methods and conclusions of epidemiologic studies on falls among the elderly, also concluded that the institutionalized elderly have a relatively high frequency of falling.

Comparison between reports on the frequency of falls among institutionalized elderly is difficult for several reasons. First, most studies obtained data through review of hospital incident reports. These reports may be completed by a variety of personnel using nonstandard methods, so that the quality of the data may vary widely within and between studies. Second, some studies report estimates of the frequency of falls, and others report all patient incidents or accidents not distinguishing falls from other accidents such as medication or surgery errors, scalds and burns, scrapes and cuts, injury by hospital equipment, and self-inflicted wounds or attempted suicide (Feist, 1978; Barbiera, 1983; Catchen, 1983; Tinker, 1979; Elliot, 1979; Kalchthaler et al., 1978; Pablo, 1977; Margulec et al., 1970; Weil & Parrish, 1958; Parrish & Weil, 1958). Raz & Baretich (1987) in a review of the literature on patient falls reported that, depending on the patient population studied, between 25-89 percent of all hospital incidents are falls. Incidence rates for falls based on reports of all accidents will therefore obscure the true incidence rate of falls. Also, although some reports do provide estimates of the frequency of falls, patients of all ages were studied and rates specific to the elderly were not reported (Manjam & MacKinnon, 1973; Pablo, 1977; Morse et al., 1985; Weil & Parrish, 1958; Mion et al., 1989; Raz & Baretich, 1987). Finally, even within institutional settings, the characteristics of the elderly studied vary considerably. For example, the health status of elderly persons living in nursing homes or homes for the aged may vary considerably depending on the criteria for admission into the home. Similarly, elderly persons in geriatric, chronic, convalescent, rehabilitation or acute care hospitals may have widely different sociodemographic and health characteristics.

Table 1.9 summarizes the characteristics of 15 studies which provide estimates of the frequency of falls among the elderly in institutional settings. One study obtained data on falls

TABLE 1.9
FREQUENCY OF FALLS AMONG THE ELDERLY IN INSTITUTION-BASED STUDIES

Invest-igator	Study population	Method of ascertainment of falls	Frequency of falls[1] No falls per 1,000 persons per year(2)	No.falls per 1,000 person days(3)	Prevalence proportion of fallers
CROSS-SECTIONAL STUDY					
Brocklehurst et al (1982)	151 frail elderly subjects all living in some form of old person's residential care.	Information about the number of falls during the past year was given by 144 subjects.	-	-	43 0
FOLLOW-UP STUDIES					
Retrospective					
Morris & Isaacs (1980)	All patients admitted to and discharged from the geriatric department of Burton-on-Trent General Hospital during 1978. Patients who remained in the unit throughout the year were also included.	Accident reports completed by nursing staff after every fall during 1978 were abstracted onto punch cards.	422	-	-
Berry et al. (1981)	Elderly veterans (96% male) in a 400-bed geriatric hospital in Toronto, Canada.	Analysis of report forms on untoward incidents during the years 1976-78.	-	4 27	-
Louis (1983)	Agency A included residents aged 60 years or older in a 115-bed intermediate care facility for the elderly.	Data on falls were abstracted from incident reports for a two-year period.	-	3 0	-
	Agency B included residents aged 62-98 years in a 190-bed facility for the elderly. 44 beds were skilled care and 145 were self-care beds.	Review of incident reports for a three-month period.	-	2 1	-
Morgan et al. (1985)	12,248 patients admitted to a 152-bed acute care specialty hospital without pediatric or obstetrical services, in a United States metropolitan area. Patients 65 years or older had a total of 19,563 patient-days.	Information on inpatient falls was abstracted from incident reports for 22 consecutive months in 1981-82.	-	3.82	-
Venglarik & Adams (1985)	Residents in a 175-bed skilled nursing facility in Cleveland, Ohio, which provides long- and short-term rehabilitation services to older persons with multiple chronic disabilities.	Data on falls were extracted from incident reports during a three-year period from 1979-82.	1,292	-	-
Mayo et al. (1989)	All 1,805 patients admitted over a two-year period to a 120-bed rehabilitation hospital in a metropolitan area of a major Canadian city.	Data were abstracted from hospital incident reports.	-	7.56	19 7
Prospective					
Sehested & Severin-Nielsen (1977)	511 patients (457 were 65 years of age or older) in a 97-bed hospital geriatric department in Naestved, Denmark. The average hospitalization time per patient was 65 days.	Data on all falls during a one-year period were recorded by a nurse immediately after the fall occurred.	495	7.7	25.6
Gryfe et al. (1977)	441 active ambulatory persons over 65 years of age, living in a 200-bed standard care residential unit of the Baycrest Centre for Geriatric Care in Toronto.	Falls were documented using standard report forms during a five-year period from April 1968-April 1973.	668	1.8	45.0[4]
Fernie et al. (1982)	205 active, ambulatory residents aged 63-99 years from the domiciliary care units of the Baycrest Centre for Geriatric Care in Toronto.	Data on falls over a 12-month period were collected on standard report forms.	820	2.3	42.0
Wild (1983)	150 subjects in four residential homes.	A research nurse investigated the circumstances of all falls during a three-month period.	1,540	-	25.3[5]

TABLE 1.9 (continued)

Invest-igator	Study population	Method of ascertainment of falls	Frequency of falls		
			No falls per 1,000 persons per year	No falls per 1,000 person-days	Prevalence proportion
Brody et al. (1984)	Frail elderly women with senile dementia of the Alzheimer type living in the Philadelphia Geriatric Centre. Results for the first year of follow-up pertain to 60 women. Results for the second year pertain to the 49 survivors	Data on all falls were extracted from medical charts.	3,429	9.4	81.0[6]
Blake & Morfitt (1986)	All residents in a 60-place Social Services residential home for the elderly in Wolverhampton, England.	Information was collected about all falls observed by staff or reported by residents over a 16-month period.	3,623	-	-
Tinetti (1987)	79 first-time admissions between September 1982 and February 1983, to the three largest intermediate care facilities in Rochester, New York. Subjects were aged 61-92 years	Information of falls during the first year of residence was ascertained by review of incident reports and subject's chart.	2,785	7.6	61.0
Tremblay (1988)	412 ambulatory residents aged 60 years or older in eight centres d'accueil and d'hébergement in Quebec, Canada were followed for four months.	A report was completed for each fall within 48 hours of the fall.	1,845	5.5	27.7[7]

Notes :
(1) Where possible, when the frequency of falls was not reported, it was calculated from data presented in the article.
(2) Censored subjects usually not taken into account.
(3) Censored subjects taken into account.
(4) The proportion of fallers during the mean 2.2 years of follow-up.
(5) The proportion of fallers during the three-month follow-up.
(6) An average of 81% fell -78% of 60 women in the first year and 84% of 49 women in the second year.
(7) The proportion of fallers during the four-month follow-up.

experienced in the past year in a convenience sample of institutionalized elderly persons. Six studies obtained data through review of incident report forms and eight studies collected data on falls prospectively. These reports suggest that the frequency of falls among institutionalized elderly ranged from a low of 1.8 falls per 1,000 person-days (Gryfe et al., 1977) to a high of 9.4 falls per 1,000 person-days (Brody et al., 1984). The number of falls per 1,000 persons at risk per year ranged from 422 (Morris & Isaacs, 1980) to 3,623 (Blake & Morfitt, 1986). Finally the prevalence proportion of fallers ranged from 19.7 percent (Mayo et al., 1989) to 81 percent (Brody, 1984). Variability in estimates of the prevalence proportion of fallers is due, in part, to variable lengths of follow-up.

Reports which provide data on the frequency of multiple falls indicate that falling repeatedly is very common among the elderly in institutional settings. Depending on the study population and length of follow-up, between 8 and 32 percent of institutionalized elderly sustained multiple falls and, of those with at least one fall, 40 to 78 percent fell repeatedly (Table 1.6).

Although falls are very common among institutionalized elderly, serious physical injury caused by falling is not frequent. Morse et al. (1987) summarized the findings from 21 studies on patient falls (total of 7,580 falls), and reported that a mean of 63 percent of falls resulted in no injury, 31 percent resulted in minor injuries such as bruises or abrasions, and serious injury occurred in only 6 percent of falls. Among the institution-based studies reviewed here, most falls (93.7 percent) resulted in either no injury or only minor soft tissue injury. An average of 3.6 percent of falls resulted in fracture, 1.4 percent resulted in hip fracture and almost no falls directly resulted in death (Table 1.10).

TABLE 1.10

FREQUENCY OF FALL-RELATED INJURY AMONG THE ELDERLY IN INSTITUTION-BASED STUDIES[1]

Investigators	Total number of falls	Noninjurious falls	Injurious Falls		Falls resulting in fracture	
	n	%	Minor %	Severe[2] %	%	Hip fracture %
Follow-up Studies						
Retrospective						
Morris & Isaacs (1980)	236	75.0	23.3	1.7	1.7	-
Berry et al. (1981)	1,803	61.8	33.6	4.6	3.2	1.5
Louis (1983)						
Agency A	253	59.8	28.5	11.7	-	-
Agency B	36	52.0	34.1	13.9		
Venglarik & Adams (1985)	933	66.8	30.3	2.9	-	-
Prospective						
Gryfe et al. (1977)	651	54.2	28.3	17.5	6.1	1.2
Sehested & Severin-Nielsen (1977)	264	74.6	20.5	4.9	3.8	2.3
Blake & Morfitt (1986)	285	73.6	23.3	3.0		
Tinetti (1987)	220	-	-	6.4	2.7	0.5
Tremblay (1988)	254	47.2	50.0	2.8	1.6	-
TOTAL	**4,935**	**62.2**	**31.5**	**6.3**	**3.6**	**1.4**

Notes: (1) When percentages of injurious falls were not reported, they were calculated from data presented in the article.

(2) Definitions of severe injury varied between studies.

1.3 - RISK FACTORS FOR FALLS

Most recent investigators agree that falls probably result from a complex interaction between intrinsic factors specific to each individual and extrinsic factors related to the person's environment and surroundings. The relative importance of intrinsic and extrinsic factors probably varies from person to person and from fall to fall (Radebaugh, 1985; McVey & Studenski, 1988; Tinetti & Speechley, 1989). Hindmarsh and Estes (1989) described falls in terms of a "threshold model" rather than "the usual "medical" model, in which the outcome is related to a single disease or etiologic factor. In a "threshold" model, a number of factors combine to limit the patient's overall functional status, and any single added problem, which would be relatively minor under other circumstances, can tip the balance and lead to one or a series of falls.

Although hypotheses regarding the association between falls and specific possible risk factors are plentiful, the empirical evidence for many is often conflicting and inconclusive. Also, understanding of how these factors combine with situational and environmental variables to precipitate a fall remains limited (Nevitt, 1989). Some of the methodological reasons for this were discussed in Sections 1.1.1 and 1.1.2 and include lack of a standardized definition of falls, widely variable study populations and research designs, varying definitions of the potential risk factors studied and inappropriate or incomplete statistical analyses. In addition, many studies focus on one or two risk factors, so that interactions between many possible causes cannot be identified.

Potential risk factors for falls among the elderly can be subdivided into those which describe the sociodemographic characteristics of the elderly, those related to lifestyle, those which describe physical and mental health, activity restriction and disability, and finally, those that describe environmental hazards. The following sections summarizes the empirical evidence for the relationships between potential risk factors in each of these categories and falls among the elderly. Although evidence from clinic- and institution-based research is presented, the discussion is focused on evidence from community-based studies, and in particular on studies with strong research designs and analytic methods. Only studies which compare the characteristics of fallers with those of a comparison group have been included in this review. Studies which report only anecdotal evidence or which do not include a control group have been excluded.

1.3.1 - SOCIODEMOGRAPHIC CHARACTERISTICS

Although many of the earlier community-based studies suggested that increased age and female gender were risk factors for falls, four of the five more recent follow-up studies which used multivariate analysis to examine the independent contribution of many potential risk factors did not report significant associations between age and falls or between gender and falls (Table 1.11). Although the effects of sex and age appear to be "washed away" by stronger predictors, they are important characteristics to study because they help identify subgroups of elderly persons at (higher) risk of falling. Preventive efforts can be targeted more efficiently towards those subgroups which experience a higher rate of falls. Similarly, other sociodemographic characteristics such as living alone, social class, and marital status do not appear to be independently associated with falls in the elderly, but do provide important information about subgroups of persons at higher risk of falling.

Nevitt et al. (1989) found that in the United States, the risk of falling repeatedly among those with a history of falls was 2.4 times higher among Caucasians than non-Caucasians. However, he suggested that non-Caucasians might have been less likely to report falls, and that potential racial differences in the risk of falling should be further investigated in population based follow-up studies.

TABLE 1.11

SUMMARY OF THE LITERATURE ON THE ASSOCIATION BETWEEN SOCIODEMOGRAPHIC CHARACTERISTICS AND FALLS IN THE ELDERLY

Investigators	Sociodemographic characteristics							
	Age	Sex	Marital status	Social class	Living alone	Race	Custodial care	Area of residence
Community-Based Studies								
Sheldon (1948)	+	+						
Droller (1955)	+	+						
Prudham & Evans (1981)	+	+		o	o		o	
Campbell et al. (1981)	+		+		o			
Cook et al. (1982)	+	+						
Perry (1982b)	o	o	o		o			
Tinetti et al. (1988)	o	o				o	o	
Blake et al. (1988)	o	o						
Wickham et al. (1989)					+			+
Nevitt et al. (1989)	o	o			o	+		
Campbell et al. (1989)	+							
Clinic-Based Studies								
Lucht (1971)	+	+	+					
Wild et al. (1981b,d)	+	+	+	+	o		+	
Stegman (1983)	o	+	o				+	
Craven & Bruno (1986)	+				+			
Institution-Based Studies								
Gryfe et al. (1977)	+	+						
Louis (1983)	+	+						
Lund et Sheafor (1985)	+	o						
Tremblay (1988)	o	o						
Mayo et al. (1989)	o							
Myers et al. (1991)	+	o						

o : No association with falls was detected.
+ : Association with falls was detected.
Blank: Association not studied or not reported.

1.3.2 - LIFESTYLE FACTORS

There is little empirical evidence from community-based studies to suggest that lifestyle factors including use of tobacco, use of alcohol, level of physical activity and frequency of social interactions are associated with falls among elderly persons (Table 1.12). Although Campbell et al. (1981) found that males who visited a club or church infrequently were at increased risk of falling, this variable was not a strong predictor of falls.

Neither Tinetti et al. (1988) nor Nevitt et al. (1989) found that level of physical activity was an independent predictor of falls. However, Campbell et al. (1989) reported that lack of physical activity, loss of proximal muscle strength (shown by difficulty in getting up from a chair) and loss of stability when standing (shown by increased body sway) were all strongly associated with an increased risk of falling. These researchers suggested that programs to increase physical activity and improve muscle strength may decrease falls both in the individual at risk and also in the elderly population as a whole.

1.3.3 - HEALTH STATUS

Indicators of health status, activity limitation and chronic disabilities are generally believed to be strong predictors of the risk of falling in the elderly. In particular, chronic diseases and disabilities that impair cognitive, neurologic, or musculoskeletal function appear to increase the risk of falls (Nevitt, 1987; Tinetti, 1987). While the mechanisms by which specific diseases and disabilities increase the risk of falls is not clear, several investigators have suggested that deficits in the components of balance control are the major intrinsic factors causing falls in the elderly (McVey & Studenski, 1988; Nevitt, 1987). Balance control is the maintenance of a stable, upright position, and is dependent upon the system's ability to

TABLE 1.12

SUMMARY OF THE LITERATURE ON THE ASSOCIATION BETWEEN LIFESTYLE FACTORS AND FALLS IN THE ELDERLY

Investigators	Lifestyle Factors			
	Tobacco	Alcohol	Physical activity	Social isolation
Community-Based Studies				
Prudham & Evans (1981)	o	o		
Campbell et al. (1981)				+
Perry (1982b)		o		
Tinetti et al. (1988)		o	o	
Nevitt et al. (1989)		o	o	o
Campbell et al. (1989)		o[(1)]	+[(2)]	
Clinic-Based Studies				
Isaacs (1981)		+		
Gabell et al. (1985)			o	

o : No association with falls was detected.
+ : Association with falls was detected.
Blank: Association not studied or not reported.

Notes: (1) Although there were no difference between male fallers and nonfallers, there was a significant difference in alcohol intake in women who fell compared to those who did not fall. Specifically, women who did not take alcohol, took it infrequently or only in small amounts were more likely to fall than those who took alcohol regularly. The taking of nightcap, the most common type of drinking, and drinking before noon were not associated with increased risk of falling. The researchers suggested that several factors influenced the relationship of alcohol to falls. Poor physical health was one of the main reasons for subjects reducing alcohol intake. The use of psychotropic medication was highest in abstainers, and the proportion of abstainers increased with age. They concluded that excess alcohol may contribute to the occasional fall, but was not important in the community as a whole.

(2) The relative risk for "frequency outdoors" was 2.0 (95% confidence interval 0.8-4.8) in women. This variable was not retained in the logistic regression model for men.

recover rapidly from postural displacement. To accomplish this, the sensory system must be able to detect body displacement, the central nervous system must be able to integrate various data in order to program an appropriate motor response, and the neuromuscular system must be able to execute the motor commands. Age or disease-related decline in the visual, hearing, proprioceptive, vestibular, or motor systems, as well as the deleterious effects of medication could affect balance and postural control, and predispose the elderly to falling (McVey & Studenski, 1988).

Indicators of health status studied to date are numerous and include general indicators of health status, many specific diseases and health problems, use of medication and use of health services. The relationship between the risk of falls in the elderly and some of the more commonly studied health-related variables will be discussed in the following paragraphs.

1.3.3.1 - General indicators of health status

Although there is a general consensus that the risk of falls increases as general health status decreases or as the number of health problems increases, the empirical evidence for such an association from community-based studies is scanty (Table 1.13). Droller (1955) found that of those liable to fall, 41 percent were judged by a physician to be medically unfit whereas only 18 percent of those not liable to falls were unfit. Perry (1982a) compared self-perceived health status between fallers and nonfallers, and found that 17 percent of fallers reported that their health was worse than their peers', compared to 2 percent of nonfallers.

To date, there are no community-based studies which have reported on the association between the risk of falls and the number of health problems. Among the eight clinic- and institution-based studies which have examined this association, only Waller (1978) and Tinetti

TABLE 1.13
SUMMARY OF THE LITERATURE ON THE ASSOCIATION BETWEEN SPECIFIC HEALTH PROBLEMS AND THE RISK OF FALLS IN THE ELDERLY

	Health in general	No. of health problems	Respiratory disorders	Diabetes	Osteo-muscular disorders	Arthritis	Foot disorders	Incontinence	Gastro-intestinal disorders	Disorders of the nervous system & sense organs	Hearing disorders	Parkinson's disease	Seizures	Cardio-vascular disorders	High blood pressure	Postural hypotension	Stroke, hemiplegia	Other
Community-based Studies																		
Droller (1955)	+											o					o	
Prudham & Evans (1981)				o										+	o		+	
Campbell et al (1981)															+			
Perry (1982b)	+						o											
Tinetti et al (1988)							+	o								o		
Blake et al (1988)						+	+	o	o		o			o	o			
Nevitt et al (1989)			o			+		o				+	+	o				
Campbell et al. (1989)						+						o				o	+	
Clinic-based Studies																		
Waller (1978)		+																
Wild et al (1981b)								+								+		
Stegman (1983)	o(1)													o	o			
Gabell et al (1985)							+								o	+		
Craven & Bruno (1986)										+(2)								
Buchner & Larson (1987)						+	o			+						o		
Morris et al (1987)															o			
Robbins et al (1989)		o		o		o		o	o					o(3)	o	+		
Institution-based Studies																		
Sobel & McCart (1983)		o	+	o	o				+			+		+(4)	o		o	
Lund & Sheafor (1985)		o																o(5)
Tinetti et al. (1986)		+									+					+		
Tremblay (1988)		o	o		+				o	+				o				o(6)
Mayo et al (1989)		o						+		o							+	
Robbins et al (1989)		o		o		o		o	o					o(3)	o	o		
Myers et al (1991)				+		o				+				o(7)	o			o(8)

o — No association with falls
\+ — Association with falls was detected
Blank — Association not studied or not reported

Notes :
(1) Includes orthopedic, cardiovascular and/or neurologic disorders
(2) Includes Parkinson's disease, nonspecific tremor, seizure disorders, early dementia, and previous cerebrovascular disorders
(3) Includes cardiac arrhythmias and cardiac abnormalities
(4) Fallers had a higher prevalence of congestive heart failure, there was no difference between fallers and nonfallers in the prevalence of arteriosclerosis or atrial fibrillation.
(5) Includes anemia
(6) Includes each of endocrine disorders, genitourinary disorders and disorders of the skin
(7) Includes each of arrhythmia, arteriosclerotic cardiovascular disease, congestive heart failure and cardiac disorders
(8) Includes each of neoplasm and osteoporosis

et al. (1986) reported that the risk of falls increased as the number of health problems and/or disabilities increased.

1.3.3.2 - Specific diseases and health problems

In general, the empirical evidence regarding the association between falls and many specific diseases or health problems is only suggestive, in part because the associations have been studied infrequently and sometimes only in the context of studies with weak designs or methods, and in part, because the evidence between studies is often inconsistent (Table 1.13). The following paragraphs summarize the evidence for the relationship between falls in community-dwelling elderly, and a variety of more commonly studied health problems including acute illness, high blood pressure, postural hypotension, incontinence, arthritis, foot disorders, vision problems, previous falls, nonspecific symptoms, mental health problems, activity restriction and disability, and neuromuscular disorders.

Acute illness

Tinetti et al. (1988) studied episodes of serious illness (defined as those that confined a subject to bed for at least 48 hours) as a risk factor for falls in community-dwelling elderly. Although the variable was significantly associated with falls in univariate analysis, it was replaced by stronger predictors in the multivariate analysis. In an earlier study among the institutionalized elderly however, Tinetti et al. (1986) found that one-third of multiple fallers fell during an acute illness (usually an upper respiratory infection), and therefore suggested that an acute illness may be important by acting as a precipitant in persons predisposed to falling on the basis of their chronic disabilities.

High Blood pressure

The majority of investigators who have studied high blood pressure as a risk factor for falls in the elderly have reported that there is no association between these two variables. This finding appears to be consistent across community-, clinic- and institution-based studies (Table 1.13). Campbell et al. (1981) reported that, in discriminant analyses, lower systolic blood pressure was a risk factor for pattern falls[1] among men. However, it was not one of the principal predictors of pattern falls.

Postural hypotension

Postural hypotension, defined as a decrease of 20 mm Hg or more in systolic blood pressure on standing, occurs in about 10 percent of community-dwelling elderly (Tinetti & Speechley, 1989). It may cause instability and falls by compromising cerebral blood flow. To date, there is little empirical evidence that postural hypotension is associated with falls in community-dwelling elderly. Tinetti et al. (1988) reported that there was no independent association between falling and postural hypotension, although she suggested that the use of a longer time for equilibrium and supine measurements of blood pressure might have generated a significant association. Campbell et al. (1989) reported that women who had impaired blood pressure control on standing or systolic hypotension were at increased risk of falling. However this variable was replaced by stronger predictors in the multivariate analysis. Although there is little evidence in community-dwelling elderly, four of six clinic- and institution-based studies have reported evidence of a positive association (Table 1.13).

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[1] Pattern falls were those which, on history and examination, were assessed as arising from only minimal external upset and primarily from a disorder of balance or postural stability in the subject.

Urinary incontinence

There is little empirical evidence, at least from community-based studies, that incontinence is associated with an increased risk of falls (Table 1.13). The evidence from clinic- and institution-based studies is mixed and provides little clarification regarding this association.

Arthritis

Any disease or disability that affects the effector components of stability including the bones, muscles, and joints contributes to the risk of falling (Tinetti & Speechley, 1989). For example, degeneration of the cervical spine from cervical spondylosis, injury, or arthritis may disturb postural control and predispose persons to falls (Tinetti & Speechley, 1989). Empirical evidence from three community-based studies suggests that arthritis does indeed increase the risk of falls (Table 1.13). Blake et al. (1988) found that arthritis or rheumatism was retained as a significant variable in discriminant analysis (Wilk's lambda=0.92), and Nevitt et al. (1988) reported an odds ratio of 2.7 (95 percent confidence interval, 1.3-5.6) for arthritis in multivariate analyses. He suggested that arthritis might increase the risk of falls through impaired joint motion or reduced muscle strength around lower extremity joints. Campbell et al. (1989) also found that lower limb arthritis contributed to the risk of falling. The relative risk for "signs of knee arthritis" was 1.8 (95 percent confidence interval, 1.1-2.8) in women and 2.7 (95 percent confidence interval, 1.3-5.3) in men. Like Nevitt et al. (1989), they suggested that arthritis may contribute to the risk of falling through a decrease in stability and through muscle weakness secondary to decreased activity. Although more research is required, active physical treatment of arthritis in elderly people prone to falls may improve muscle strength and stability.

Foot disorders

Foot problems such as calluses, bunions, toe deformities, ulcers and deformed nails, and those resulting from ill-fitting shoes, may be underappreciated as a cause of instability and falls (Tinetti & Speechley, 1989). In general, the empirical evidence to date suggests that foot disorders do increase the risk of falls in the elderly (Table 1.13). Perry (1982a) found that 42 percent of fallers reported foot problems compared to 23 percent of nonfallers, but perhaps because of insufficient power, the association was not statistically significant. Tinetti et al. (1988) found that, in multivariate analysis, the relative risk for foot problems was 1.8 (95 percent confidence interval, 1.0-3.1), and Blake et al. (1988) reported that foot trouble was retained as a significant variable in discriminant analysis (Wilk's lambda=0.92).

Cardiovascular disorders

Prudham & Evans (1981) reported that 20.7 percent of fallers had heart disease, compared to 16.3 percent of nonfallers ($p<0.05$), and Campbell et al. (1989) found that a past history of stroke, especially when there were residual neurological signs, was strongly associated with an increased risk of falling. The relative risk for stroke was 13.6 (95 percent confidence interval, 2.6-71.3) in women and 1.8 (95 percent confidence interval, 0.6-5.8) in men. The investigators recommended that for patients who have had a stroke, careful attention should be paid to the safety of the home environment. Instruction on how to get up from the ground should be provided, and use of telephone activating devices when the person lives alone should be considered.

On the other hand, Blake et al. (1988) found that heart trouble was not retained as a significant variable in discriminant analysis, and Nevitt et a'. (1989) reported that all cardiovascular findings had relative risks ranging from 0.7 to 1.5 with 95 percent confidence intervals that included 1.0 (Table 1.13).

Vision problems

Vision provides important spatial information in maintaining equilibrium, and may serve as the predominant means of assessing body position as aging and disease diminish the input from the kinaesthetic and vestibular systems (McVey & Studenski, 1988). The normal process of aging may produce visual deficits such as reduction in acuity, peripheral fields, color and depth perception, dark adaptation, glare tolerance, gaze stability, and temporal visual processing. The net effect is decreased ability to see objects clearly, focus at different distances, function in low light, discern colour intensity, and judge distances (Duthie, 1989). These in turn, could affect postural stability and increase the risk of falls (Tinetti & Speechley, 1989). Diseases such as cataracts, glaucoma, and macular degeneration may further impair vision and increase the risk of falling.

To date, the empirical evidence for an association between vision and falls in community-dwelling elderly is mixed (Table 1.14), and may reflect a difficulty in defining and measuring an appropriate indicator of visual impairment. Prudham & Evans (1981) found that use of spectacles did not differ between fallers and nonfallers. Campbell et al. (1981) reported that, although women experiencing pattern falls had poorer vision that those who did not, poor vision was not significant in discriminant analyses. Similarly, neither "poor eyesight" nor "registered blind" were retained as significant variables in Blake et al.'s study (1988).

Perry (1982a) on the other hand, found that problems with near vision was one of the best predictors of falling, and Tobis et al. (1985) reported that errors in visual perception of verticality and horizontality were significantly more prevalent in older fall victims, compared to nonfallers. Nevitt et al. (1989) also reported a positive association between vision and falls, specifically, that decreased depth perception was an independent risk factor for three or more falls. He suggested that accurate perception of spatial relationships is important in negotiating obstacles and may also contribute to postural stability. Although Tinetti et al. (1988) found

TABLE 1.14

SUMMARY OF THE LITERATURE ON THE ASSOCIATION BETWEEN VISION PROBLEMS AND FALLS IN THE ELDERLY

Investigators	Poor vision	Visual disorders	Failure to wear eye glasses	Cataracts	Glaucoma
Community-Based Studies					
Prudham & Evans (1981)			o		
Campbell et al. (1981)	o				
Perry (1982b)	+				
Tobis et al. (1985)	+				
Tinetti et al. (1988)	o				
Blake et al. (1988)	o				
Nevitt et al. (1989)	+				
Campbell et al. (1989)	o				
Clinic-Based Studies					
Gabell et al. (1985)			+		
Craven & Bruno (1986)	+				
Buchner & Larson (1987)				o	
Robbins et al. (1989)	o	o			
Institution-Based Studies					
Brocklehurst et al. (1982)	o				
Sobel & McCart (1983)					o
Tinetti et al. (1986)	+				
Robbins et al. (1989)	o	o			
Myers et al. (1991)	o				

o : No association with falls was detected.
+ : Association with falls was detected.
Blank: Association not studied or not reported.

that poor vision was significantly associated with falling in univariate analyses, it was not included in the final risk model, probably because of its strong association with balance and gait abnormalities which were included in the final risk model. Campbell et al. (1989) were also unable to demonstrate an association between impaired vision and increased risk of falls. Findings from clinic- and institution-based studies are also mixed and do not clarify the nature of the association between vision and falls in the elderly.

Previous falls

A history of falls appears to substantially increase the risk of falling, a finding which is consistent across community-, clinic-, and institution-based studies (Table 1.15). Among community-based studies, Tinetti et al. (1988) found the relative risk for falling in the previous two years was 2.5 (95 percent confidence interval, 1.9-3.4). Nevitt et al. (1989) reported adjusted odds ratios of 2.4 (95 percent confidence interval, 1.3-4.4) for ≥3 falls in the past 12 months, and 3.1 (95 percent confidence interval, 1.5-6.4) for >1 fall-related injury in the past 12 months. Campbell et al. (1989) found that a history of previous falls was significantly associated with falls in univariate analysis, but did not include this variable in the multivariate analysis because it was considered to be a marker of frailty or poor mobility and not a cause of falls. Nevitt et al. (1989) suggested that recurrent falls is a chronic disorder; those who have fallen repeatedly in one year have a substantially increased risk of falling repeatedly in the subsequent year, underscoring the importance of a careful history of falls to investigate intrinsic and extrinsic factors that contributed to a previous fall. Correction or treatment of these factors may help prevent further falls caused by the same factors.

Nonspecific symptoms

The empirical evidence on the association between nonspecific symptoms such as blackouts, faints, headaches, dizziness, and weakness, and the risk of falls in the elderly is inconclusive (Table 1.16). Only dizziness, vertigo, and giddiness have been examined

TABLE 1.15

SUMMARY OF THE LITERATURE ON THE ASSOCIATION BETWEEN HISTORY OF PREVIOUS FALLS AND FALLS IN THE ELDERLY

Investigators	Previous fall	Previous fracture
Community-Based Studies		
Prudham & Evans (1981)		o
Tinetti et al. (1988)	+	
Nevitt et al. (1989)	+	
Campbell et al. (1989)	+	
Clinic-Based Studies		
Waller (1978)	+	
Wild et al. (1981b)	+	
Institution-Based Studies		
Tinetti et al. (1986)	+	
Myers et al. (1991)	+	o

o : No association with falls was detected.
+ : Association with falls was detected.
Blank: Association not studied or not reported.

TABLE 1.16

SUMMARY OF THE LITERATURE ON THE ASSOCIATION BETWEEN NONSPECIFIC SYMPTOMS AND FALLS IN THE ELDERLY

Investigators	Dizziness, vertigo, giddiness	Blackouts, faints	Headaches	Double vision, visual blurring	Drowsiness	Insomnia	Numbness, weakness	Recent weight loss	Ataxia
Community-Based Studies									
Droller (1955)	o								
Prudham & Evans (1981)	+(1)	+		+			+		
Perry (1982b)	+								
Tinetti et al. (1988)	o								
Blake et al. (1988)	+		o						
Wickham et al. (1989)								+	
Clinic-Based Studies									
Stegman (1983)	+(2)								
Gabell et al. (1985)	o(3)								
Buchner & Larson (1987)							+		
Institution-Based Studies									
Sobel & McCart (1983)	+		+	+	+	+			+

o : No association with falls was detected.
+ : Association with falls was detected.
Blank: Association not studied or not reported.

Notes :
(1) Nonrotary vertigo was associated with falls; rotary vertigo was not associated with falls.
(2) Includes weakness, dizziness and/or orthostatic hypotensive symptoms.
(3) Includes fear of falling/sense of imbalance.

frequently in community-based studies, and no clear trends have emerged. Prudham & Evans (1981) compared the frequency of nonspecific symptoms among fallers and nonfallers, and found that episodes of dizziness and faints or blackouts, non-rotary vertigo, episodes of numbness or weakness, and a history of double vision were all more common among fallers. They suggested that these symptoms may represent a generalized failure of proprioceptive mechanisms. Perry (1982a) and Blake et al. (1988) also found that dizziness was associated with falling. However, neither Droller (1955) nor Tinetti et al. (1988) found an association between dizziness and the risk of falling.

Mental health problems

Impaired mental health (cognitive impairment, depression, confusion, distraction, agitation, impaired judgement) could affect the risk of falls by increasing exposure to hazardous situations through confusion or impaired judgement. The cognitively impaired or depressed elderly may be more prone to take unnecessary risks in their daily activities or to demonstrate a tendency for inattention or carelessness (McVey & Studenski, 1988). Alternatively the risk of falls may be increased through associated use of psychotropic medication. Neurologic disorders or other illnesses associated with cognitive impairment or depression could also increase the risk of falls.

The empirical evidence regarding the association between falls and cognitive impairment is fairly consistent across community-, clinic- and institution-based studies, and is suggestive of a positive association with falls in the elderly (Table 1.17). Among the community-based studies, two early cross-sectional surveys (Prudham & Evans, 1981; Campbell et al., 1981) and one later follow-up study reported a positive association between falls and cognitive impairment. In fact, Tinetti et al. (1989) reported that the risk of falling was five times higher among those with cognitive impairment as measured by the Short Portable Mental-Status Questionnaire. Subjects with severe impairment had been excluded

TABLE 1.17

SUMMARY OF THE LITERATURE ON THE ASSOCIATION BETWEEN MENTAL HEALTH STATUS AND FALLS IN THE ELDERLY

Investigators	Mental Health Status					
	General mental health	Cognitive impairment, dementia, confusion, poor memory	Depression, anxiety, psychosis	Morale	Agitated behavior	Other
Community-Based Studies						
Prudham & Evans (1981)		+				
Campbell et al. (1981)		+	+			
Perry (1982b)	o					
Tinetti et al. (1988)		+	o			
Nevitt et al. (1989)		o	o			
Campbell et al. (1989)		o				
Clinic-Based Studies						
Waller (1978)		+				
Wild et al. (1981b)	+					
Gabell et al. (1985)			+			
Buchner & Larson (1987)		o				
Morris et al. (1987)		+				
Robbins et al. (1989)	+					
Institution-Based Studies						
Sobel et McCart (1983)	+	o	+			
Lund & Sheafor (1985)		+				
Tinetti et al. (1986)	+			+		
Vellas et al. (1987)		+	+		+	
Tremblay (1988)		+				
Mayo et al. (1989)	o[1]					
Robbins et al. (1989)	o					
Myers et al. (1991)		o	o			o[2]

o : No association with falls was detected.
+ : Association with falls was detected.
Blank: Association not studied or not reported.

Notes: (1) Includes not fully alert or oriented at any time.
(2) Includes each of neurotic disorders and Alzheimer's disease.

from the study, and Tinetti et al. (1989) suggested that this exclusion probably resulted in an underestimation of the risk of falling associated with cognitive impairment.

Nevitt et al. (1989) on the other hand, reported that mental status as measured by the Mini-Mental State Examination and the slowest 25 percent in the Trail Making Task, was not associated with falling repeatedly. Similarly, Campbell et al. (1989) reported that impaired memory shown by a short mental status questionnaire was not an independent risk factor for falls. However, these researchers suggested that because of poor memory, these subjects may not have had all their falls recorded, decreasing the chances of demonstrating an association.

Evidence of an association between depression and falls in the elderly is mixed. Although two follow-up community-based surveys suggested that there is no association, three clinic- and institution-based studies have reported a positive association.

Activity restriction and disability

Many community-, clinic-, and institution-based studies which have examined the association between falls in the elderly and activity restriction or disability have reported that there is a positive association between these indicators and the risk of falls (Table 1.18). In the community-based studies, both Prudham and Evans (1981) and Campbell et al. (1981) found that, compared to nonfallers, fallers had more functional disabilities in activities of daily living and increased impairment of mobility. Tinetti et al. (1988) measured level of mobility (frequency of leaving neighbourhood), functional disability (gross impairment of mobility, physical-performance disability and disability in activities of daily living), and disabilities of the upper and lower extremities (any reported problems with strength, sensation or balance). Although all these indicators were significantly associated with falls in univariate analyses, only lower extremity disability was retained in the multivariate analysis. The investigators suggested that lower extremity disability might indicate difficulty with neurologic and

TABLE 1.18

SUMMARY OF THE LITERATURE
ON THE ASSOCIATION BETWEEN ACTIVITY RESTRICTION
AND DISABILITY AND FALLS IN THE ELDERLY

Investigators	House-bound	Restriction in activities of daily living	Lower extremity disability	Upper extremity disability	Mobility	Use mobility aid, assistive devices
Community-Based Studies						
Prudham & Evans (1981)	+	+			+	
Campbell et al. (1981)		+			o	+
Perry (1982b)						
Tinetti et al. (1988)	o	o	+	o	o	o
Nevitt et al. (1989)	o	o				
Wickham et al. (1989)		+			+	
Campbell et al. (1989)					o	o
Clinic-Based Studies						
Wild et al. (1981b,d)					+	
Gabell et al. (1985)					+	
Buchner & Larson (1987)		+				
Robbins et al. (1989)		o				o
Institution-Based Studies						
Sobel & McCart (1983)						+
Lund & Sheafor (1985)						+
Tinetti et al. (1986)		+			+	+
Vellas et al. (1987)					+	
Tremblay (1988)						o
Mayo et al. (1989)		o				
Robbins et al. (1989)		o				o
Myers et al. (1991)					+	

o : No association with falls was detected.
+ : Association with falls was detected.
Blank: Association not studied or not reported.

musculoskeletal functions that contribute to physical stability. Wickham et al. (1989) found that the risk of falling was double in those who were housebound, chairfast, or who had limited outdoor mobility, compared to those who were fully mobile. Nevitt et al. (1989) on the other hand, found that impairment in activities of daily living and "leaves residence" were both displaced by stronger predictors in multivariate analyses. Similarly, Campbell et al. (1989) found that none of mobility (measured with a timed 15-meter walk), use of cane, frame or elbow crutches were significant in logistic regression analyses.

Neuromuscular dysfunction

As indicated earlier, age or disease-related disturbances of balance and gait may eventually prove to be the causal link between health status and falling (Nickens, 1985). Acute or chronic disturbances which affect the complex interaction between sensory input, central nervous system integration, and motor output (the components of human locomotion), may cause a fall (Sorock, 1988). Gait and balance disorders may be implicated in falls with and without an overt environmental component, the common factor being a displacement of the body beyond its support base which is not corrected in time to avoid a fall (Isaacs, 1985).

Many characteristics of neuromuscular performance (postural reflexes, reaction time, muscle strength, proprioception, tactile sensation, vestibular sense, vibration sense) have been studied in relation to the risk of falls (Table 1.19). In particular gait, balance, and sway have been studied repeatedly in community-, clinic-, and institution-based studies. In spite of variable definitions, measuring instruments and techniques, the results at least for balance and sway are quite consistent, and suggestive of an association with the risk of falls. The results on gait are mixed and therefore difficult to interpret.

Among the recent community-based follow-up studies, Nevitt et al. (1989) studied 17 indicators of neuromuscular performance. Only difficulty standing up from a chair and poor

TABLE 1.19
SUMMARY OF THE LITERATURE ON THE ASSOCIATION BETWEEN NEUROMUSCULAR INDICATORS AND FALLS IN THE ELDERLY

	Neuro-muscular findings	Knee reflexes	Knee strength	Leg strength	Hip strength	Gait	Balance	Sway	Flexi-bility	Chair stand	Tandem walk	Grip strength	Palmo-mental reflex	Plantar reflex	Posture, changing posture	Neck move-ments	Lower extremity coordi-nation	Unable to extend back	Proprio-ception	Other
Community-based Studies																				
Droller (1955)														+						
Overstall et al. (1977)								+												
Overstall et al (1978)								+												
Campbell et al (1981)															o					o[7]
Perry (1982b)						+														
Ring et al (1988)								+												
Tinetti et al. (1988)						+[1]	+[1]						+							
Blake et al (1988)									o			+								
Nevitt et al (1989)		+	o		o	o				+	+	o								o[4]
Wickham et al (1989)												+								
Campbell et al (1989)				o				+		+		+								
Chandler et al. (1990)							+													
Gehlsen et al (1990 a,b)				+		o	+		+											
Clinic-based Studies																				
Wild et al. (1981b,d)						+	+													+[10]
Gabell et al. (1985)						o[2]	+[3]							+		+				
Craven & Bruno (1986)							+													
Buchner & Larson (1987)	o[8]					o	+													
Morris et al (1987)	o														o					
Robbins et al. (1989)			o		+	o	+													o[9]
Institution-based Studies																				
Brocklehurst et al (1982)								+											+	o[5]
Fernie et al. (1982)								+												
Tinetti et al. (1986)					+	+	+									+	+	+		
Guimaraes & Isaacs (1988)						+														
Robbins et al. (1989)			o		+	o	+													o[9]
Mayo et al (1990)																				o[6]

o . No association with falls
+ Association with falls was detected
Blank Association not studied or not reported.

Notes :
[1] Scores for a three-item gait score and a four-item balance score were summed.
[2] Includes the gait parameters of velocity, step-length variability, and double support/stride time.
[3] Includes inverse Romberg ratio (greater stability on eye closure than with eyes open); raised Romberg ratio (excessive sway on eye closure) showed no association with falls
[4] Includes each of knee muscle tone, hip or knee pain, cogwheeling rigidity (brachial), pronator drift, pretibial edema, step-ups, one-leg balance, walking speed, arm swing, number of steps in 180° turn, and reaction time in feet.
[5] Includes each of vestibular sense and vibration sense.
[6] Includes reaction time to visual stimuli
[7] Includes symptoms turning head
[8] Includes neuromuscular rigidity
[9] Includes each of extrapyramidal signs, frontal release signs, sensory abnormalities in upper or lower extremities, absent patellar reflex, absent Achilles reflex, weak ankle strength, weak shoulder strength, and weak elbow strength
[10] Includes abnormal response to sternal pressure (push test)

tandem gait were significantly associated with two or more falls. Absent knee reflexes was identified as an additional risk factor for three or more falls. The investigators suggested that two simple tests (a patient's ability to stand up from a chair and to perform a tandem walk) were the most useful indicators of the risk of multiple falls, perhaps because these abilities require a combination of neuromuscular competences including dynamic balance, strength, and an adequate range of motion in the lower extremities.

Although neither Nevitt et al. (1989) nor Gehlsen et al. (1990) reported an association, both Perry (1982a) and Tinetti et al. (1988) identified gait as a risk factor for falls. Tinetti suggested that balance and gait problems (among others) indicate difficulty with neurologic and musculoskeletal functions that contribute to stability. However, in their study, the association with falls was not stronger than for several other risk factors, and the investigators suggested that their indicator of balance and gait might be problematic. Also, the relationship between gait and falling is complex since elderly persons with gait problems might adapt over time or avoid certain risks, thus limiting their risk.

Tinetti et al. (1988) reported that the palmomental reflex was associated with falls, and probably reflects central nervous system dysfunction. Although nonspecific, it is a simple test that may help identify elderly persons who require more thorough clinical and radiologic evaluation.

Finally, Campbell et al. (1989) reported that body sway, grip strength, and ability to rise from a chair were all significant predictors of falls in logistic regression analyses, with relative risks ranging between 1.7 and 3.4. They suggested that loss of proximal muscle strength, and loss of stability when standing can be increased by physical training in the elderly, and that programs to increase physical activity and improve muscle strength may decrease falls both in the individual at risk and in the elderly population as a whole.

Body-mass

To date, only one community-based study has examined body mass as a risk factor for falls. Tinetti et al. (1988) reported that there was no association between body-mass index and the risk of falls in the elderly.

1.3.3.3 - Use of medication

Although the possible causal role of some medications in increasing the risk of falls appears plausible, the empirical evidence for individual drugs is often difficult to interpret. Investigators tend to include widely different medications under the same category, so that comparison between studies is difficult. In addition, many studies rely on self-reports of medication use, which could be subject to recall bias and result in substantial misclassification of exposure. Finally, it may be difficult to differentiate the effect of a specific drug from the effect of the underlying disease for which the drug is taken. Table 1.20 summarizes the evidence for some of the more frequently studied medications.

Although many anecdotal reports have suggested that polypharmacy increases the risk of falls in the elderly, only four of 13 studies which examined this association systematically reported that a positive association existed.

Several studies have examined the association between falls and the use of psychotropic drugs, sedatives and/or tranquillizers, with mixed results. Among the community-based studies, Prudham & Evans (1981), Tinetti et al. (1988), Sorock & Shimkin (1988), Wickham et al. (1989) and Campbell et al. (1989)[1], all reported statistically significant associations. In

[1] Campbell et al. (1989) reported that the relative risk for psychotropic drugs among women was 1.6 (95 percent confidence interval, 1.0-2.8). This variable, however, was not retained in the logistic regression model for men.

TABLE 1.20

SUMMARY OF THE LITERATURE ON THE ASSOCIATION BETWEEN USE OF MEDICATION AND FALLS IN THE ELDERLY

Investigators	Use of medication	No of medications	Psychotropic drugs, sedatives, tranquillizers	Antidepressants	Hypnotics	Antipsychotics	Anticonvulsants	Diuretics	Antihypertensives	Antianginals, cardiac drugs	Analgesics	Vasodilators	Topical eye preparations	Others
Community-Based Studies														
Prudham & Evans (1981)	+		+	o				+						o[1]
Campbell et al. (1981)		o												
Perry (1982b)			o						o					
Tinetti et al. (1988)			+[3]											+[2]
Sorock & Shimkin (1988)			+											
Blake et al (1988)		o	o	o	o			o	o					
Nevitt et al. (1989)			o	o				o						
Wickham et al. (1989)		+[6]												
Campbell et al (1989)		+	+			o								o[15]
Clinic-Based Studies														
Wild et al. (1981b)	+		+											
Isaacs (1981)				o	+				+		+			o[13]
Stegman (1983)									o					
Craven & Bruno (1986)									o[5]					
Morris et al (1987)		o												o[4]
Buchner & Larson (1987)		o												+[12]
Robbins et al. (1989)		o												
Institution-Based Studies														
Louis (1983)		o												
Sobel & McCart (1983)						o		+	o	o				+[9]
Lund & Sheafor (1985)		o	o	o	o			+						+[7]
Tinetti et al. (1986)														+[8]
Vellas et al. (1987)		+												
Tremblay (1988)		o	+[10]				o	o		o	o			o[11]
Mayo et al. (1989)		o		o	o		+	o		o			+	o[14]
Robbins et al. (1989)		+												
Myers et al (1991)			o	o				o		o	o	+		o[16]

o . No association with falls was detected.
+ Association with falls was detected
Blank· Association not studied or not reported

Notes:
(1) Includes cerebral activators, hypnotics (sleeping tablets), hypotensives, and angina therapies
(2) Includes diuretics, antihypertensive agents, and cardiac medications
(3) Includes benzodiazepines, phenothiazines, and antidepressants.
(4) Includes cardiovascular drugs and psychotropic agents
(5) Includes blood pressure medication and diuretics.
(6) Includes non-phenothiazine tranquilizers.
(7) Includes vitamins and iron, and anticonvulsants
(8) Includes antidepressants, phenothiazines, and sleeping medications
(9) Includes sedatives/hypnotics
(10) Includes barbiturates only.
(11) Includes each of tricyclics, ains, phenothiazines, benzodiazepines, antihistamines, hypoglycemics and antiparkinsonian drugs
(12) Includes adverse drug reaction
(13) Includes anti-dizziness drugs
(14) Includes each of laxatives, bronchodilators, and anti-diarrhea drugs
(15) Includes each of drugs causing postural hypotension and anti-inflammatory drugs.
(16) Includes each of nonsteroidal anti-inflammatory drugs, anti-Parkinson's drugs, hypoglycemics, hypotensives, opiate agonists, and potassium

fact, Tinetti et al. (1988) reported that the adjusted odds ratio for use of benzodiazepines, phenothiazines and antidepressants was 28.3 (95 percent confidence interval, 3.4-239.4). Others however, have not found significant associations between these medications and falls (Campbell et al., 1981; Perry, 1982a; Blake et al., 1988; Nevitt et al., 1989).

Evidence of a lack of association between antidepressants and falls is consistent across community-, clinic-, and institution-based studies. Similarly there is little evidence to suggest that antihypertensives increase the risk of falls. The empirical evidence for other drugs including hypnotics, antipsychotics, anticonvulsants, diuretics, cardiovascular drugs and analgesic eye preparations is either limited or mixed, and therefore inconclusive.

1.3.3.4 - Use of health services

The evidence on the association between use of health services and falls in the elderly has been studied infrequently, and the results are far from conclusive. Both Campbell et al. (1981) and Wild et al. (1981a) suggested that need for and use of professional and/or family support were risk factors for falls, and Prudham & Evans (1981) found that fallers had had more recent contact with their general practitioners than nonfallers. However, Tinetti et al. (1988) found no association between hospitalizations in the past year and falls (Table 1.21).

1.3.4 - ENVIRONMENTAL HAZARDS

Environmental factors such as objects tripped over, poor lighting, slippery surfaces, and poorly designed or inappropriate furniture, contribute to most falls (Tinetti & Speechley, 1989). More subtle factors such as visual or spatial design may also contribute to falls (Nevitt, 1987). Although there are almost no controlled studies, Tinetti & Speechley (1989) state that there is general agreement on three points regarding the association between the risk

TABLE 1.21

SUMMARY OF THE LITERATURE ON THE ASSOCIATION BETWEEN USE OF HEALTH OR SOCIAL SERVICES AND FALLS IN THE ELDERLY

Investigators	Hospital-ization	Physician consultations	Professional and/or family support
Community-Based Studies			
Campbell et al. (1981)			+
Prudham & Evans (1981)		+	
Tinetti et al. (1988)	o		
Clinic-Based Studies			
Wild et al. (1981a)		+	+

o : No association with falls was detected.
+ : Association with falls was detected.
Blank: Association not studied or not reported.

of falls and environmental hazards. First, even minor hazards such as long pants or ill-fitting shoes can be a serious hazard among frail elderly such as those in nursing homes. Second, the extent of an individual's disabilities affects the degree of hazard posed by environmental hazards, and finally, experience with an environmental factor such as stairs used regularly, may lower the risk associated with that factor.

Although many researchers mention environmental hazards as important contributing factors, only two studies have systematically examined the association with falls. Consistency between these studies might be difficult to achieve because of a lack of a reliable and valid measure of environmental hazards both in and out of the home.

Tinetti et al. (1988) reported that 44 percent of the falls occurred in the presence of environmental hazards (e.g. objects tripped over (25 percent of falls), stairs (10 percent), and snow and ice (3 percent)). However, a systematic evaluation of home hazards showed that the number of hazards in the bedroom and living room was not significantly associated with falling, although there were trends toward both increased and decreased risk in individual rooms. Tinetti et al. (1988) suggested that the relationship between environmental hazards and falls is complex. Subjects at greatest risk of falling might have made changes to improve safety in some rooms and might have limited their use of other rooms.

Nevitt et al. (1989) excluded falls which occurred outside the home, and found that subjects who reported one or more environmental factors in the home which interfered with activities of daily living (such as poor lighting or low seats) were 3.1 times more likely to experience multiple falls in the home. However, reports of hazards (e.g. loose rugs, obstacles on floor, stairs without railings) and safety habits (e.g. use of nonskid surfaces in bathrooms) were not significantly associated with falls at home.

1.4 - RISK FACTORS FOR FALL-RELATED INJURY

To date, there are no community-based studies which have reported specifically on risk factors for fall-related injury among community-dwelling elderly. Although no empirical evidence is reported, Melton & Riggs (1985) identified several possible risk factors for increased trauma after a fall. Factors related to the environmental circumstances of the fall included height of fall and hardness of the landing surface. Factors related to the individual included increased frequency of falls, orientation of the fall, speed and effectiveness of protective responses, and impaired energy absorption (decreased protective behavior, slowed reflexes, diminished muscular response, and reduced soft padding tissue). In addition, Melton & Riggs (1985) suggested the increased risk of fall-related fractures among the elderly could relate to a variety of changes in skeletal resistance to fractures, including reduced repair of microfractures, impaired bone mineralization and osteoporosis. Nevitt (1990) pointed out that in addition to the increased risk of injury related to a fall, older people often have a worse outcome than younger people because of impaired tissue regeneration, decreased functional reserves, and poorer immunologic function.

Only three institution-based studies have provided empirical evidence on the risk factors for injurious falls. Tinetti (1987) studied factors associated with injurious falls among ambulatory nursing home residents. Forty-eight of 79 subjects fell during their first year of residence and 14 fallers sufferred serious injury (defined as all nonvertebral fractures and all other injuries resulting in emergency room stay for more than 24 hours, admission to acute hospital, bedrest for more than 48 hours, or restriction in activity for more than 72 hours). Factors associated with injurious falls included lower extremity weakness and a recent previous fall. However injured fallers tended to require less assistance with activities of daily living and in addition, were less likely to be depressed than noninjured fallers. Tinetti (1987) reported that the finding that injured fallers tended to be more independent, yet have greater lower extremity weakness, suggests that both force of injury and protective responses of the faller, may contribute to the likelihood of injury during a fall.

Although few falls among the elderly result in fracture, over 90 percent of hip fractures are the result of a fall. Grisso et al. (1991) conducted a case-control study of 174 women (median age, 80 years) admitted with a first hip fracture, to assess whether several known risk factors for falls were also important risk factors for hip fracture. Risk factors identified included lower-limb dysfunction (odds ratio = 1.7, 95 percent confidence interval, 1.1-2.8), visual impairment (odds ratio = 5.1, 95 percent confidence interval, 1.9-13.9), previous stroke (odds ratio = 2.0, 95 percent confidence interval, 1.0-4.0), Parkinson's disease (odds ratio = 9.4, 95 percent confidence interval, 1.2-76.1), and use of long-acting barbiturates (odds ratio = 5.2, 95 percent confidence interval, 0.6-45.0). No associations were reported for dizziness, limping, numbness or problems with balance. Also, there was no increased risk associated with use of alcohol or use of long-acting benzodiazepine medication. Grisso et al. (1991) concluded that because of the similarity of risk factors, effective programs to prevent falls will also be useful in preventing hip fractures.

Finally, in a case-control study of 184 matched pairs of patients 65 years or older in a long-term care facility in Baltimore, Maryland, Myers et al. (1991) reported that among fallers, the diagnosis of dementia (odds ratio=7.5) or taking a diuretic (odds ratio=7.2) was positively associated with injury ($p \leq 0.01$).

1.5 - SUMMARY

This literature review has shown that falls are a frequent occurrence among both community-dwelling and institutionalized elderly. Although few falls actually result in serious injury, falls are the leading cause of injury-related hospitalization and death among the elderly.

Even when there is no physical injury, the psychological trauma resulting from a fall may be severe, leading to inappropriate and undesirable limitations in activity and increased dependence. The financial and social burden of falls and their consequences is substantial, and will continue to increase as the number of persons surviving to the sixth decade of life and beyond increases.

Over the last decade, the number of publications on falls among the elderly has increased substantially reflecting the increased interest in what has become a major public health problem. Several recent follow-up studies have confirmed earlier estimates of the frequency of falls and fall-related injury in community and institutional settings. However, knowledge about the many potential risk factors for falls and in particular, about the possibly complex interactions between risk factors is lacking. There is general consensus that both intrinsic and extrinsic environmental factors contribute to most falls, and that deficits in the components of balance control are the major intrinsic factors causing falls in the elderly. Although there are many hypotheses regarding the association between the risk of falls and individual factors, the empirical evidence for these associations is often conflicting and inconclusive. Possible risk factors for which the empirical evidence is relatively consistent across community-based studies include arthritis, foot disorders, activity restriction or disability (and in particularly, disability of the lower extremities), history of previous falls, balance, sway and cognitive impairment. Although the evidence is somewhat less solid, impaired gait, visual deficits, depression, and the use of sedatives or tranquillizers also appear to increase the risk of falls. Among those factors which do not appear to increase the risk of falls (at least among community-dwelling elderly) are sociodemographic characteristics, lifestyle habits, high blood pressure, urinary incontinence, body-mass, use of antidepressants, and use of antihypertensives. There are almost no controlled studies which specifically address the identification of risk factors for injurious falls among community-dwelling elderly.

As indicated earlier, the current study was undertaken to provide data on the incidence and risk factors for falls and fall-related injury among community-dwelling elderly persons in Montreal, Quebec, prior to selecting, implementing and evaluating a fall prevention intervention for the at-home elderly. During the planning phases of this study there were almost no community-based follow-up studies of falls among the elderly reported in the literature. The data available at that time were considered questionable because they derived either from studies of institutionalized elderly or from cross-sectional surveys of community-dwelling elderly, in which recall bias could result in substantial underestimates of the frequency of falls. In addition, identification of the risk factors for falls in these studies was problematic for the reasons described earlier in this chapter. To minimize the problems of recall bias and to establish temporality of exposure to potential risk factors, it was decided to conduct a concurrent follow-up study of falls and fall-related injury in a representative sample of community-dwelling elderly.

CHAPTER 2 - OBJECTIVES

The overall objective of the research was to determine the incidence rate of falls and the risk factors for falling in community-dwelling elderly persons and to make recommendations regarding the development and implementation of preventive interventions.

The specific objectives were:

1) to determine the incidence density of falls and fall-related injuries in community-dwelling elderly persons,

2) to describe injuries sustained as a result of a fall,

3) to describe the characteristics of falls occurring among community-dwelling elderly, including the time when the fall occurred (hour of day, day of the week, month of the year), the place where the fall occurred, the subject's activity at the time of the fall, the subject's self-reports of the reason for the fall, physical symptoms experienced prior to the fall, and other aspects of the fall including height of fall, direction of fall, parts of body receiving impact, characteristics of the surface onto which the subject fell, length of time on the ground, presence of witnesses, and help getting up from the ground,

4) to determine the incidence density ratio between falls and fall-related injuries sustained during the 48-week follow-up period, and possible risk factors including sociodemographic characteristics, lifestyle habits including level of physical activity, use of alcohol, and social interactions, health status, disability, use of medication and use of health services.

CHAPTER 3 - METHODS

This chapter describes the research design, the study population, the method of sampling, the data collection procedures, the variables studied, and the methods of data analysis.

3.1 - RESEARCH DESIGN

The research design comprised a 48-week follow-up study of 417 community-dwelling elderly persons living in west-central Montreal. Following an initial at-home, interviewer-administered questionnaire, subjects were interviewed over the telephone once every four weeks for 48 weeks, to collect data on falls and fall-related injuries sustained since the last contact with the interviewer. Data on potential risk factors which could change from month to month including health status, use of medication, use of alcohol, and level of physical activity were also collected in the follow-up interviews. To permit comparisons with previous cross-sectional studies on the frequency of falls, subjects were asked in the initial interview about falls and fall-related injuries sustained during the 12 months preceding the initial interview.

To identify risk factors for falls which occurred during the 48-week follow-up, persons exposed to the potential risk factors of interest as identified in the initial and follow-up interviews were compared to internal comparison groups composed of persons who were not exposed.

3.2 - SAMPLE SELECTION

The sampling frame included all persons of both sexes 64 years of age[1] or older living on the territory of the Department of Community Health of the Montreal General Hospital (DSC-MGH) and included on the Quebec provincial electoral list of October 1985. The electoral list is updated once every four years just prior to the provincial elections, and identifies the home address including the postal code, of all Canadian citizens 18 years of age or older, who are eligible to vote in the provincial elections. In 1985 this included 24,700 persons aged 65 years or older living in private households located on the DSC-MGH territory, and 3,540 persons living in institutions (prisons, public or private nursing homes and chronic or acute care hospitàls) and noninstitutional collective dwellings with ten or more residents (rooming houses, boarding homes, motels and hotels) (Wilkins, 1987).

In addition to home address, the list also indicates the age of each person at the time of enumeration. In a sample of 45 booklets selected randomly from the October 1985 electoral list for the DSC-MGH territory, age was indicated for 8,925 of the 9,509 persons listed (93.9 percent). Permission to use the electoral lists for the Falls Study was obtained from the office of the Directeur général des élections du Québec in Sainte-Foy, Québec.

To assure a 95 percent certainty that the proportion of elderly persons who fell during the follow-up period was within ± 5 percent of the true population proportion of fallers, a sample of 384 persons was required[2]. The number of persons to be selected from the electoral

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[1] Persons aged 64 years on the October 1985 list were included in the sampling frame because the recruitment of study participants was scheduled to begin in October 1986, at which time these individuals were 65 years of age.

[2] Colton (1975) described a formula for determining the sample size for a study given a maximum tolerable difference between the proportion observed in the sample and the true population proportion, and the degree of certainty the result is to be within this discrepancy.

list was increased by 48 percent following the pretest of study procedures (see Appendix I), which indicated that 24 percent of persons selected from the electoral list had either died, moved outside the DSC-MGH territory, or were otherwise ineligible for inclusion in the study, 22 percent refused to participate, and 2 percent could not be contacted. The number to be selected was increased a further 7 percent to account for study participants who were expected to be lost to follow-up because of death or refusal to continue to participate in the study. The final number of subjects to be selected from the electoral lists was 845.

The sampling procedure included five steps (Figure 3.1). In Step 1, the 589 booklets containing addresses located on the DSC-MGH territory were identified based on postal codes located in the territory. The total number of names for all ages listed in the 589 booklets was 122,977 (mean of 209 names per booklet). The minimum number of names listed in a single booklet was 25 and the maximum number was 432.

All the pages in the 589 booklets were numbered consecutively (Step 2), and a 10 percent sample of the total 3,318 pages was selected using a random number generator (Step 3)[1]. In Step 4, all persons aged 64 years of age or older listed on the 331 pages selected were identified and numbered consecutively. Persons for whom age was not indicated were excluded. Finally, of the 2,432 persons identified in Step 4, 845 were selected using a random number generator (Step 5). These persons were the potential study participants.

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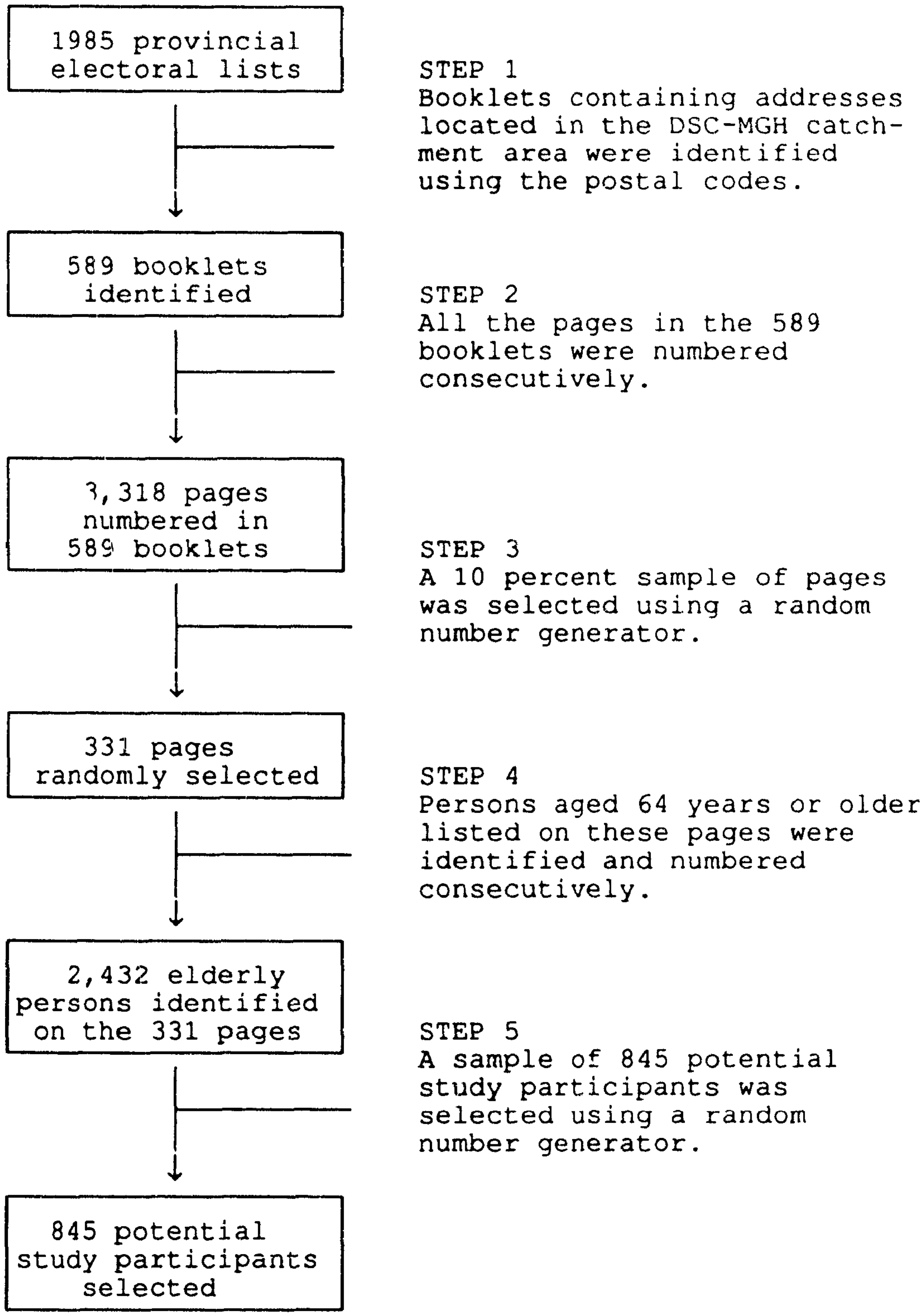
[1] Selection of pages rather than individuals at this point simplified the sampling procedure considerably, but could have increased the homogeneity of the sample selected since individuals with similar ethnic or language backgrounds, for example, may live in the same neighbourhood. Their addresses would tend to cluster on the same page of the electoral list. However, this possibility was deemed to be of little significance with respect to the results.

FIGURE 3.1

SAMPLE SELECTION



As indicated earlier, the electoral list included the names and addresses of elderly individuals living in institutions and noninstitutional collective households with ten or more residents. The addresses of persons selected for the study were compared to the addresses of all known institutions and noninstitutional collective households with ten or more residents located in the DSC-MGH territory. If the individual was living in either of these settings, he/she was excluded from the sample immediately, avoiding the necessity of an at-home visit. In a few cases, however, these individuals were excluded at the time of the initial contact with the interviewer, who recognized that the person was living in an institution or a noninstitutional collective household and was not eligible for inclusion in the study.

3.4 - DATA COLLECTION PROCEDURES

3.4.1 - INITIAL DATA COLLECTION

3.4.1.1 - Method

The method selected for the initial data collection was the at-home interviewer-administered questionnaire. Although more expensive than mailed questionnaires or telephone interviews, at-home interviews typically result in a higher response rate, and also permit administration of more complete and complex questionnaires (Dillman, 1978). In studies of the elderly, the interviewer can adapt the interview to account for the hearing, visual or other communication problems often experienced by the elderly. She can establish a personal rapport with the subject, emphasize the importance of the research, and encourage the subject to participate in any required follow-up procedures. In addition to these reasons, at-home interviews were necessary in the Falls Study because the interviewers were required to record their observations on certain characteristics of the stairways and bathrooms in the subjects' homes[1].

3.4.1.2 - Interviewer Training

Six experienced, bilingual (French/English) interviewers were trained by the research coordinator, over a two-week period in May 1987, to complete the initial interviews. During the training, emphasis was placed on methods of recruiting study participants, how to explain what participation in the study entailed, how to obtain informed consent, and how to identify whether or not a subject was having difficulty understanding or responding to questions during the interview. The Initial Questionnaire was reviewed question-by-question to ensure that the interviewers understood the purpose of each question and became familiar with the skip patterns. They each received a copy of the Interviewer's Manual which explained all procedures related to the initial interview, and provided specific instructions for each question in the questionnaire. During the pretest phases of the study (see Appendix I), three of the six interviewers practised administering the questionnaire to elderly subjects.

3.4.1.3 - Recruitment of study participants

Prior to the home visit, potential study participants were sent a bilingual letter of introduction signed by the Director of the DSC-MGH. The letter explained the purpose of the research, emphasized its importance, and invited recipients to participate in the research. Two weeks later. the interviewers visited the home of each potential participant with a copy of the

[1] The data on stairways and bathrooms were collected as part of a descriptive study of these features of the homes in which community-dwelling elderly persons live. The data have been analyzed in a separate substudy, and will not be considered further in the context of this thesis.

letter in hand. They identified themselves, referring to their Montreal General Hospital identification cards, explained the purpose of the visit and asked to speak to the potential subject.

If the potential subject was not at home, the interviewer inquired when he/she would be at home, and made an appointment to return at the time. Return visits were also necessary when no one answered the doorbell. In these cases, the interviewers left a bilingual letter in the mailbox informing the occupants of the date and reason for the visit, and that an interviewer would return at a later date. This strategy was particularly useful in apartment buildings with restricted access to the subject's front door. To increase the likelihood of finding someone at home, the interviewers varied the days and hours of their visits, and included evening and weekend visits. They made at least three visits to the home (and usually many more) before reporting an incomplete interview to the research coordinator. In five cases, when the interviewer reported that there was someone at home when they rang the doorbell but the person refused to answer, the interviewers attempted to recruit the subject over the telephone. Telephone numbers were obtained from the Montreal telephone directory. Three of the five persons so contacted, agreed to participate in the study.

3.4.1.4 - Exclusions

Person selected from the electoral list were excluded from the study at the time of the initial at-home visit for the following reasons:

- Person was less than 65 years of age.
- Person did not speak French or English.
- Person was hospitalized (as indicated by other household members or a neighbour).

- Person was on extended vacation.
- Person had moved to a location outside the DSC-MGH territory (as indicated by other household members or a neighbour).
- Person lived in an institution or a noninstitutional collective household with ten or more residents.

Before beginning the interview, the interviewer checked if one of the exclusion criteria was applicable. If the subject was not eligible for inclusion in the study, the interviewer thanked the individual involved and ended the contact. The interviewers kept careful note of the reasons for exclusion of subjects.

3.4.1.5 - Consent to participate

Before proceeding with the interview, the interviewers obtained informed consent from study participants. Each subject was asked to sign a consent form, in which they indicated that they understood what participation in the study entailed, and gave their written consent to participate. The interviewers emphasized during the introductory dialogue that a decision to refuse to participate in the study would not affect the services received from the Montreal General Hospital in any way, and that the subject could withdraw from the study at any time. When the subject had difficulty understanding or signing the form, consent from another member of the household on behalf of the subject was accepted. Also, when the subject was willing to participate but refused to sign the consent form, verbal consent to participate was accepted.

3.4.1.6 - Proxy respondents

After obtaining consent, the interviewers began the interview with a series of "trial" questions based on Pfeiffer's Short Portable Mental Health Status Questionnaire (Pfeiffer, 1975). The trial questions were included in the Initial Questionnaire (see Section 3.4.1.7). The objective was to identify persons who were too confused to provide valid responses or who would have difficulty responding to the questionnaire because of hearing or speech impediments, or other difficulties. If the trial questions indicated that the subject would have difficulty responding, or that the validity of the answers would be questionable, the interviewer identified a proxy respondent from among the other household members. The proxy was asked to respond on behalf of the subject during the initial interview and in the subsequent follow-up interviews. The proxy respondent's identity was carefully noted on the questionnaire, as well as the reason for using a proxy.

This methodology was applied during the pretest of study procedures and during the first 20 interviews of the main study. After these interviews, a decision was taken to discontinue the trial questions, based on the interviewers' comments regarding the difficulty of administering this section of the questionnaire. They indicated that the questions were not necessary to identify subjects who would have difficulty responding to the questionnaire, and that they often caused the subjects to become ill at ease and embarrassed, and thus perform poorly. Therefore after the first 20 interviews, the decision to identify a proxy respondent for a particular subject was based on the interviewers' subjective impressions regarding the subject's ability to respond.

3.4.1.7 - Initial Questionnaire

The Initial Questionnaire collected data on the subject's sociodemographic characteristics, physical health including short- and long-term activity limitation and disability, use of medication, social support, and lifestyle characteristics including use of tobacco and alcohol and level of physical activity. Also, as indicated earlier, data were collected on certain characteristics of the stairways and bathrooms in the subjects' homes. Many of the questions included in the Initial Questionnaire were extracted verbatim from the General Social Survey (Statistique Canada, 1987). Also some questions from the Canada Health Survey (Health and Welfare Canada, 1981) and Canada's Health Promotion Survey (Health and Welfare Canada, 1988) were used. These questions had already been tested extensively in both French and English in these surveys.

Because many of the questions were identical to those used in the General Social Survey, a preliminary version of the Initial Questionnaire was reviewed with members of the Statistics Canada team responsible for the General Social Survey. Difficulties administering and coding the questions extracted from the General Social Survey were discussed, as well as problems encountered in interpreting the results.

A preliminary version of the Initial Questionnaire was also reviewed with a family practitioner from the Family Medicine Unit of the Montreal General Hospital and then with two geriatricians from the Royal Victoria Hospital. Their suggestions were incorporated into the questionnaire. In particular, their comments on questions related to use of medication and chronic health problems were particularly useful. The Initial Questionnaire, all other study instruments, as well as the study procedures were pretested prior to initiation of data collection (see Appendix I for a detailed description of the pretest procedures). An English version of the Initial Questionnaire is included in Appendix II.

3.4.1.8 - Completion of initial at-home interviews

After completing the questionnaires, the interviewers explained the follow-up procedures to study participants and assessed the feasibility of conducting follow-up interviews over the telephone. If the subject did not have a telephone, or if telephone interviews were not feasible for other reasons such as hearing impairment or memory difficulties, and no proxy respondent was available, the interviewer recommended that the subject be followed up in at-home visits. For each subject, the interviewer obtained the name and telephone number of a relative or close friend in the event that follow-up contact could not be established.

After completion of the home visit, interviewers recorded their impressions of the validity of the subject's responses, and whether or not the subject appeared to have memory or other kinds of difficulties understanding or responding to the questions. They edited each questionnaire for completeness, consistency, and readability. The research coordinator completed a second verification.

Recruitment of study participants and administration of the Initial Questionnaires were carried out from May 1987 to September 1987. The initial interviews were conducted in either French or English depending on the subject's preference. They lasted on average one hour.

3.4.2 - FOLLOW-UP

3.4.2.1 - Method

Subjects were interviewed over the telephone once every four weeks for 48 weeks following the initial interview. The objective of the follow-up interviews was to collect data on falls experienced by the subject since the previous contact with the interviewer, as well as exposures which could change from month to month, including health status, symptoms, use of medication, use of alcohol, and level of physical activity. The telephone interview technique was selected for follow-up because it is much less expensive than at-home interviews, because the content of the questionnaire was familiar to the subject, and because the subject had already established personal contact with an interviewer from the study team. All but four study participants had access to a telephone in their own homes. These four subjects received at-home follow-up visits.

Follow-up interviews were scheduled four weeks after the preceding interview. The interviewer began trying to contact the subject on the date scheduled and, if unsuccessful, continued for six more days. If the subject could not be contacted during that period, the interviewer waited until the next scheduled contact, and then covered all the interim period since the last follow-up interview in that interview. For example, some subjects went out of town unexpectedly and were unable to complete a scheduled follow-up interview. In these cases, the interviewers covered the entire period of time since the last contact with the subject during the subsequent interview. She carefully noted the period of time covered on the questionnaire, as well as the reason why the previous follow-up interview was not completed.

Several subjects were admitted to hospital during the follow-up period. In order not to inconvenience these subjects, the follow-up interviews were temporarily discontinued for the duration of the hospitalization unless a proxy respondent was available. The interviews were resumed when the subject was released from hospital and returned home. If a study participant became too ill (either temporarily or permanently) to be interviewed, a proxy respondent was identified and data on the subject were obtained from the proxy.

Finally, several subjects did not want to be telephoned each month, but instead accepted to be interviewed bimonthly or only on occasion (i.e. two or three times during the year). In these cases, the interviewers requested data on falls experienced during the entire period since the previous interview, in the subsequent interview. These deviations from the normal protocol were carefully recorded on the questionnaires.

At the end of each follow-up interview, the interviewer verified that the subject would be available at the same phone number on the date of the next scheduled interview. If the subject was planning to be on vacation or out of town, the interviewer obtained a telephone number at which the subject could be contacted. After completing each interview, the interviewers recorded their impressions regarding the ease of conducting the interview and its validity. They then edited each questionnaire for completeness, consistency, and readability. The research coordinator completed a second verification.

Follow-up interviews began in June 1987 and continued until October 1988 (48 weeks after the last initial interview was completed). They were conducted in either French or English according to the subject's preference, by three interviewers, two of whom had worked on the initial interviews. The interviews lasted, on average, ten minutes.

3.4.2.2 - Follow-up Questionnaire

Most of the questions in the Follow-up Questionnaire were extracted verbatim from the initial interview, including the questions on bed-days, activity limitation, nonspecific symptoms, use of medication, physical activity, and use of alcohol. In addition, data were collected on recent hospitalizations, renovations to the home, and falls experienced since the last contact with the interviewer. A separate Falls Questionnaire (see Section 3.4.2.5) was completed for each fall reported by the study participant. Appendix III contains an English version of the Follow-up Questionnaire. The last Follow-up Questionnaire during the 48th week of follow-up was expanded to include several questions extracted from the Initial Questionnaire, including self-perceived health status, satisfaction with health status, use of health care services in the 12 months preceding the interview, chronic health problems, long-term disability, and social support networks. The purpose of these questions was to determine if there had been any major changes in these variables since the initial interview. Subjects were also asked if, in the 12 months preceding the interview, they had changed or cut down their usual activities because of a fall or because of fear of falling.

In addition to the monthly telephone interviews, two other methods were designed to assist study participants recall and record their falls, including a Falls Memory-Aid Calendar and the Falls Surveillance Service.

3.4.2.3 - Falls Memory-Aid Calendar

A bilingual, Falls Memory-Aid Calendar covering 18 months from March 1987 to August 1988 was designed specifically for the Falls Study, in consultation with a graphic artist and member of the gerontology intervention team at the DSC-MGH. The objective was to create an attractive, easily readable calendar on which study participants could record days on which they stayed in bed because of a health problem, and days on which they experienced a fall. The calendar contained a page of half-inch, self-adhesive stickers which illustrated either an elderly person lying in bed or an elderly person falling. Subjects were asked to place the appropriate sticker on the dates on which either of these events occurred. The calendar also contained the telephone number of the Falls Surveillance Service (see Section 3.4.2.4), and instructions on procedures to follow in the event of a fall (with respect to the research project).

Each subject received a Falls Memory-Aid Calendar and was instructed on its use during the initial interview. They were invited to place the calendar on the wall near the telephone for easy referral during the follow-up interviews. The interviewers always began the follow-up interviews by asking the respondents to consult their calendars.

3.4.2.4 - Falls Surveillance Service

A telephone answering machine was purchased for the research. The purpose of the 24-hour Falls Surveillance Service was to permit collection of data on falls as soon as possible after a fall occurred, when the details were still fresh in the subject's memory. Subjects were invited to telephone the service immediately after a fall if they did not sustain injuries requiring medical attention, or as soon as they were able, if treatment was required. The interviewers and research coordinator monitored the telephone service and telephoned the subject as soon as possible to complete a Falls Questionnaire.

Study participants were provided with the telephone number of the Falls Surveillance Service during the initial interview and were instructed on when and how to use the service.

The interviewers emphasized that its purpose was to collect data, and that no medical services were available through the service.

After several months, it became apparent that the study participants did not use the Falls Surveillance Service to inform the research team about their falls. Because of the time and expense associated with its monitoring, the service was discontinued after eight months of operation in December 1987. At that time, the interviewers provided each subject with the telephone number of the DSC-MGH and encouraged them to contact the research coordinator or one of the interviewers at that number, in the event of a fall.

3.4.2.5 - Falls Questionnaire

A third questionnaire was designed to collect detailed data on each fall which occurred during follow-up. The interviewers completed a separate Falls Questionnaire for each fall reported by the study participants during follow-up.

The questionnaire collected data on all important details of the fall including the time of the fall (hour of the day, day and month of the year), the place where it occurred, the activity in which the subject was engaged at the time of the fall, the subject's self-report of the reason for the fall, physical symptoms experienced prior to the fall, height and direction of the fall, part(s) of the body onto which the subject fell, characteristics of the surface onto which the subject fell, length of time on the ground, whether there were any witnesses present, whether the subject received assistance in getting up from the ground, injuries suffered as a consequence of the fall, and consultations with health professionals in the seven days following the fall. If the Falls Questionnaire was completed less than one week post-fall, the subject was telephoned again after the seven-day period to collect data on consultations related to the fall in the week after the fall.

The Falls Questionnaires were administered in French or English, according to the subject's preference, by the same interviewers who conducted the follow-up interviews. It took approximately ten minutes to administer the questionnaire. An English version of the Falls Questionnaire is included in Appendix III. After completing each questionnaire, the interviewers recorded their impressions regarding the validity of the subjects' responses. They then edited each questionnaire for completeness, consistency, and readability. The research coordinator completed a second verification.

3.4.2.6 - Loss to follow-up

Subjects were considered lost to follow-up if they died or if they refused to continue to participate in the study. Subjects who refused to continue to participate during the first six months of follow-up were telephoned at their scheduled six-month follow-up date, to attempt to reverse the refusal. All other subjects, including those who were hospitalized or who moved to locations outside the DSC-MGH territory, were followed for the full duration of the study.

3.5 - DESCRIPTION OF VARIABLES

Appendix V describes the range of responses observed and/or coded categories for variables in the Initial, Follow-up, and Falls Questionnaire which were included in the analysis. Many variables are self-explanatory and will not be elaborated upon. The following sections provide descriptions of variables which are not self-explanatory. This first section defines the outcome variables including falls and fall-related injury, and details the descriptive data collected on these outcomes. The second section describes exposure variables which were not expected to fluctuate substantially over time. These were measured in the initial at-home interview only and are hereafter referred to as "stable exposure variables". The third section describes exposure variables which had the potential to fluctuate substantially over time and were therefore measured in the initial interview and in each of the follow-up interviews. Hereafter these variables, which include number of different activities, number of activities, use of alcohol, bed-days, activity-limitation days, nonspecific symptoms, use of medications and follow-up falls are referred to as "time dependent exposure variables."

3.5.1 - OUTCOME VARIABLES

Fall was defined as "an event which results in a person coming to rest inadvertently on the ground or other lower level..." (Kellogg International Work Group, 1987). Our definition of falls excluded the latter part of the Kellogg definition: "...and other than as a consequence of the following: sustaining a violent blow, loss of consciousness, sudden onset of paralysis as in a stroke, or an epileptic seizure". The purpose of excluding the latter part of the definition was that descriptive data would be obtained on all falls experienced during the study, and if required, certain kinds of falls could be eliminated at a later time from certain analyses. In addition, because all data were obtained from subject self-reports, the validity of the data on the cause of the fall might be questionable[1].

The definition used excluded unintentional falls onto a chair or bed and falls against an object during which the subject did not come to rest on the ground. Although data were collected on nine sports-related falls (eight were ski-related), these falls were excluded from the analyses because the cause of the fall was more than likely due to the nature of the sport engaged in.

[1] In fact, none of the falls sustained during the study appeared to be associated with either a violent blow, sudden onset of paralysis or an epileptic seizure. Ten falls were purportedly associated with a blackout, but it was difficult to determine in some cases whether the blackout occurred prior to or because of the fall.

Subjects who reported a fall during the 48-week follow-up were asked in the Falls Questionnaire to describe in their own words why they fell. Reason subject fell was coded as "environment-related", "health-related", "both environment- and health-related" or "don't know" according to the concensus of three coders who reviewed the verbatim responses. Falls were coded as environment-related when there was an obvious or unexpected environmental hazard mentioned by the subject such as ice or snow, inadequate footwear, poor lighting, uneven pavement or wet surface. Falls attributed to health-related factors included those in which the subject mentioned an acute or chronic health problem, a visual impairment, those in which the subject lost his/her balance (without mention of an environmental hazard), falls involving distraction, miscalculation or carelessness, and those in which the subject slipped or tripped (without mention of an environmental hazard).

In addition to coding the reasons subjects fell, each response was scanned for 18 words or phrases which recurred in the verbatim descriptions of why subjects fell. These included lost balance, dizziness or light-headedness, blackout, any chronic health problem, any acute health problem, weakness in legs, miscalculation or carelessness, any medication, problem with footwear, snow or ice, slipped, tripped, problem with sidewalk, road or pavement, wet surface, problem with lighting, vision problem, and carrying something. Each fall description was coded "yes" or "no" for each of these words or phrases according to whether or not the descriptions included them.

Subjects were asked in an open-ended question in the Falls Questionnaire to describe, for each fall, what they were doing at the time of the fall. Two physical therapists and one clerk attempted to categorize activity at time of fall as mild, moderate or marked, according to the amount of displacement of the body's center of gravity outside the base of support (Tinetti et al., 1988). Because concensus between the three coders was not achieved, activity at the time of fall was coded according to the most frequently observed responses including "stair-related activity", "walking", "getting up", "other", "don't know" and "no answer".

Finally, subjects were asked whether or not they were injured as a result of the fall. Fall-related injury included all falls in which the subject reported that an injury, whether minor or severe, had occurred. Minor injuries included laceration without suture, bruise, abrasion, and other minor soft tissue injury. Severe injuries included laceration with suture and fractures.

3.5.2 - STABLE EXPOSURE VARIABLES

Level of education refers to the number of years of schooling that the subject had completed. The question was extracted from Canada's Health Promotion Survey (Health and Welfare Canada, 1988). Responses were categorized as "0-7 years", "8-10 years", "11 years", "12 or more years" or "don't know".

Household income refers to the subject's best estimate of the total income of all household members from all sources during the 12 months preceding the initial interview. The question was extracted from the 1986 Montreal Health Promotion Survey (Enquête Promotion de la Santé à Montréal 1986, 1988). Responses were categorized as "<$10,000", "$10,000-$20,000", ">$20,000-$40,000", and ">$40,000".

Employment refers to whether or not the subject was employed and earning an income during the 12 months preceding the initial interview. Responses included "yes, full-time", "yes, part-time", and "no". Because of the small number of respondents who worked either full-time or part-time, these categories were collapsed into a single "yes" category.

Consultations with other health professionals refers to whether or not the subject consulted any of a nurse, pharmacist, chiropractor, or physiotherapist one or more times in the 12 months preceding the initial interview.

The questions to measure long-term disability were extracted verbatim from the General Social Survey (Statistique Canada, 1987). Subjects were asked if they had trouble carrying out any of eight normal activities including walking 400 meters without resting, walking up and down a flight of stairs, carrying a 12-pound bag of groceries 30 feet, standing for 20 minutes, bending down to pick up an object from the floor, cutting their toenails, using their fingers to grasp or handle, and reaching. Responses included "completely unable to carry out activity", "has trouble carrying out activity (but not completely unable)", and "has no trouble carrying out activity". Number of disabilities was calculated for each subject by summing the number of disabilities (i.e. the number of items scored either 1 ("completely unable") or 2 ("has trouble")). The scores observed ranged between 0 and 8, with higher scores indicative of more disability.

Quetelet index refers to body-mass index, which was calculated as the weight of the subject in kilograms divided by the square of the height in meters (Stavig et al., 1984). The scores observed ranged between 14.19 and 41.51.

Data were collected on whether or not subjects suffered from any of eight common long-term health problems including high blood pressure, trouble with the heart (such as heart attack, angina, heart failure, rheumatic heart disease, or irregular heart beat), diabetes, stroke, arthritis or rheumatism, Parkinson's disease, respiratory disorders including asthma, emphysema or chronic bronchitis, and any other long-term health problem[1]. In addition, subjects were considered to have a vision problem if they were completely unable or had difficulty seeing or reading ordinary newsprint or recognizing a friend on the other side of the street. They were considered to have a hearing problem if they were completely unable or had trouble hearing normal conversation. All questions were drawn from the General Social Survey (Statistique Canada, 1987). Because the number of subjects with Parkinson's disease was small (n=2) it was included in the category other long-term health problem. Number of chronic health problems refers to the sum of the number of problems from which the subject suffered. The scores observed ranged between 0 and 7.

Data on two indicators of usual level of physical activity were collected in the Initial Questionnaire. Physical activity compared to peers refers to the subject's self-rating of his/her level of physical activity compared to other people the same age. This question came from Canada's Health Promotion Survey (Health and Welfare Canada, 1988). Responses included "much more physically active", "somewhat more active", "same", "somewhat less active", "much less active", and "don't know". A question on level of physical effort expended in usual daily activities was extracted from the General Social Survey (Statistique Canada, 1987). Responses included "light (such as driving or sitting)", "moderate (such as housework, carpentry or walking)", "heavy (such as pushing or carrying heavy objects)", and "don't know".

The questions on use of alcohol were based on those used in the General Social Survey (Statistique Canada, 1987) and Canada's Health Promotion Survey (Health and Welfare

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[1] In order to reflect the data more accurately, the terminology for medical conditions and medications used in the text is the same as that used in the questionnaires completed by study participants.

Canada, 1988). Subjects were asked about their usual frequency of drinking alcoholic beverages in the 12 months preceding the initial interview. Responses included "never", "less than once a month", "one or more times a month", "once a week" and "every day".

Member of a social group refers to whether or not the subject was, at the time of the initial interview, a member of, or participant in, a senior citizens group, Golden Age club, parish, or any other association, club or group (i.e. NDG Senior Citizens Council, Shriner's, Legion, etc.).

3.5.3 - TIME DEPENDENT EXPOSURE VARIABLES

The first part of this section defines the time dependent exposure variables and describes the methods of data collection. The second part details how scores for each variable were obtained and the third section describes how the data set used in the analyses was created.

3.5.3.1 - Description of time dependent exposure variables

Subjects were asked to indicate the number of times in the week preceding the interview that they had participated in each of 13 common physical activities including walking for exercise, swimming, home exercise, exercise classes, jogging or running, gardening, golf, dancing, bowling, tennis, light housework or handiwork (washing dishes, ironing, making beds), heavy housework or handiwork (washing or waxing floors, painting), and other. These questions were developed based on the questions used in the Canada Fitness Survey (Stephens, 1983). Number of different activities refers to how many of these 13 activities the subject participated in, in the week preceding the interview. Total number of activities refers to the total number of times the subject engaged in the 13 activities. For example, if the subject walked for excercise 14 times and did home exercise 7 times, then the total number of activities was 21.

In addition to data on usual frequency of drinking collected in the initial at-home interview only, data on recent use of alcohol were collected in the initial and follow-up interviews. Subjects were asked to think back over the last seven days and to report on how many of these days they had any alcoholic drinks, on how many days they had two or more, four or more, eight or more, and twelve or more drinks. Number of alcoholic drinks in the past week was calculated using the algorithm from Canada's Health Promotion Survey (Health and Welfare Canada, 1988):

> Number of alcoholic drinks = (no. days on which subject drank - no. days subject drank 2+ drinks) + 3 (no. days subject drank 2+ drinks - no. days subject drank 4+ drinks) + 6 (no. days subject drank 4+ drinks - no. days subject drank 8+ drinks) + 10 (no. days subject drank 8+ drinks - no. days subject drank 12+ drinks) + 12 (no. days subject drank 12+ drinks).

This algorithm assumes that subjects drank three drinks on the number of days on which they drank two or more drinks minus the number of days on which they drank four or more drinks. Similarly, it assumes that they drank six, eight, ten, and 12 drinks as specified in the algorithm.

The two questions which measured two-week disability were drawn from the General Social Survey (Statistique Canada, 1987). Bed-days refers to the number of days in the two weeks preceding the interview during which the respondent stayed in bed because of a health problem. Activity-limitation days refers to the number of days in the two weeks preceding the interview during which the respondent cut down on things he/she normally did because of a health problem. Responses for both variables ranged between 0 and 14 days and were categorized as "none" or "one or more days".

Subjects were asked in the initial and follow-up interviews whether or not they had experienced any of five nonspecific symptoms in the 14 days preceding the interview, including dizziness on standing up quickly, any other dizziness, vertigo or light-headedness, palpitations (sensation of heart beating in a rapid or irregular way), short of breath at rest, and short of breath on exertion. Responses to each symptom were coded either "Yes" or "No". Number of symptoms, the total number of symptoms that the subject had experienced, was calculated for the initial and each of the follow-up interviews.

Data were collected on the use of medication in the two days preceding each of the initial and follow-up interviews. Specifically, subjects were asked whether or not they had taken or used any of 14 medications including medicine for arthritis or rheumatism, any other pain relievers, tranquilizers, medicine for the nerves or medicine to help you sleep, medicine for blood pressure, medicine for the heart, antibiotics (taken orally), laxatives, stomach remedies or medicines, cough or cold remedies, vitamins or minerals, anticoagulants, medicine for diabetes, medicine for chronic obstructive pulmonary disease, or any other medications. These questions were based on those used in the Canada Health Survey (Health and Welfare Canada, 1981). Responses to each medication were coded either "Yes" or "No". Number of medications refers to the sum of the total number of different medications taken by the subject in the two days preceding the interview. It was calculated for the initial and each of the follow-up interviews.

Finally, a variable called "follow-up fall" was created and added to each file to record whether or not there was a history of falls (i.e. if a fall had been reported in the 12 months preceding the initial interview or if a fall had been experienced up to that moment in time since entry into the study). In the analyses to determine risk factors for falls and for fall-related injury, follow-up fall represented an exposure variable (i.e. a potential risk factor).

3.5.3.2 - Computation of scores for time dependent exposure variables

Two sets of scores were obtained for each time dependent exposure variable. One set reflected "short-term" or recent exposure, and one set measured average exposure over time. Short-term exposure was simply the value of the time dependent exposure variable as obtained in each of the initial and first 11 of the 12 follow-up interviews. When follow-up interviews or data for specific variables were missing[1], scores for short-term exposure were obtained from the nearest completed preceding interview and assigned to the missing interview(s) or missing variable(s). Thus, each subject had 12 measures of short-term exposure for each time dependent exposure variable.

Scores for average exposure were computed for each time dependent exposure variable for each of the initial and first 11 follow-up interviews, as the mean of values obtained in the current and all preceding completed interviews. For example, the first value of average exposure was simply the value of the variable obtained in the initial interview. The score for the sixth subset of data was the average of the values obtained in the initial and the first five follow-up interviews. When follow-up interviews or data for specific variables were missing, average scores were obtained from the nearest completed preceding interview, and assigned to the missing interview(s) or missing variables. Thus, in addition to a set of 12

[1] One or more follow-up interviews were missing for 139 subjects for a total of 318 missing interviews. (This excludes interviews missing for 34 subjects lost to follow-up because of death or refusal to continue to participate in the study).

scores of short-term exposure for each time dependent variable, each subject also had a set of 12 scores of average exposure for each time dependent exposure variable.

For the categorical time dependent variables, the average exposure score ranged between 0 and 1, and represented the proportion of interviews in which the subject reported exposure. For continuous variables, the score represented the average of exposures reported in the current and all preceding completed interviews.

3.5.3.3 - Creation of data set

To create the data set used in the analyses, 12 subsets of data were created for each study subject. Each of the 12 subsets contained data on the outcome variables available from follow-up interviews 1 to 12[1]. Each also contained data for each of the stable exposure variables collected in the initial interview. (The values for these variables were identical in all 12 subsets of data). Finally each subset contained measures of short term and average exposure to the time dependent exposure variables available from the initial and first 11 follow-up interviews. Table 3.2 depicts the content of the 12 data subsets for a single subject.

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[1] When interviews were missing, data on falls or fall-related injury were extracted from the next completed follow-up interview in which the dates of all falls experienced since the previous contact with the interviewer were recorded. These data were used to decide whether or not a fall (and fall-related injury) should have been recorded in any of the missing interviews. If so, these data were added to the file.

TABLE 3.2

CONTENTS OF 12 DATA SUBSETS FOR A SINGLE SUBJECT

		Interview from which data were extracted		
		Stable	Time dependent exposure variables	
Data subset	Outcome variables	exposure variables	Short-term	Average
1	FU[1]1	Initial	Initial	Initial
2	FU2	Initial	FU1	$\bar{x}$ (Initial, FU1)
3	FU3	Initial	FU2	$\bar{x}$ (Initial, FU1-FU2)
4	FU4	Initial	FU3	$\bar{x}$ (Initial, FU1-FU3)
5	FU5	Initial	FU4	$\bar{x}$ (Initial, FU1-FU4)
6	FU6	Initial	FU5	$\bar{x}$ (Initial, FU1-FU5)
7	FU7	Initial	FU6	$\bar{x}$ (Initial, FU1-FU6)
8	FU8	Initial	FU7	$\bar{x}$ (Initial, FU1-FU7)
9	FU9	Initial	FU8	$\bar{x}$ (Initial, FU1-FU8)
10	FU10	Initial	FU9	$\bar{x}$ (Initial, FU1-FU9)
11	FU11	Initial	FU10	$\bar{x}$ (Initial, FU1-FU10)
12	FU12	Initial	FU11	$\bar{x}$ (Initial, FU1-FU11)

Note: (1) FU = Follow-up.

In essence, this procedure created 12 substudies of the same subject, each representing four weeks of follow-up time. The data set so created contained 4,763 files including 4,445 completed follow-up interviews and 318 "missing" interviews for which data was assigned from other completed interviews. The total follow-up time was therefore 4,763 person-months.

3.6 - CODING

Three clerks transcribed the data from the questionnaires onto coding sheets according to instructions in coding manuals. Several variables included an "Other (specify)" category. If the subjects' response fell into this category, the interviewers were required to specify the subject's response. Frequency distributions of responses in these categories were compiled by hand, and the coding scheme was modified to include responses which were sufficiently frequent to warrant a separate response category.

3.7 - DATA EDITING

Coding errors were detected through review of the frequency distributions of each variable which identified inadmissible codes, and unusual or unexpected patterns or frequencies of responses. In addition, 21 Initial Questionnaires (5 percent) were selected randomly, and printouts of the data from these questionnaires were compared to responses in the original questionnaires. Similarly, five percent random samples of the Follow-up and Falls Questionnaires were selected for data editing.

Because there were many coding errors, printouts of the data for each subject for each of the Initial, Follow-up, and Falls Questionnaires, were compared against responses in the original questionnaires. Corrections to the data files based on these checks were entered into the computer. This verification, although time-consuming and laborious, ensured that mis-classification due to coding errors was minimal.

3.8 - DATA ANALYSIS

Data analysis comprised three phases: The first phase involved analysis of the description of falls and fall-related injuries sustained during the 48-week follow-up period. Data on the time, place, and circumstances of falls and fall-related injury were analyzed in frequency distributions and cross-tabulations of data from the Falls Questionnaire.

The second phase of analysis described the frequency of falls and fall-related injury, first in the 12 months preceding the initial interview, and then in the 48-week follow-up period. Two measures of frequency are reported. First, the prevalence proportion of subjects with a positive fall history (or fall-related injury history) was calculated as the number of subjects who reported one or more falls (or fall-related injuries) during the study divided by the total number of subjects. Ninety-five percent confidence intervals were computed using a formula applicable to single proportions described by Fleiss (1981). Second, the incidence rate of falls (and of falls-related injuries) was calculated as the number of falls (or fall-related injuries) observed per person-month of follow-up[1]. Ninety-five percent confidence intervals were computed using a normal approximation for a Poisson variable in a large sample.

[1] Rothman (1986) defines the incidence rate as "the number of disease onsets in the population divided by the sum of the time periods of observation for all individuals in the population". He states that the incidence rate is also referred to as the incidence density or the force of morbidity or mortality. In this text, incidence rate and incidence density are used synonymously.

The third phase of analysis involved the identification of risk factors for falls and fall-related injury. The following section describes this third phase in more detail.

3.8.1 - ANALYSIS OF RISK FACTORS

3.8.1.1 - Risk factors for falls

To determine risk factors for falls, data for all falls for all subjects were examined in the same analysis, as if each of the four-week periods under study for a single subject represented observations from different subjects. The outcome variable was, for each follow-up interview, whether or not the subject had reported a fall which had occurred in the previous four-week period. The data were analyzed in two stages. During the first stage of analysis, univariate analyses were used to study the distributions of each variable and to select potential risk factors for inclusion in the early multivariate models. Specifically, the associations between having fallen and each sociodemographic, lifestyle, health, medication and use of health services variable was examined in univariate cross-tabulations. For each variable, one category of response was selected as the baseline category. In most cases, the baseline category included subjects considered to be at least risk of falling based on literature evidence or on intuitive reasoning. The incidence density of falls was calculated for each category of response, and then the incidence density ratios[1] were calculated for each category of response against the baseline category. When the number of missing responses was small, subjects with missing responses were arbitrarily included in the baseline category. When the number of

[1] The incidence density ratio (also referred to as the incidence rate ratio, risk ratio, relative risk, relative rate and rate ratio) is a measure of the strength of an association or, under appropriate circumstances, causal role and is based on the ratio of the absolute effect to a baseline rate. If I_0 in the incidence rate among the unexposed and I_1 in the incidence rate among exposed persons, the relative effect is I_1/I_0 (Rothman, 1986).

missing responses was large (income, Quetelet index), the missing responses were retained as a separate response category. To facilitate the univariate analysis, responses to continuous variables including age, years of schooling and Quetelet index were arbitrarily subdivided into quartiles. For categorical variables in which the number of responses in a single category was small, two or more categories were combined. The measures of average exposure to the time dependent exposure variables were categorized into "none" (exposure was not reported in any preceding interview), "less than half" (exposure was reported in at least one but less than half of preceding interview), and "half or more" (exposure was reported in half or more of preceding interview).

In the second stage of analysis, multivariate logistic-regression analysis was used to identify the combination of independent risk factors which best predicted whether or not a fall had occurred. The parameter of interest was the incidence density ratio, and an unbiased estimate of the incidence density ratio was obtained from the exposure odds ratio computed in logistic-regression analysis[1].

The usual logistic-regression approach could not be used for two reasons. First, it was possible to observe more than one fall per subject and second, the timing of outcome events and of time dependent exposures had to be taken into account. The usual logistic-regression analysis does not allow more than one outcome event per subject, and it does not incorporate information on timing of exposure and outcome events. D'Agostino et al. (1990) described a modified logistic-regression method, called pooled logistic-regression, which meets the requirements for this data analysis. In general, time to failure data are analyzed with

[1] The exposure odds ratio obtained from a case-control study is mathematically equivalent to the incidence rate ratio when the sampling fraction is identical for both the exposed and unexposed. Controls must be selected independently of exposure to guarantee that the sampling fraction can be removed from the odds ratio calculation (Rothman, 1986).

techniques like the Cox model. The pooled logistic-regression is asymptotically equivalent to the Cox time dependent covariate regression method when the interval between measurements is small, when the probability of an event within an interval is small, and when the intercept for the pooled logistic model is constant across intervals (Hosmer & Lemeshow, 1989; D'Agostino et al., 1990).

Two series of multivariate analyses were conducted. In the first series, risk factors for the outcomes of interest were identified from among all potential risk factors studied. The model so created is hereafter called the "full model". In the second series, a smaller number of potentially "etiologic" risk factors were identified from among all potential risk factors as those which, according to the literature or to intuitive reasoning might have a direct causal role in the etiology of falls or fall-related injury. Variables which did not appear to have a direct causal role in the etiology of falls including sociodemographic characteristics, indicators of social life, use of tobacco, self-reported health, follow-up falls, quetelet index, and use of health services were excluded from these analyses. In addition, only two of the eight indicators of long-term disability (trouble walking 400 meters and trouble walking up and down a flight of stairs) were included in the analysis, since they were deemed to be proxy indicators for mobility. Number of disabilities was not included because its inclusion might have washed away the effects of either trouble walking 400 meters or trouble walking up and down a flight of stairs. Independent predictors of the outcomes were then identified from among this smaller number of potentially etiologic risk factors. Hereafter this model is referred to as the "etiologic model".

Multivariate logistic-regression models were fitted by maximum likelihoods using the BMDP EM/286 computing package (BMDP Statistical Software Inc., 1990). Follow-up interview number (1-12) was included as a categorical variable in the early models to assess the assumption of constancy of the intercept across intervals. Using backwards stepwise procedures, potential risk factors selected in the univariate analysis were sequentially deleted from the initial models on the basis of lack of a statistically significant change ($p \leq 0.05$) in the likelihood ratio. As the models became more defined, variables eliminated in the early models (including follow-up interview number) were retested to check for possible confounding. In addition, all variables not yet tested (i.e. those which did not appear to be associated with falls in the univariate analysis) were tested one by one in the model. Finally, each variable retained in the etiologic model of risk factors for falls as well as each variable not retained in the model was tested for age (65-74 years, ≥75 years) and then sex interactions[1]. For significant interaction factors, such as sex for example, the results were reported separately by estimating incidence density ratios of every risk factor for each sex from the single model with interactions.

3.8.1.2 - Risk factors for fall-related injury

The outcome variable for this analysis was, for each follow-up interview, whether or not the subject had reported a fall-related injury. The data were analyzed in two stages (univariate and multivariate) exactly as described in the analysis of risk factors for falls. Both a full model and an etiologic model of risk factors for fall-related injury were created, but no interaction analyses were conducted.

[1] Because of their exploratory and time-consuming nature, it was deemed useful to conduct interaction analyses only for the etiologic model of risk factors for falls.

CHAPTER 4 - RESULTS

This chapter begins with a description of the response to the initial and follow-up interviews. It then describes the sociodemographic, lifestyle, and health characteristics of study participants. The characteristics and circumstances of falls sustained during the 48-week follow-up are described in the next section. The frequency of falls and fall-related injury sustained in the year preceding the initial interview and during the 48-week follow-up are then described. The next section describes the risk factors for falls and fall-related injury, and the last section summarizes the main findings

4.1 - RESPONSE

4.1.1 - INITIAL INTERVIEW

A total of 845 potential subjects were selected from the electoral list. Table 4.1 shows that 289 subjects (34.2 percent) were ineligible for inclusion in the study. The most frequent reason for exclusion was that the person selected from the list was living in an institutional setting. Among the 556 persons who were eligible to participate, 417 (75.0 percent) completed the initial interview (Table 4.2). Forty-six persons (8.3 percent) could not be contacted despite repeated visits to the home, and 93 persons (16.7 percent) refused to participate in the study either because they were not interested (12.9 percent) or because they were too sick (3.8 percent).

During the initial interviews, the interviewers identified 11 subjects (2.6 percent) who required proxy respondents to answer on their behalfs. Nine of the 11 subjects required proxies because of memory problems or confusion. One subject suffering from shingles was too sick to respond, and one subject was depressed and manifested behaviour problems. For six subjects, the spouse acted as proxy. Other relatives including a son, daughter or sibling responded for three subjects. A friend or acquaintance provided proxy responses for two subjects.

TABLE 4.1

ELIGIBILITY FOR INCLUSION IN THE STUDY AND REASONS FOR EXCLUSIONS

	n	%
Selected from electoral lists	**845**	**100.0**
Eligible for inclusion	**556**	**65.8**
Ineligible for inclusion	**289**	**34.2**
Living in an institution or noninstitutional collective dwelling with ten or more occupants[1]	100	11.8
Person had moved or did not live at address indicated on electoral list	84	9.9
Died	36	4.3
Could not speak French or English	31	3.7
Hospitalized at time of initial visit	21	2.5
On vacation at time of initial visit	10	1.2
Less than 65 years old	7	0.8

Note: [1] According to the 1986 Canadian Census (Statistics Canada, 1986), 12 percent of the 28,155 persons aged 65 years and over in the territory of the DSC-MGH, lived in institutions or in noninstitutional collective dwellings with ten or more occupants.

TABLE 4.2

RESPONSE TO THE INITIAL INTERVIEW

	n	%
ELIGIBLE FOR INCLUSION	**556**	**100.0**
Initial interview completed	417	75.0
Nobody home	46	8.3
Refusals	93	16.7
Not interested	72	12.9
Too sick	21	3.8

4.1.2 - FOLLOW-UP INTERVIEWS

Table 4.3 provides details on the response to each of the 12 follow-up interviews. On average, 370 interviews were completed each four-week period for a total of 4,445 completed follow-up interviews. The proportion of eligible subjects who completed the follow-up interviews was 90 percent or higher for all follow-up interviews. Most interviews (4,409 of the 4,445 completed interviews) were conducted over the telephone. Four participants did not have a telephone in their home, necessitating at-home follow-up visits for a total of 37 interviews.

A total of 100 interviews were not completed because the subject refused to respond. Ninety-four interviews were not completed because the interviewers could not contact the subject during the allotted interview period (six days after the date scheduled for the interview). Ninety-six interviews were not completed because the subject was on vacation at the scheduled interview time and could not be contacted. Finally, 35 interviews were not completed because the subject was either hospitalized or too sick to respond and there was no proxy respondent available.

Thirty-four subjects were lost to follow-up during the study. Thirteen subjects (3.1 percent of the original sample) died during the 48-week follow-up. Twenty-one subjects refused to continue to participate in the study while the study was ongoing.

Table 4.4 shows the number of subjects by the number of follow-up interviews completed. Eight subjects (1.9 percent) did not complete any of the follow-up interviews, and 253 subjects (60.7 percent) completed all 12 follow-up interviews. The majority of subjects (84.7 percent) completed at least ten follow-up interviews.

TABLE 4.3

RESPONSE TO THE TWELVE FOLLOW-UP INTERVIEWS

								Lost to follow-up		
FOLLOW-UP INTERVIEW	Eligible for interview	Interviewed[1] n	Interviewed[1] %	Refused n	Unable to contact n	On vacation n	Hospitalized, too sick n	Died n	Refused to continue in study n	Total n
1	417	386	92.6	6	7	10	0	1	7	8
2	409	375	91.7	5	8	15	5	0	1	1
3	408	375	91.9	12	7	8	2	1	3	4
4	404	367	90.8	10	12	10	1	1	3	4
5	400	374	93.5	14	8	2	1	0	1	1
6	399	372	93.2	6	14	4	2	1	0	1
7	398	364	91.5	9	9	10	6	0	0	0
8	398	370	93.0	6	7	8	7	0	0	0
9	398	357	89.7	9	8	15	5	2	2	4
10	394	364	92.4	8	5	11	3	2	1	3
11	391	359	91.8	14	9	3	3	2	1	3
12	388	382	98.5	1	0	0	0	3	2	5
Total	**4 804**	**4 445**		**100**	**94**	**96**	**35**	**13**	**21**	**34**

Note: [1] Includes interviews which were partially completed. Missing data were treated as described in the Methods (Sections 3.5.3.2 and 3.5.3.3).

TABLE 4.4

DISTRIBUTION OF SUBJECTS BY NUMBER OF FOLLOW-UP INTERVIEWS COMPLETED

Number of follow-up interviews completed[1]	Subjects n	%
Total	**417**	**100.0**
0	8	1.9
1	2	0.5
2	6	1.4
3	7	1.7
4	3	0.7
5	5	1.2
6	3	0.7
7	8	1.9
8	6	1.4
9	16	3.8
10	28	6.7
11	72	17.3
12	253	60.7

Note: (1) Includes interviews which were partially completed. Missing data were treated as described in the Methods (Sections 3.5.3.2 and 3.5.3.3).

Fifty-four subjects (13.0 percent of 417 subjects) required a proxy respondent to complete one or more follow-up interviews. A total of 286 follow-up interviews (6.4 percent of the 4,446 interviews) were completed by proxy respondents. Illness and confusion, forgetfulness, or Alzheimer's disease were the most common reasons for needing proxy respondents (Table 4.5). Fifty-eight percent of the 286 interviews were completed by the subject's spouse, 25.2 percent were completed by other relatives, and the remainder (16.8 percent) were completed by a friend or acquaintance.

One hundred and ninety-seven falls identified during the follow-up interviews met the study definition of a fall. A Falls Questionnaire was completed for all 197 falls. Nineteen Falls Questionnaires (9.6 percent of the 197 questionnaires) were completed by a proxy respondent. In most cases (12 of 19), the proxy respondent was the subject's spouse.

4.2 - DESCRIPTION OF SAMPLE

This section describes the sociodemographic, health, and lifestyle characteristics of the study participants. Where applicable, their characteristics are compared to those of elderly persons living in the DSC-MGH territory as described in the 1986 Canadian Census (Statistics Canada, 1986 Census). For this analysis, the data on the time dependent exposure variables including number of different activities, number of activities, use of alcohol, disability-days, symptoms, and use of medication were obtained from the initial at-home interview.

TABLE 4.5

REASONS FOR PROXY RESPONDENTS DURING FOLLOW-UP INTERVIEWS

Reason for proxy	Subjects n[1]	Subjects %	Interviews n	Interviews %
Total	**54**	**100.0**	**288**	**100.0**
Illness	15	27.8	40	13.9
Confusion, forgetfulness, Alzheimer's disease	12	22.2	116	40.3
Unable to come to telephone[2]	10	18.5	22	7.6
Difficulty hearing	8	14.8	68	23.6
Refusal	5	9.3	35	12.2
Difficulty communicating in French or English	4	7.4	7	2.4

Notes: [1] Number of subjects who required a proxy respondent for one or more follow-up interview.
[2] Includes subjects "not at home", "sleeping", and "in wheelchair".

4.2.1 - SOCIODEMOGRAPHIC CHARACTERISTICS

Table 4.6 describes the sociodemographic characteristics of the study subjects. One-third were male and two-thirds were female. The average age of males and females was 73.7 and 75.5 years, respectively. Thirty percent of female subjects were 80 years or older, compared to only 15.0 percent of male subjects.

Over half of subjects (52.8 percent) spoke English, 36.7 percent spoke French, and 10.6 percent spoke other languages such as Italian, Greek, Hungarian, German, Polish, and Chinese. The majority were either currently married (42.9 percent) or widowed (36.7 percent). Only 15.8 percent were single (never married) and 4.6 were divorced or separated. Thirty-nine percent lived alone, 48.4 percent lived in two-person households, and 12.2 percent lived in households with three or more persons.

One-quarter of subjects (26.9 percent) had elementary school education, 46.8 percent had 8-11 years of schooling, and 23.3 percent had 12 years or more. Three percent did not know or could not remember the number of years of schooling that they had received. The majority of subjects (87.5 percent) were not employed. Nineteen percent reported that their annual household income was less than $10,000, 24.9 percent reported that their income was between $10,000 and $20,000, and one-third reported an income of more than $20,000 per year. One-fifth (20.6 percent) did not respond to the question on household income.

Table 4.7 compares several sociodemographic characteristics of study participants with those of persons aged 65 years and over living in private households located in the territory of the DSC-MGH in 1986. This latter group represents the source population from which the sample was drawn. The data show that males and females aged 65-69 years were underrepresented in the sample, and those aged 80 and over were overrepresented. The

TABLE 4.6
SOCIODEMOGRAPHIC CHARACTERISTICS OF STUDY SUBJECTS

SOCIODEMOGRAPHIC CHARACTERISTIC	SUBJECTS n		%
Total	**417**		**100.0**
Sex			
Male	153		36.7
Female	264		63.3
Age group (years)			
65-69	102		24.5
70-74	111		26.6
75-79	102		24.5
80-92	102		24.5
Mean ± SD		74.8 ± 6.3	
Males			
Total	153		100.0
65-69	42		27.5
70-74	46		30.1
75-79	42		27.5
80-91	23		15.0
Mean ± SD		73.7 ± 5.7	
Females			
Total	264		100.0
65-69	60		22.7
70-74	65		24.6
75-79	60		22.7
80-92	79		29.9
Mean ± SD		75.5 ± 6.6	
Language			
English	220		52.8
French	153		36.7
Other	44		10.6
Marital status			
Married (including common law)	179		42.9
Single (never married)	66		15.8
Widowed	153		36.7
Divorced, separated	19		4.6
Number of persons in household			
One	164		39.3
Two	202		48.4
Three or more	51		12.2
Years of schooling			
0-7	112		26.9
8-10	97		23.3
11	98		23.5
12 or more	97		23.3
Don't know	13		3.1
Paid employment			
Yes	52		12.5
No	365		87.5
Annual household income			
<$10,000	83		19.9
$10,000 - $20,000	104		24.9
>$20,000 - $40,000	80		19.2
>$40,000	64		15.4
No response	86		20.6

TABLE 4.7

COMPARISON OF THE SOCIODEMOGRAPHIC CHARACTERISTICS OF STUDY PARTICIPANTS AND PERSONS AGED 65 YEARS AND OVER LIVING IN PRIVATE HOUSEHOLDS LOCATED IN THE DSC-MGH TERRITORY

SOCIODEMOGRAPHIC CHARACTERISTIC	Study participants (n=417) %	DSC-MGH (n=24,700)[1] %
Sex		
Male	36.7	37.9
Female	63.3	62.1
Age group (years)		
65-69	24.5	31.2
70-74	26.6	27.7
75-79	24.5	20.8
≥80	24.5	20.4
Males		
65-74	55.5	63.6
≥75	44.5	36.4
Females		
65-74	44.7	58.6
≥75	55.3	41.4
Number of persons in household		
One	39.3	39.2
Two or more	60.7	60.8
Paid employment		
Yes	12.5	12.7
No	87.5	87.3

Note: (1) Statistique Canada, Compilations spéciales du recensement de 1986 par CLSC et DSC, Région 06A.

distribution of study participants by sex, number of persons in household and paid employment (the other variables for which data from the 1986 Census were available) was similar to that of those living in private households as identified in the 1986 Census.

4.2.2 - LIFESTYLE HABITS

Table 4.8 describes the lifestyle habits of the study participants. Subjects were asked to compare their level of physical activity with other people of the same age. Over half (54.5 percent) felt that they were more active than others of the same age, 21.6 percent felt that they were about the same, and 21.6 percent felt that they were less active. Ten subjects (2.4 percent) did not know.

Approximately one-quarter of study participants engaged in daily activities which required light physical effort such as driving or sitting. More than two-thirds engaged in activities which required moderate physical effort such as housework, carpentry, or walking, and only 2.9 percent described their daily activities as involving heavy physical effort such as pushing or carrying heavy objects.

When asked about participation in 13 common activities in the past week, the majority of subjects (82.5 percent) reported that they had walked for exercise one or more times, and 84.7 percent had done some light housework or handiwork. One-third had done home exercises, 17.0 percent had done heavy housework or handiwork, and 14.9 percent had done some gardening. Very few subjects (5 percent or less) had participated in any of the other eight activities including swimming, exercise classes, golf, dancing, bowling, tennis and other. About 17 percent had done 0-1 of these activities in the week preceding the initial interview, 37.9 percent had done two activities, 24.0 percent had done three, and 20.9 percent had done 4-6 different activities. When the total number of all activities was computed, 27.6 percent

TABLE 4.8
LIFESTYLE HABITS OF STUDY SUBJECTS

LIFESTYLE HABITS	SUBJECTS n	%
Total	**417**	**100.0**
Physical Activity		
Physical activity compared to peers		
Much more active	132	31.7
Somewhat more active	95	22.8
Same	90	21.6
Somewhat less active	43	10.3
Much less active	47	11.3
Don't know	10	2.4
Physical effort in daily activities		
Light	114	27.3
Moderate	288	69.1
Heavy	12	2.9
Don't know	3	0.7
Number of different activities		
0-1	72	17.3
2	156	37.4
3	102	24.5
4-6	87	20.9
Mean ± SD	2.5 ± 1.2	
Number of activities		
0-10	79	19.0
11-15	88	21.1
16-20	98	23.5
21-25	88	21.1
26-52	64	15.4
Mean ± SD	18.0 ± 8.4	
Social Life		
Member of social group	208	49.9
Frequency of social gatherings		
More than once a week	184	44.1
Once a week	107	25.7
At least once a month	67	16.1
Less than once a month	41	9.8
Never	18	4.3
Social life		
Very satisfying	160	38.4
Rather satisfying	186	44.6
Unsatisfying	71	17.0
Own cat or dog	56	13.4
Smokes cigarettes	85	20.4
Use of Alcohol		
Frequency of alcohol consumption		
Every day	61	14.6
At least once a week	81	19.4
One or more times a month	49	11.8
Less than once a month	82	19.7
Don't drink	143	34.3
Don't know	1	0.2
Number of alcoholic drinks per week		
0	239	57.3
1-3	93	22.3
4-10	40	9.6
11-70	45	10.8
Mean ± SD	3.6 ± 8.5	

Note: (1) Totals may not add to 417 because of missing data.

had participated in 0-10 activities in the past week, and 32.1 percent had participated in 21 or more activities.

About half of subjects belonged to a Golden Age Club, parish, or some other club or association. The majority (69.8 percent) participated in a get-together with family, friends, or acquaintances once a week, 16.1 percent did so at least once a month, and 14.1 did so less than once a month or never. Most subjects (83 percent) were satisfied with their social life, although 17 percent reported that their social life was unsatisfying. Thirteen percent of subjects owned a pet dog or cat.

One-fifth of the sample smoked cigarettes, and 65.5 percent had taken at least one drink of beer, wine, liquor, or other alcoholic beverage in the last 12 months. Fourteen percent were daily drinkers.

4.2.3 - HEALTH STATUS

Table 4.9 presents data on the health status of study participants. Subjects were asked to describe their state of health compared to other people the same age. Seventy-two percent felt their health was good or excellent, 22.8 percent felt it was average, and 5.5 percent felt that they were in poor health. The majority of subjects (79.3 percent) were satisfied with their health. Twenty percent were not too satisfied or not at all satisfied with their health.

Data on recent health status included short-term (two-week) disability, and symptoms experienced in the two weeks preceding the interview. Only 22 subjects (5.3 percent) had spent one or more days in bed because of a health problem in the two weeks preceding the initial interview, and 15.6 percent had to cut down on the things they usually did because of their health. Over half (53.2 percent) had recently experienced one or more nonspecific

TABLE 4.9
HEALTH CHARACTERISTICS OF STUDY SUBJECTS

HEALTH STATUS	SUBJECTS n[1]		%
Total	**417**		**100.0**
Self-Reported Health			
Self-perceived health status			
Excellent	133		31.9
Good	166		39.8
Average	95		22.8
Poor	23		5 5
Satisfaction with health			
Very satisfied	169		40.5
Somewhat satisfied	162		38.8
Not too satisfied	67		16.1
Not at all satisfied	19		4.6
Two-Week Disability			
Bed-days	22		5.3
Activity-limitation days	65		15.6
Symptoms			
Short of breath on exertion	154		36.9
Other dizziness	87		20.9
Dizziness on standing	69		16.5
Palpitations	49		11.8
Short of breath at rest	42		10.1
Number of symptoms			
0	195		46.8
1	115		27.6
2	57		13.7
3-5	50		12.0
Mean ± SD		1.0 ± 1.2	
Chronic Health Problems			
Arthritis or rheumatism	230		55.2
High blood pressure	167		40.0
Heart trouble	124		29.7
Vision problem	121		29.0
Hearing problem	95		22.8
Respiratory disorder	65		15.7
Diabetes	40		9.6
Stroke	29		7.0
Other long-term problem	152		36.5
Number of chronic health problems			
0	47		11.3
1	94		22.5
2	101		24.2
3	71		17.0
4	57		13.7
5-7	47		11.3
Mean ± SD		2.4 ± 1.6	
Long-Term Disability			
Experiences trouble:			
Walking 400 meters	105		25.2
Walking up and down stairs	144		34.5
Carrying a 12-pound object	143		34.3
Standing for long periods	129		30.9
Bending down	125		30.0
Cutting toenails	147		35.3
Using fingers to grasp	64		15.3
Reaching	52		12.5

TABLE 4.9 (continued)

HEALTH STATUS	SUBJECTS n		%
Number of disabilities			
0	151		36.2
1-2	121		29.0
3-5	84		20.1
6-8	61		14.6
Mean ± SD		2.1 ± 2.2	
Use of Health Services			
Number of ophthalmologist consultations			
0	160		38.4
1	179		42.9
2	42		10.1
3	10		2.4
4-50	26		6.2
Mean ± SD		1.2 ± 2.8	
Number of physician consultations			
0-1	109		26.1
2-3	115		27.6
4-5	85		20.4
6-10	67		16.1
12-72	41		9.8
Mean ± SD		4.8 ± 6.6	
Consulted other health professionals	120		28.8
Hospitalized in 12 months preceding initial interview	88		21.1
Received homecare	56		13.4
Use of Medication			
Medicine for blood pressure	146		35.0
Vitamins or minerals	137		32.9
Medicine for the heart	91		21.8
Tranquilizers	89		21.3
Medicine for arthritis	69		16.5
Laxatives	57		13.7
Other pain relievers	55		13.2
Stomach remedies	51		12.2
Other major medications	39		9.4
Other minor medications	31		7.4
Medicine for diabetes	28		6.7
Cough or cold remedies	21		5.0
Anticoagulants	20		4.8
Medicine for asthma or COPD[2]	19		4.6
Antibiotics	10		2.4
Number of medications			
0	68		16.3
1	94		22.5
2	108		25.9
3	77		18.5
4	45		10.8
5-8	25		6.0
Mean ± SD		2.1 ± 1.5	
Quetelet Index			
14.19 - 21.33	101		24.2
21.36 - 23.52	106		25.4
23.53 - 25.96	91		21.8
25.97 - 41.51	104		24.9
Missing	15		3.6

Notes: [1] Totals may not add to 417 because of missing data.
[2] Chronic obstructive pulmonary disease.

symptoms, and the most commonly experienced symptoms were shortness of breath on exertion (36.9 percent), dizziness, giddiness, vertigo, or light-headedness (20.9 percent), and dizziness on standing up quickly (16.5 percent).

Most subjects (88.7 percent) had at least one chronic health problem and the average number of problems per subject was 2.0 (±1.5). The most common chronic health problems were arthritis or rheumatism (55.2 percent), high blood pressure (40.0 percent), heart trouble (29.7 percent), vision problems (29.0 percent) and hearing problems (22.8 percent).

About 64 percent of subjects had one or more long-term disabilities, and the mean number of disabilities per subject was 2.5 (±2.7). The most common disabilities were cutting toenails (35.3 percent), walking up and down stairs (34.5 percent) and carrying a 12-pound object (34.3 percent).

Two-thirds of study subjects had consulted an ophthalmologist, optometrist or optician about their eyes or vision during the 12 months preceding the interview, and the mean number of consultations was 1.2 (±2.8) per subject. Most (91.8 percent) had consulted a physician about their health in the past 12 months and the average number of physician consultations per subject was 4.8 (±6.6). Twenty-nine percent had consulted another health professional (any of a nurse, pharmacist, chiropractor, or physiotherapist) one or more times in the past twelve months, and 21.1 percent been hospitalized at least once in the year preceding the interview. Thirteen percent of study participants reported that they received community services at home such as meals-on-wheels, homecare, or friendly visitors, at the time of the initial interview.

The majority of subjects (83.7 percent) had used one or more medications in the two days preceding the initial interview. The average number of medications used was 2.1 (±1.5) per subject. Seventeen percent had used four or more medications. The most commonly used medications were medicine for blood pressure (35.0 percent), vitamins or minerals (32.9 percent), medicine for the heart (21.8 percent), tranquilizers, medicine for the nerves or medicine to help sleep (21.3 percent), and medicine for arthritis or rheumatism (16.5 percent).

4.2.4 - <u>TIME DEPENDENT EXPOSURE VARIABLES</u>

Table 4.10 shows the distribution of short-term and average exposure to each time dependent exposure variable by category of response. For continuous measures of average exposure, including number of different activities, number of activities, number of alcoholic drinks, number of symptoms and number of medications, responses were subdivided into quartiles. Responses to the categorical measures of average exposure were categorized into "none (exposure not reported in any preceding interview), "less than half" (exposure reported in at least one but less than half of preceding interviews) and "half or more" (exposure reported in half or more of preceding interviews). Appendix VI presents descriptive data on the variability in exposure to the time dependent (and stable) exposure variables over time.

4.3 - DESCRIPTION OF FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

This section describes where and when the 197 falls sustained during the 48-week follow-up period occurred. It also describes other characteristics of falls including activity engaged in at the time of the fall and subject self-reports of the reasons for the fall.

4.3.1 - <u>WHERE FALL OCCURRED</u>

The majority of falls (86.8 percent of 197 falls) occurred in a location which was familiar to the subject. One hundred sixteen falls (58.9 percent) occurred inside a building,

TABLE 4.10

DISTRIBUTION OF SHORT-TERM AND AVERAGE EXPOSURE TO TIME DEPENDENT EXPOSURE VARIABLES DURING THE 48-WEEK FOLLOW-UP PERIOD

VARIABLE	Person-months[1] n	%
Total	**4,763[2]**	**100.0**
LIFESTYLE HABITS		
Number of different activities		
Short-term		
0-1	694	14.6
2	1,810	38.0
3	1,428	30.0
4-7	831	17.4
Average		
0 -1.9	1,010	21.2
2.0-2.4	1,363	28.6
2.5-3.1	1,199	25.2
3.2-6.0	1,191	25.0
Number of activities		
Short-term		
0-10	1,050	22.1
11-15	1,191	25.0
16-20	672	14.1
21-25	998	21.0
26-70	851	17.8
Average		
0 -12.7	1,193	25.0
12.8-17.2	1,188	24.9
17.3-22.2	1,198	25.2
22.3-54.0	1,184	24.9
Number of alcoholic drinks		
Short-term		
0	3,022	63.5
1-3	798	16.8
4-10	529	11.1
11-84	412	8.7
Average		
0	1,931	40.5
0.1-0.3	492	10.3
0.4-2.8	1,149	24.1
2.9-70.0	1,191	25.0
HEALTH STATUS		
Two-Week Disability		
Bed-days		
Short-term		
No	4,502	94.5
Yes	261	5.5
Average		
None	3,826	80.3
Less than half	795	16.7
Half or more	142	3.0
Activity-limitation days		
Short-term		
No	4,117	86.5
Yes	645	13.5
Average		
None	2,788	58.5
Less than half	1,600	33.6
Half or more	375	7.9

TABLE 4.10 (continued)

VARIABLE	Person-months n	%
Symptoms		
Dizziness on standing		
Short-term		
No	4,458	93.6
Yes	305	6.4
Average		
None	3,518	73.9
Less than half	898	18.9
Half or more	347	7.3
Other dizziness		
Short-term		
No	4,264	89.5
Yes	499	10.2
Average		
None	3,109	65.3
Less than half	1,173	24.6
Half or more	481	10.1
Palpitations		
Short-term		
No	4,373	91.8
Yes	390	8.2
Average		
None	3,619	76.0
Less than half	772	16.2
Half or more	372	7.8
Short of breath at rest		
Short-term		
No	4,403	92.4
Yes	360	7.6
Average		
None	3,746	78.6
Less than half	727	15.3
Half or more	290	6.1
Short of breath on exertion		
Short-term		
No	3,802	79.8
Yes	960	20.2
Average		
None	2,406	50.5
Less than half	1,355	28.4
Half or more	1,002	21.0
Number of symptoms		
Short-term		
0	3,228	67.8
1	866	18.2
2	442	9.3
3-5	227	4.7
Average		
0	1,514	31.8
0.1-0.3	955	20.1
0.4-0.9	1,053	22.1
1.0-5.0	1,241	26.0

TABLE 4.10 (continued)

VARIABLE	Person-months n	%
Follow-up fall		
Short-term		
No	4,493	94.3
Yes	270	5.7
Average		
None	3,130	65.7
Less than half	1,363	28.6
Half or more	270	5.7
USE OF MEDICATION		
Medicine for arthritis		
Short-term		
No	4,043	85.1
Yes	708	14.9
Average		
None	3,615	75.9
Less than half	439	9.2
Half or more	709	14.9
Other pain relievers		
Short-term		
No	4,316	90.9
Yes	434	9.1
Average		
None	3,552	74.6
Less than half	765	16.1
Half or more	446	9.4
Tranquilizers		
Short-term		
No	3,902	82.1
Yes	848	17.9
Average		
None	3,434	72.1
Less than half	425	8.9
Half or more	904	19.0
Medicine for blood pressure		
Short-term		
No	3,074	64.7
Yes	1,676	35.3
Average		
None	2,845	59.7
Less than half	226	4.7
Half or more	1,692	35.5
Medicine for the heart		
Short-term		
No	3,860	81.2
Yes	890	18.8
Average		
None	3,601	75.6
Less than half	266	5.6
Half or more	896	18.8

TABLE 4.10 (continued)

VARIABLE	Person-months n	%
Antibiotics		
Short-term		
No	4,654	98.0
Yes	96	2.0
Average		
None	4,426	92.9
Less than half	267	5.6
Half or more	70	1.5
Laxatives		
Short-term		
No	4,206	88.6
Yes	544	11.4
Average		
None	3,747	78.7
Less than half	450	9.4
Half or more	566	11.9
Stomach remedies		
Short-term		
No	4,300	90.5
Yes	450	9.5
Average		
None	3,850	80.8
Less than half	455	9.6
Half or more	458	9.6
Cough or cold remedies		
Short-term		
No	4,591	96.7
Yes	158	3.3
Average		
None	4,149	87.1
Less than half	509	10.7
Half or more	105	2.2
Vitamins or minerals		
Short-term		
No	3,239	68.2
Yes	1,511	31.8
Average		
None	2,798	58.7
Less than half	470	9.9
Half or more	1,495	31.4
Anticoagulants		
Short-term		
No	4,384	92.2
Yes	372	7.8
Average		
None	4,284	89.9
Less than half	120	2.5
Half or more	359	7.5

TABLE 4.10 (continued)

VARIABLE	Person-months n	%
Medicine for diabetes		
Short-term		
No	4,413	92.7
Yes	349	7.3
Average		
None	4,382	92.0
Less than half	26	0.5
Half or more	355	7.5
Medicine for asthma or COPD(3)		
Short-term		
No	4,506	94.7
Yes	250	5.3
Average		
None	4,454	93.5
Less than half	92	1.9
Half or more	217	4.6
Other major medications		
Short-term		
No	4,245	89.3
Yes	511	10.7
Average		
None	4,049	85.0
Less than half	238	5.0
Half or more	476	10.0
Other minor medications		
Short-term		
No	4,470	94.0
Yes	285	6.0
Average		
None	4,247	89.2
Less than half	259	5.4
Half or more	257	5.4
Number of medications		
Short-term		
0	836	17.6
1	1,211	25.4
2	1,324	27.8
3	711	14.9
4	441	9.3
5-8	240	5.0
Average		
0 -0.9	1,095	23.0
1.0-1.8	1,323	27.8
1.9-2.7	1,154	24.2
2.8-8.5	1,191	25.0

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on exposure were extracted from the nearest preceding completed interview. Totals for each variable may vary because of missing data.
(3) Chronic obstructive pulmonary disease.

and 41.1 percent occurred outside (Table 4.11). The majority of indoor falls occurred in the subjects' homes, and the majority of outdoor falls occurred in the street, parking lot, or sidewalk. Table 4.12 shows that, with the exception of a slightly higher proportion of indoor falls occurring among those aged 80 years or older, there was little difference in the distribution of indoor and outdoor falls by age group or sex.

Table 4.13 shows that indoor falls were evenly distributed by room or area in which the fall occurred. A total of 22 falls (11.2 percent) occurred on stairs. Twelve stair-related falls occurred inside a building and the remainder occurred on outdoor stairs.

Subjects who fell outdoors were asked about the weather conditions at the time of the fall. One-third of outside falls (33.3 percent) occurred when it was very sunny, 24.7 percent occurred during precipitation of some kind (rain, snow, hail, sleet), 4.9 percent occurred when it was very windy, and for 37.0 percent of falls, subjects did not remember any particular weather condition.

All subjects were asked about the quality of the lighting in the place where they fell. Most falls (81.2 percent of 197 falls) occurred in a place which was well lit, 10.2 percent occurred in a place which was poorly lit, and subjects could not remember the quality of the lighting for 8.6 percent of falls.

Because the circumstances and characteristics of indoor and outdoor falls were quite different, many of the subsequent analyses differentiate between indoor and outdoor falls.

TABLE 4.11

DISTRIBUTION OF FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD BY LOCATION WHERE FALL OCCURRED

LOCATION	FALLS n	FALLS %
Total	**197**	**100.0**
Indoor falls	116	58.9
Subject's home	82	41.6
Another building	26	13.2
Don't know	8	4.1
Outdoor falls	81	41.1
Street, parking lot, sidewalk	40	20.3
Stairs	10	5.1
Other[1]	31	15.7

Note: [1] Includes locations such as on the earth, mud or grass, in the garden, on the snow or ice, into a boat, onto the balcony.

TABLE 4.12

DISTRIBUTION OF INDOOR AND OUTDOOR FALLS BY AGE GROUP AND SEX

	FALLS		
	Indoor (n=116) %	Outdoor (n=81) %	Total (n=197) %
Total	**100.0**	**100.0**	**100.0**
Age group (years)			
65-69	25.9	27.2	26.4
70-74	16.4	19.8	17.8
75-79	22.4	27.2	24.4
80-92	35.4	25.9	31.5
Sex			
Male	30.2	34.6	32.0
Female	69.8	65.4	68.0

X^2 (age group) = 2.12; p=0.55.
X^2 (sex) = 0.25; p=0.62.

TABLE 4.13

DISTRIBUTION OF INDOOR FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD BY ROOM WHERE FALL OCCURRED

ROOM	FALLS n	FALLS %
Total	**116**	**100.0**
Bedroom	22	19.0
Living room	19	16.4
Bathroom	16	13.8
Kitchen	16	13.8
Hallway	15	12.9
Stairs	12	10.3
Other	13	11.2
Don't know	3	2.6

4.3.2 - WHEN FALL OCCURRED

Table 4.14 shows that most falls (40.1 percent of 197 falls) occurred between 12:00 and 17:30 during the afternoon, followed by morning (24.9 percent) and then evening (15.2 percent). Only 18 falls (9.1 percent) occurred during the night between 23:00 and 5:30.

Fewer falls occurred on the weekend (Saturday and Sunday) compared to other days of the week (Table 4.15). The highest number of falls occurred on Monday and Tuesday, and the lowest occurred on Saturday.

4.3.3 - ACTIVITY AT TIME OF FALL

The most common activity by far at the time of falling was walking (Table 4.16). Forty percent of the 197 falls occurred while the subject was walking. Thirty falls (15.2 percent) were stair- or step-related, and 21 falls (10.7 percent) occurred while the subject was getting up. The majority of outdoor falls occurred while the subject was walking. Also, proportionately more outdoor falls occurred during stair- or step-related activities. Indoor fallers tended to fall while getting up and for a wide variety of "other" reasons.

Only 23 falls (11.7 percent) occurred while the subject was in a hurry. Most falls were unexpected - only 18 falls (9.1 percent of 197 falls) had been anticipated by the subject.

4.3.4 - SYMPTOMS BEFORE FALL

Table 4.17 shows that subjects experienced few symptoms just prior to falling. The most common symptoms experienced were vertigo or light-headedness (10.2 percent of 197 falls) and sudden weakness in the legs (6.1 percent of 197 falls).

TABLE 4.14

DISTRIBUTION OF FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD BY TIME OF DAY

TIME OF FALL (24-hour clock)	FALLS n	%
Total	**197**	**100.0**
6:00 - 11:59	49	24.9
12:00 - 17:59	79	40.1
18:00 - 22:59	30	15.2
23:00 - 5:59	18	9.1
Don't know	21	10.7

TABLE 4.15

DISTRIBUTION OF FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD BY DAY OF THE WEEK

DAY OF WEEK	FALLS n	FALLS %
Total	**197**	**100.0**
Monday	35	17.8
Tuesday	35	17.8
Wednesday	31	15.7
Thursday	29	14.7
Friday	26	13.2
Saturday	15	7.6
Sunday	21	10.7
Don't know	5	2.5

TABLE 4.16

ACTIVITY AT TIME OF FALL FOR FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

ACTIVITY AT TIME OF FALL	FALLS Indoor (n=111)[1] %	Outdoor (n=81) %	Total (n=192) %
Total	**100.0**	**100.0**	**100.0**
Walking	25.2	63.0	41.2
Stair or step-related	10.8	22.2	15.6
Getting up	18.0	1.2	10.9
Other	46.0	13.6	32.3

X^2 (activity at time of fall) = 47.36; $p<0.01$.

Note: [1] Excludes five indoor falls for which activity at time of fall was not known.

TABLE 4.17

SYMPTOMS EXPERIENCED JUST BEFORE FALLING FOR FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

SYMPTOMS	FALLS n	FALLS %[1]
Vertigo or light-headedness	20	10.2
Sudden weakness in legs	12	6.1
Weakness	1	0.5
Palpitations	0	0.0
Short of breath	0	0.0
Coughing	0	0.0
Difficulty talking	0	0.0
Flashing lights	0	0.0
Other symptoms	15	7.6

Note: [1] Categories of response were not mutually exclusive. Percentages were calculated using the total number of falls (n=197) as the denominator.

4.3.5 - SELF-REPORTS OF CAUSES OF FALLS

Classification of the reasons for falls according to subjects' self-reports suggested that 43.1 percent of falls involved environment-related factors (Table 4.18). Health-related factors were cited as the cause of 35.5 percent of falls, and both environment and health-related factors were mentioned for 16 falls (8.1 percent). Twenty-six falls (13.2 percent) could not be categorized, in most cases because the subject did not know the cause of the fall. Indoor fallers tended to cite health-related reasons for their falls, while the majority of outdoor fallers blamed their falls on environment-related factors.

Table 4.19 lists 18 phrases or words which recurred in the subjects' self-reports of the reasons for falling. The most frequently recurring phrases or words included slipped, tripped, snow or ice, lost balance, and dizziness or light-headedness.

In addition to self-reports of the causes of falling, each subject was asked systematically if the fall was the result of slipping, tripping, a surprise event, turning head quickly or getting up quickly. Table 4.20 presents these results. There is a concordance between the causes mentioned in the self-reports of the reasons for falling and the responses to systematic questions on tripping and slipping. In 11 of 49 trip falls, stairs or steps were cited as the causal agent, and in 31 of 51 slip falls, snow or ice was cited as the precipitator.

Table 4.21 compares some characteristics of falls which occurred for health-related reasons with those which occurred for environment-related reasons, according to the subjects' self-reports. The data show that a higher proportion of environment-related falls occurred among females. By age group, there was a slight excess of health-related falls in the oldest age group, while the highest proportion of environment-related falls occurred in the youngest

TABLE 4.18

SELF-REPORTS OF REASONS FOR FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

REASON FOR FALL	FALLS Indoor (n=116) %	Outdoor (n=81) %	Total (n=197) %
Total	**100.0**	**100.0**	**100.0**
Health-related	46.6	19.8	35.5
Environment-related	27.6	65.4	43.1
Environment and health-related	8.6	7.4	8.1
Unknown	17.2	7.4	13.2

x^2 (reason for fall) = 29.05; $p<0.01$.

TABLE 4.19

FREQUENCY OF 18 PHRASES OR WORDS WHICH RECURRED IN SUBJECTS' SELF-REPORTS OF REASONS FOR FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD(1)

RECURRING PHRASES	FALLS n	%(2)
Slipped	47	23.9
Tripped	47	23.9
Snow or ice	31	15.7
Lost balance	24	12.2
Dizziness or light-headedness	21	10.7
Weakness in legs	14	7.1
Chronic health problem	12	6.1
Problem with sidewalk, road, pavement	12	6.1
Carelessness	11	5.6
Blackout	10	5.1
Footwear	8	4.1
Medication	7	3.6
Wet surface	7	3.6
Problem with lighting	5	2.5
Problem with vision	5	2.5
Carrying something	5	2.5
Acute health problem	2	1.0
Weakness	2	1.0
Don't know	24	12.2

Notes: (1) Based on subjects' verbatim self-reports of the reason for the fall.
(2) Categories of response were not mutually exclusive. Percentages were calculated using the total number of falls (n=197) as the denominator.

TABLE 4.20

RESPONSE TO SYSTEMATIC QUESTIONS ON CAUSES OF FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

CAUSE OF FALL[1]	FALLS Indoor (n=116) %[2]	Outdoor (n=81) %[2]	Total (n=197) %[2]
Slipped	19.0	33.3	25.9
Tripped	12.9	44.4	24.9
Surprise event	5.2	3.7	4.6
Turning head quickly	3.5	0.0	2.0
Getting up quickly	2.6	0.0	1.5

Notes: [1] Subjects were asked whether or not the fall was the result of any of the events listed.

[2] Categories of response were not mutually exclusive. Percentages were calculated using the total number of falls as the denominator.

TABLE 4.21

COMPARISON OF HEALTH- AND ENVIRONMENT-RELATED FALLS[1]

	FALLS Health-related (n=70) %	FALLS Environment-related (n=85) %	p
Sex			
Male	42.9	28.2	0.08
Female	57.1	71.8	
Age group (years)			
65-69	25.7	32.9	0.22
70-74	17.1	17.7	
75-79	20.0	27.1	
80-92	37.1	22.4	
Location of fall			
Indoor	77.1	37.7	<0.01
Outdoor	22.9	62.4	
Activity at time of fall[2]			
Walking	21.2	55.3	<0.01
Stair or step-related	22.7	12.9	
Getting up	24.2	3.8	
Other	31.8	28.2	
Tripped	12.9	50.6	<0.01
Slipped	5.7	30.6	<0.01
Injury	42.9	47.1	0.72
Consulted health professional	20.0	9.4	0.10

Notes: [1] Excludes 42 of 197 falls for which subject self-reports of reasons for the fall were both environment and health-related or were unknown.
[2] Excludes four health-related falls for which activity at time of fall was unknown.

age group. By far the majority of health-related falls occurred indoors whereas two-thirds of environment-related falls occurred outdoors.

Activity at the time of fall varied according to whether the reason for the fall was related to health or to the environment. Over half of environment-related falls occurred while the subject was walking. Only one-fifth of health-related falls occurred while the subject was walking. However, compared to environment-related falls, proportionately more health-related falls were stair-related or occurred while the subject was getting up. A trip or slip was cited more frequently for environment-related falls. Finally, while the injury rates were similar, health professionals were consulted more frequently for health-related than for environment-related falls.

4.3.6 - OTHER CHARACTERISTICS OF FALLS

Table 4.22 describes several other characteristics of falls which occurred during the 48-week follow-up. About half of the falls were witnessed. Also, only one subject experienced a "long lie". About two-thirds of subjects got up alone after the fall.

4.4 - FREQUENCY OF FALLS AND FALL-RELATED INJURY

Data on the frequency of falls and fall-related injuries are presented in this section. Section 4.4.1 presents data on falls sustained in the 12 months preceding the initial interview. Section 4.4.2 describes the frequency of falls, repeat falls, and fall-related injuries sustained during the 48-week follow-up period, and Section 4.4.3 compares the data obtained in the two time intervals.

TABLE 4.22

CHARACTERISTICS OF FALLS EXPERIENCED DURING THE 48-WEEK FOLLOW-UP PERIOD

CHARACTERISTIC	FALLS n	%
Total	**197**	**100.0**
Direction of the fall		
Forward	74	37.6
Backward	58	29.4
To the side	47	23.9
Other	9	4.4
No answer	9	4.6
Part of body which received most impact		
Knees	38	19.3
Buttocks	36	18.3
Upper extremities	20	10.2
Lower ext:emities	12	6.1
Hips	10	5.1
Head	10	5.1
Other	61	62.9
No answer	10	5.1
Distance subject fell		
Same as own height	132	67.0
Greater than own height	8	4.1
Less than own height	49	24.9
No answer	8	4.1
Surface onto which subject fell		
Hard	106	53.8
Soft	84	42.6
Other	2	1.0
No answer	5	2.5
No. minutes subject remained on ground		
Less than one	18	9.1
1	95	48.2
2	28	14.2
3-10	21	10.7
11-14	0	0.0
15-30	8	4.0
31-59	0	0.0
≥60	1	0.5
Don't know	26	13.2
Witness	94	47.7
Subject got up		
Alone	118	59.9
With help	78	39.6
No answer	1	0.5

4.4.1 - FALLS SUSTAINED IN THE 12 MONTHS PRECEDING THE INITIAL INTERVIEW

Table 4.23 shows the distribution of subjects by the number of falls sustained in the 12 months preceding the initial interview. The prevalence proportion of subjects with a positive fall history was 24.2 percent[1]. Of the 101 subjects who fell, 62 (61.4 percent) reported that they fell once and 38 (37.6 percent of fallers; 9.1 percent of all subjects) fell two or more times. Table 4.24 shows that 22.2 percent of males had fallen compared to 25.4 percent of females. In both males and females the proportion of fallers was highest in the youngest and oldest age groups, and lowest among subjects aged 75-79 years, although none of these differences were statistically significant. Table 4.25 shows that there was little difference between males and females in the proportion of repeat fallers. By age group, proportionately more subjects in the youngest and oldest age groups fell repeatedly, compared to those aged 70-79 years but again, none of these differences were statistically significant. Male fallers fell an average of 1.9 ± 1.3 times, and female fallers fell an average of 1.8 ± 1.9 times.

Fall-Related Injury

Fifty-five subjects (54.5 percent of fallers; 13.2 percent of all subjects) sustained a fall-related injury in the 12 months preceding the initial interview (Table 4.26)[1]. Proportionately more females than males had been injured, although the difference was not statistically significant. The majority of injuries were minor including laceration without suture, bruise, abrasion, and other minor soft tissue injury (Table 4.27). Seventeen subjects (16.8 percent of fallers; 4.1 percent of all subjects) sustained one or more fall-related fractures. Most fractures involved the upper (shoulder, arm, elbow wrist) or lower (toes, leg, ankle) extremities. Two subjects sustained hip fractures (2.0 percent of fallers; 0.5 percent of all subjects).

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[1] A total of 21 persons selected from the electoral list were excluded from the study because they were hospitalized at the time of the initial at-home visit. If some of these individuals were hospitalized because of a fall, the proportions of subjects with a positive fall history and in particular, with a history of fall-related injury, could be underestimated.

TABLE 4.23

DISTRIBUTION OF SUBJECTS BY NUMBER OF FALLS SUSTAINED IN THE 12 MONTHS PRECEDING THE INITIAL INTERVIEW

NUMBER OF FALLS	SUBJECTS n	%
Total	**417**	**100.0**
0	316	75.8
1	62	14.9
2	22	5.3
3	8	1.9
4	3	0.7
6	3	0.7
10	1	0.2
12	1	0.2
Don't know(1)	1	0.2

Note: (1) One male subject aged 75 years who reported having fallen did not know the number of times he had fallen.

TABLE 4.24

PROPORTION OF SUBJECTS WHICH FELL IN THE 12 MONTHS PRECEDING THE INITIAL INTERVIEW BY AGE GROUP AND SEX

AGE GROUP AND SEX	Total number of subjects n	Fallers n	%	(95% CI)[1]
Age group (years)				
Total	417	101	24.2	(20.2 - 28.7)
65-69	102	28	27.5	(19.3 - 37.4)
70-74	111	26	23.4	(16.1 - 32.6)
75-79	102	15	14.7	(8.7 - 23.4)
80-92	102	32	31.4	(22.8 - 41.5)
Males				
Total	153	34	22.2	(16.1 - 29.8)
65-69	42	11	26.2	(14.4 - 42.3)
70-74	46	10	21.7	(11.4 - 36.7)
75-79	42	7	16.7	(7.5 - 32.0)
80-91	23	6	26.1	(11.1 - 48.7)
Females				
Total	264	67	25.4	(20.4 - 31.2)
65-69	60	17	28.3	(17.8 - 41.6)
70-74	65	16	24.6	(15.1 - 37.1)
75-79	60	8	13.3	(6.3 - 25.1)
80-92	79	26	32.9	(23.0 - 44.5)

Note: [1] 95 percent confidence interval (Fleiss, 1981).

TABLE 4.25

PROPORTION OF SUBJECTS WHICH FELL REPEATEDLY IN THE 12 MONTHS PRECEDING THE INITIAL INTERVIEW BY AGE GROUP AND SEX

AGE GROUP AND SEX	Total number of subjects n	Repeat fallers n	%	(95% CI)[1]
Age group (years)				
Total	417	38	9.1	(6.6 - 12.4)
65-69	102	11	10.8	(5.8 - 18.9)
70-74	111	9	8.1	(4.0 - 15.2)
75-79	102	5	4.9	(1.8 - 11.6)
80-92	102	13	12.8	(7.3 - 21.2)
Males				
Total	153	16	10.5	(6.3 - 16.7)
65-69	42	4	9.5	(3.1 - 23.5)
70-74	46	5	10.9	(4.1 - 24.4)
75-79	42	5	11.9	(4.5 - 26.4)
80-91	23	2	8.7	(1.5 - 29.5)
Females				
Total	264	22	8.3	(5.4 - 12.5)
65-69	60	7	11.7	(5.2 - 23.2)
70-74	65	4	6.2	(2.0 - 15.8)
75-79	60	0	0.0	(0.0 - 7.5)
80-92	79	11	13.9	(7.5 - 23.9)

Note: [1] 95 percent confidence interval (Fleiss, 1981).

TABLE 4.26

PROPORTION OF SUBJECTS WHICH SUSTAINED FALL-RELATED INJURY IN THE 12 MONTHS PRECEDING THE INITIAL INTERVIEW BY AGE GROUP AND SEX

AGE GROUP AND SEX	Total number of subjects n	Fall-related injury n	%	(95% CI)[1]
Age group (years)				
Total	417	55	13.2	(10.2 - 16.9)
65-69	102	17	16.7	(10.3 - 25.7)
70-74	111	14	12.6	(7.3 - 20.6)
75-79	102	6	5.9	(2.4 - 12.9)
80-92	102	18	17.7	(11.1 - 26.8)
Males				
Total	153	14	9.2	(5.3 - 15.2)
65-69	42	4	9.5	(3.1 - 23.5)
70-74	46	4	8.7	(2.8 - 21.7)
75-79	42	3	7.1	(1.8 - 20.5)
80-91	23	3	13.0	(3.4 - 34.6)
Females				
Total	264	41	15.5	(11.5 - 20.6)
65-69	60	13	21.7	(12.5 - 34.6)
70-74	65	10	15.4	(8.0 - 27.0)
75-79	60	3	5.0	(1.3 - 14.8)
80-92	79	15	19.0	(11.4 - 29.7)

Note: [1] 95 percent confidence interval (Fleiss, 1981).

TABLE 4.27

FALL-RELATED INJURY SUSTAINED IN THE 12 MONTHS PRECEDING THE INITIAL INTERVIEW

INJURY	SUBJECTS n	%
Total	**417**	**100.0**
No injury	362	86.8
Injury	55	13.2
Minor soft tissue injury[1]	34	8.2
Sprains[2]	3	0.7
Fractures[3]	17	4.1
Anxiety, nervousness	1	0.2

Notes :
(1) Includes laceration without suture, bruise, abrasion and other minor soft tissue injury.
(2) Includes two subjects with sprained ankles, and one subject with a sprained knee.
(3) Includes seven subjects with fractures of the upper extremities, four with fractures of the lower extremities, two with hip fractures, two with rib fractures, one subject with fractures of the shoulder and foot, and one subject with fractures of the shoulder and arm.

Forty subjects (39.6 percent of fallers; 9.6 percent of all subjects) had consulted a physician at least once about a fall in the 12 months preceding the initial interview, and 12 subjects (11.9 percent of fallers; 2.9 percent of all subjects) had been hospitalized because of a fall.

4.4.2 - FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

Table 4.28 shows the distribution of subjects by the number of falls sustained during the 48-week follow-up period. The proportion of fallers was 29.1 percent. Of the 119 subjects who fell, 72 (60.5 percent) fell once, and 47 (39.5 percent of fallers; 11.5 percent of all subjects) fell two or more times. Table 4.29 shows that proportionately more females than males had fallen (33.5 percent compared to 21.7 percent). The proportion of fallers was highest among the youngest (65-69 years) and oldest (80-92 years) age groups. This U-shaped pattern of association was marked among females, whereas in males, the proportion of fallers increased with age.

Forty-seven subjects fell repeatedly during the follow-up (11.5 percent of all subjects; 39.5 percent of those who fell at least once). There was no difference between males and females in the proportion of repeat fallers (Table 4.30). The proportion of repeat fallers increased with age but the differences were not statistically significant. Male fallers fell an average of 1.9 ± 1.4 times, and female fallers fell an average of 1.6 ± 1.1 times.

Because the incidence density of falls expresses the number of falls per person-time of follow-up, it takes subjects lost to follow-up as well as multiple falls in a single individual into account, and therefore provides a more precise measure of the frequency of falls than the proportion of fallers reported above. Table 4.31 shows that the incidence density was 41.4 falls per 1,000 person-months (1.5 falls per 1,000 person-days). The rate was higher in

TABLE 4.28

DISTRIBUTION OF SUBJECTS BY THE NUMBER OF FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

NUMBER OF FALLS	MALES n	MALES %	FEMALES n	FEMALES %	TOTAL n	TOTAL %
Total	**152**	**100.0**	**257**	**100.0**	**409**	**100.0**
0	119	78.3	171	66.5	290	70.9
1	15	9.9	57	22.2	72	17.6
2	13	8.6	18	7.0	31	7.6
3	3	2.0	8	3.1	11	2.7
4	0	0.0	1	0.4	1	0.3
5	1	0.6	1	0.4	2	0.5
6	0	0.0	0	0.0	0	0.0
7	0	0.0	0	0.0	0	0.0
8	1	0.6	1	0.4	2	0.5

TABLE 4.29

PROPORTION OF SUBJECTS WHICH FELL DURING THE 48-WEEK FOLLOW-UP PERIOD BY AGE GROUP AND SEX

AGE GROUP AND SEX	Total number of subjects n	Fallers n	Fallers %	Fallers (95% CI)[1]
Age group (years)				
Total	409	119	29.1	(24.8 - 33.8)
65-69	102	33	32.4	(23.7 - 42.5)
70-74	109	24	22.0	(14.9 - 31.2)
75-79	99	25	25.3	(17.3 - 35.2)
80-92	99	37	37.4	(28.0 - 47.7)
Males				
Total	152	33	21.7	(15.6 - 29.3)
65-69	42	6	14.3	(6.0 - 29.2)
70-74	46	10	21.7	(11.4 - 36.7)
75-79	42	8	19.1	(9.2 - 34.7)
80-91	22	9	40.9	(21.5 - 63.3)
Females				
Total	257	86	33.5	(27.8 - 39.7)
65-69	60	27	45.0	(32.3 - 58.3)
70-74	63	14	22.2	(13.1 - 34.8)
75-79	57	17	29.8	(18.8 - 43.5)
80-92	77	28	36.4	(26.0 - 48.2)

Note: [1] 95 percent confidence interval (Fleiss, 1981).

TABLE 4.30

PROPORTION OF SUBJECTS WHICH FELL REPEATEDLY DURING THE 48-WEEK FOLLOW-UP PERIOD BY AGE GROUP AND SEX

AGE GROUP AND SEX	Total number of subjects n	Repeat fallers n	Repeat fallers %	Repeat fallers (95% CI)[1]
Age group (years)				
Total	409	47	11.5	(8.7 - 15.1)
65-69	102	12	11.8	(6.5 - 20.1)
70-74	109	9	8.3	(4.1 - 15.6)
75-79	99	12	12.1	(6.7 - 20.6)
80-92	99	14	14.1	(8.2 - 22.9)
Males				
Total	152	18	11.8	(7.3 - 18.3)
65-69	42	4	9.5	(3.1 - 23.5)
70-74	46	4	8.7	(2.8 - 21.7)
75-79	42	6	14.3	(6.0 - 29.2)
80-91	22	4	18.2	(6.0 - 41.0)
Females				
Total	257	29	11.3	(7.8 - 16.0)
65-69	60	8	13.3	(6.3 - 25.1)
70-74	63	5	7.9	(2.9 - 18.2)
75-79	57	6	10.5	(4.3 - 22.2)
80-92	77	10	13.0	(6.7 - 23.1)

Note: [1] 95 percent confidence interval (Fleiss, 1981).

TABLE 4.31

INCIDENCE DENSITY OF FALLS DURING THE 48-WEEK FOLLOW-UP PERIOD BY AGE GROUP AND SEX

AGE GROUP AND SEX	Person-months[1] n	Number of falls n	Incidence density[3] n (95% CI)[4]
Age group (years)			
Total	4,763[2]	197	41.4 (35.6-47.2)
65-69	1,251	52	41.6 (30.3-52.9)
70-74	1,295	35	27.0 (18.1-36.0)
75-79	1,088	48	44.1 (31.6-56.6)
80-92	1,129	62	54.9 (41.2-68.6)
Males			
Total	1,767	63	35.7 (26.9-44.5)
65-69	522	13	24.9 (11.4-38.4)
70-74	527	15	28.5 (14.1-42.9)
75-79	463	21	45.4 (26.0-64.8)
80-91	255	14	54.9 (26.1-83.7)
Females			
Total	2,996	134	44.7 (37.1-52.3)
65-69	729	39	53.5 (36.7-70.3)
70-74	768	20	26.0 (14.6-37.4)
75-79	625	27	43.2 (26.9-59.5)
80-92	874	48	54.9 (39.4-70.4)

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on falls were extracted from the next completed follow-up interview in which the dates of all falls experienced since the last contact with the interviewer were recorded.
(3) Number of falls per 1,000 person-months.
(4) 95 percent confidence intervals were computed using a normal approximation for a Poisson variable in a large sample.
($ID = \frac{X}{L}$; $VAR(\widehat{ID}) = \frac{X}{L^2}$; 95% CI $= \frac{X}{L} \pm 1.96\frac{\sqrt{X}}{L}$)

females than in males. It increased with age in males, but the pattern was U-shaped in females, with higher incidence densities in the youngest and oldest age groups.

Table 4.32 shows the incidence density of falls by month of interview. While the incidence rate of indoor falls remained constant over seasons (with a slight increase during the summer months), outdoor falls were slightly more frequent during the fall and winter months than during the spring and summer months.

Fall-Related Injury

Seventy-three subjects (61.4 percent of fallers; 17.9 percent of all subjects) reported one or more fall-related injuries during the 48-week follow-up period. Table 4.33 shows that there was little difference between males and females in the proportion which sustained a fall-related injury. In both males and females, the proportion of subjects injured was highest in the oldest age group, but the differences were not statistically significant. About half of subjects who fell once (54.2 (95 percent confidence interval, 42.4-66.5) percent) were injured compared to 72.3 (95 percent confidence interval, 62.5-84.5) percent of subjects who fell repeatedly).

Of the 197 falls reported, 91 (46.2 percent) resulted in an injury (Table 4.34). The proportion of falls which produced injury was fairly consistent across sex and age groups. Table 4.35 shows the incidence density of fall-related injury by age group and sex. The data show that the rate of fall-related injury was higher (although not statistically significantly higher) among females than males. In males, the rate increased with age, while in females, the rate was highest in the youngest and oldest age groups. Table 4.36 shows that most injuries were minor (laceration without suture, bruise, abrasion, other minor soft tissue injury). One fall resulted in laceration with suture and five falls (2.5 percent of 197 falls) resulted in fracture including three hip fractures, one of the arm, and one fall which caused fractures of the nose and of two fingers. None of the injuries resulted in death.

TABLE 4.32

INCIDENCE DENSITY OF FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD BY MONTH OF INTERVIEW

MONTH	Person-months n[1]	Incidence density[1] Indoor (n=114)[3]	Outdoor (n=81)	Total (n=195)[3]
Total	**4,763[2]**	**23.9**	**17.0**	**40.9**
December-February	1,292	21.7	20.9	42.6
March-May	1,146	22.7	14.8	37.5
June-August	1,022	29.4	12.7	42.1
September-November	1,303	23.0	18.4	41.4

Notes: (1) Number of falls per 1,000 person-months.
(2) Includes 4,445 follow-up interviews and 318 "missing" interviews for which data on falls were extracted from the next completed follow-up interview, in which the dates of all falls experienced since the last contact with the interviewer were recorded.
(3) Month of fall was missing for two indoor falls.

TABLE 4.33

PROPORTION OF SUBJECTS WHICH SUSTAINED FALL-RELATED INJURY DURING THE 48-WEEK FOLLOW-UP

AGE GROUP AND SEX	Total number of subjects n	Fall-related injury n	%	(95% CI)[1]
Age group (years)				
Total	409	73	17.9	(14.4 - 22.0)
65-69	102	19	18.6	(11.8 - 27.8)
70-74	109	14	12.8	(7.4 - 20.9)
75-79	99	14	14.1	(8.2 - 22.9)
80-92	99	26	26.3	(18.2 - 36.3)
Males				
Total	152	23	15.1	(10.0 - 22.0)
65-69	42	5	11.9	(4.5 - 26.4)
70-74	46	5	10.9	(4.1 - 24.4)
75-79	42	7	16.7	(7.5 - 32.0)
80-91	22	6	27.3	(11.6 - 50.5)
Females				
Total	257	50	19.5	(14.9 - 25.0)
65-69	60	14	23.3	(13.8 - 36.3)
70-74	63	9	14.3	(7.1 - 25.9)
75-79	57	7	12.3	(5.5 - 24.3)
80-92	77	20	26.0	(17.0 - 37.5)

Note: [1] 95 percent confidence interval (Fleiss, 1981).

TABLE 4.34

PROPORTION OF FALLS WHICH RESULTED IN INJURY DURING THE 48-WEEK FOLLOW-UP PERIOD BY AGE GROUP AND SEX

AGE GROUP AND SEX	Total number of falls n	Falls which resulted in injury n	%	(95% CI)[1]
Age group (years)				
Total	197	91	46.2	(39.1 - 53.4)
65-69	52	24	46.2	(32.5 - 60.5)
70-74	35	16	45.7	(29.2 - 63.1)
75-79	48	20	41.7	(28.0 - 56.8)
80-92	62	31	50.0	(37.2 - 62.8)
Males				
Total	63	27	42.9	(30.7 - 56.0)
65-69	13	6	46.2	(20.4 - 73.9)
70-74	15	6	40.0	(17.5 - 67.1)
75-79	21	9	42.9	(22.6 - 65.6)
80-91	14	6	42.9	(18.8 - 70.4)
Females				
Total	134	64	47.8	(39.2 - 56.6)
65-69	39	18	46.2	(30.5 - 62.7)
70-74	20	10	50.0	(27.9 - 72.1)
75-79	27	11	40.7	(23.0 - 61.0)
80-92	48	25	52.1	(37.4 - 66.5)

Note: [1] 95 percent confidence interval (Fleiss, 1981).

TABLE 4.35

INCIDENCE DENSITY OF FALL-RELATED INJURY DURING THE 48-WEEK FOLLOW-UP PERIOD BY AGE GROUP AND SEX

AGE GROUP AND SEX	Person-months[1] n	Number of fall-related injuries n	Incidence density[3] n (95% CI)[4]
Age group (years)			
Total	4,763[2]	91	19.1 (15.2-23.0)
65-69	1,251	24	19.2 (11.5-26.9)
70-74	1,295	16	12.4 (6.4-18.5)
75-79	1,088	20	18.4 (10.3-26.5)
80-92	1,127	31	27.5 (17.8-37.2)
Males			
Total	1,767	27	15.3 (9.5-21.1)
65-69	522	6	11.5 (2.3-20.7)
70-74	527	6	11.4 (2.3-20.5)
75-79	463	9	19.4 (6.7-32.1)
80-91	255	6	23.5 (4.7-42.3)
Females			
Total	2,996	64	21.4 (16.2-26.6)
65-69	729	18	24.7 (13.2-36.1)
70-74	768	10	13.0 (4.9-21.1)
75-79	625	11	17.6 (7.2-28.0)
80-92	874	25	28.6 (17.4-39.8)

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on fall-related injury were extracted from the next completed follow-up interview, in which the dates of all falls experienced since the last contact with the interviewer were recorded.
(3) Number of fall-related injuries per 1,000 person-months.
(4) 95 percent confidence intervals were computed using a normal approximation for a Poisson variable in a large sample.
($ID = \frac{X}{L}$; $VAR(\hat{ID}) = \frac{X}{L^2}$; 95% CI $= \frac{X}{L} \pm 1.96\sqrt{\frac{X}{L}}$)

TABLE 4.36

FALL-RELATED INJURY SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

	SUBJECTS		FALLS	
INJURY	n	%	n	%
Total	**409**	**100.0**	**197**	**100.0**
No injury	336	82.2	106	53.8
Injury	73	17.9	91	46.2
Minor soft tissue injury[1]	67	16.4	85	43.2
Laceration with suture	1	0.3	1	0.5
Fractures[2]	5	1.2	5	2.5

Notes: [1] Includes laceration without suture, bruise, abrasion, and other minor soft tissue injury.

[2] Includes three fractures of the hip, one of the arm, and one fall which resulted in fractures of the nose and of two fingers.

One or more health professionals were consulted about a total of 30 falls (15.2 percent of 197 falls), but only 13 falls (6.6 percent) were actually treated. Five falls (2.5 percent of 197 falls) resulted in hospitalization. Three subjects spent less than a week in hospital. One subject spent 23 nights in hospital and one spent 173 nights in hospital.

In addition to injury, six subjects (1.5 percent of 409 subjects) indicated in the last follow-up interview that they had modified their normal activities during the past year because of a fall, and ten subjects (2.5 percent of 409 subjects) had modified their normal activities because of fear of falling.

Tables 4.37 and 4.38 examine the frequency of fall-related injury by location and by activity engaged in at the time of the fall. Although none of the differences were statistically significant, Table 4.37 suggests that a higher proportion of falls which occurred in either an unfamiliar place or in a place which is poorly lit, resulted in fall-related injury. Also subjects tended to consult a health professional more frequently when the fall occurred in the bathroom or in a place which was poorly lit. Table 4.38 suggests that more falls which occurred during stair or step-related activities resulted in injury, while fewer "getting up" falls resulted in injury. Again, these differences were not statistically significant.

4.4.3 - COMPARISON OF THE FREQUENCY OF FALLS AND FALL-RELATED INJURY SUSTAINED DURING THE 12 MONTHS PRECEDING THE INITIAL INTERVIEW AND THE 48-WEEK FOLLOW-UP PERIOD

Table 4.39 shows that the proportions of fallers, repeat fallers, and subjects with fall-related injury were very similar during the two reference periods. Although the number of hip fractures was similar in the two reference periods (n=2 and 3, respectively) the proportion of subjects which reported other kinds of fall-related fractures was much higher during the 12-

TABLE 4.37

FALL-RELATED INJURY BY LOCATION OF FALL

Location of fall	Falls n	Fall-related injury % (95% CI)[1]	Consulted health professional % (95% CI)
Total	**197**	**46.2 (39.1-53.4)**	**15.2 (10.7-21.2)**
Indoor	116	43.1 (34.0-52.6)	20.7 (14.0-29.4)
Outdoor	81	50.6 (39.4-61.8)	7.4 (3.0-16.0)
Stairs	22	54.5 (32.7-74.9)	13.6 (3.6-36.0)
Familiar	171	43.9 (36.4-51.6)	15.2 (10.3-21.7)
Unfamiliar	26	61.5 (40.7-79.1)	15.4 (5.0-35.7)
Bathroom	16	50.0 (25.5-74.5)	31.3 (12.1-58.5)
Well-lit	160	43.1 (35.4-51.2)	13.1 (8.5-19.6)
Poorly-lit	20	70.0 (45.7-87.2)	25.0 (9.6-49.4)

Note: (1) 95 percent confidence interval (Fleiss, 1981).

TABLE 4.38

FALL-RELATED INJURY BY ACTIVITY AT TIME OF FALL

Activity at time of fall	Falls n	Fall-related injury % (95% CI)[1]	Consulted health professional % (95% CI)
Total	**197**	**46.2 (39.2-53.4)**	**15.2 (10.7-21.2)**
Walking	79	49.4 (38.0-60.8)	16.5 (9.4-26.9)
Stair or step-related	30	60.0 (40.7-76.8)	16.7 (6.3-35.5)
Getting up	21	33.3 (15.5-56.9)	19.0 (6.3-42.6)
Other	67	40.3 (28.7-53.0)	13.4 (6.7-24.5)

Note: (1) 95 percent confidence interval (Fleiss, 1981).

TABLE 4.39

COMPARISON OF THE FREQUENCY OF FALLS AND FALL-RELATED INJURY SUSTAINED DURING THE 12-MONTHS PRECEDING THE INITIAL INTERVIEW AND THE 48-WEEK FOLLOW-UP PERIOD

		REFERENCE PERIOD	
		12-months preceding initial interview	48-week follow-up period
Falls	n	182	197
Fell one or more times	%	24.2	29.1
Repeat falls			
All subjects	%	9.1	11.5
Fallers	%	37.6	39.5
Fall-related injury			
All subjects	%	13.2	17.9
Fallers	%	54.5	61.4
Fall-related fracture[1]			
All subjects	%	4.1	1.2
Fallers	%	16.8	4.2
Fall-related hip fracture			
All subjects	%	0.5	0.7
Fallers	%	2.0	2.5
Fall-related physician consultations			
All subjects	%	9.6	5.1
Fallers	%	39.6	17.7
Fall-related hospitalization			
All subjects	%	2.9	1.2
Fallers	%	11.9	4.2

Note: (1) Includes hip fractures.

month period preceding the initial interview than during the 48-week follow-up period. This suggests that in a 12-month recall, study participants might overestimate the occurrence of falls with more serious injury such as fracture.

4.5 - RISK FACTORS FOR FALLS

This section presents results on the identification of risk factors for falls and fall-related injury sustained during the 48-week follow-up period. In each section, results from the univariate analyses describing the associations between falls or fall-related injury and each sociodemographic, lifestyle, and health-related variable are described first. The results of the multivariate analyses are presented subsequently.

4.5.1 - RISK FACTORS FOR FALLS

4.5.1.1 - Univariate analysis

Tables 4.40 to 4.44 show the univariate association between each potential risk factor and falls sustained during the 48-week follow-up. The tables show the incidence density of falls by category of exposure for each variable. The first category shown for each variable is the baseline category against which the incidence density ratios for the other categories were calculated.

The data show that several sociodemographic characteristics including age group, marital status, income, number of persons in household, and years of schooling, were associated with falls experienced during the 48-week follow-up (Table 4.40). Subjects aged 70-74 years fell less frequently than subjects in the other age groups. The fall rate was higher among widowed persons compared to those who were married, single, divorced or separated.

TABLE 4.40

ASSOCIATIONS BETWEEN SOCIODEMOGRAPHIC CHARACTERISTICS AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

SOCIODEMOGRAPHIC CHARACTERISTIC	Falls n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Total	**197**	**4,763[3]**	**41.4**	-
Sex				
Female	134	2,996	44.7	1.0
Male	63	1,767	35.7	0.8
Age group (years)				
65-69	52	1,251	41.6	1.0
70-74	35	1,295	27.0	0.7
75-79	48	1,088	44.1	1.1
80-92	62	1,129	54.9	1.3
Marital Status				
Married (incl. common law)	69	2,092	33.0	1.0
Single (never married)	33	763	43.3	1.3
Widowed	88	1,680	52.4	1.6
Divorced, Separated	7	228	30.7	0.9
Language				
English	116	2,561	45.3	1.0
French	59	1,722	34.3	0.8
Other	22	480	45.8	1.0
Paid employment				
No	176	4,165	42.3	1.0
Yes	21	598	35.1	0.8
Income				
<$10,000	44	913	48.2	1.0
$10,000 - $20,000	63	1,192	52.9	1.1
>$20,000 - $40,000	40	913	43.8	0.9
>$40,000	25	767	32.6	0.7
No answer	25	986	25.4	0.5
Number of persons in household				
One	97	1,857	52.2	1.0
Two	81	2,305	35.1	0.7
Three or more	19	601	31.6	0.6
Years of schooling				
0-7	41	1,249	32.8	1.0
8-10	47	1,109	42.4	1.3
11	55	1,144	48.1	1.5
12 or more	47	1,117	42.1	1.3

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on time dependent exposures were extracted from the nearest preceding completed interview and data on falls were extracted from the next completed follow-up interview. Totals for each variable may differ because of missing data.

It was higher among subjects who lived alone than among those who lived in households with two or more persons. The fall rate decreased with increasing income and, finally, the rate of falling was higher among subjects who had completed high school, compared to those who had not graduated from high school.

Table 4.41 shows the univariate association between lifestyle habits and the rate of falls. Several indicators of physical activity including physical activity compared to peers, physical effort in daily actitivies, average number of different activities, and average number of activities suggested that the rate of falls was higher among the less physically active. Neither of the short-term indicators of physical activity suggested that level of physical activity was associated with the rate of falls.

The fall rate increased substantially as the degree of satisfaction with social life decreased (from 26.5 falls per 1,000 person-months among those whose social lives were very satisfying, to 78.5 falls per 1,000 person-months among subjects who were dissatisfied with their social lives).

All three measures of the use of alcohol suggested that the fall rate was lower among subjects who drank more alcohol. Data on the frequency of alcohol consumption suggested that daily use of alcohol was protective against falls. The fall rate decreased from 45.3 to 29.1 falls per 1,000 person-months as short-term number of alcoholic drinks increased. Finally, data on average exposure also suggested that the fall rate was lowest among those who drank the most.

Many indicators of health status were associated with falls in the univariate analysis (Table 4.42). Subjects whose self-reports indicated that they were in poor health or that they were not satisfied with their health had higher fall rates compared to those in good health or

TABLE 4.41

ASSOCIATIONS BETWEEN LIFESTYLE HABITS AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

LIFESTYLE HABIT	Falls n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
TOTAL	**197**	**4,763[3]**	**41.4**	-
Physical activity				
Physical activity compared to peers				
Much more active	64	1,519	42.1	1.0
Somewhat more active	43	1,112	38.7	0.9
Same	33	1,037	31.8	0.8
Somewhat less active	24	485	49.5	1.2
Much less active	33	499	66.1	1.6
Physical effort in daily activities				
Light	56	1,274	44.0	1.0
Moderate	133	3,311	40.2	0.9
Heavy	3	144	20.8	0.5
Number of different activities				
Short-term				
0-1	27	694	38.9	1.0
2	83	1,810	45.9	1.2
3	55	1,428	38.5	1.0
4-7	32	831	38.5	1.0
Average				
0 -1.9	58	1,010	57.4	1.0
2.0-2.4	46	1,363	33.7	0.6
2.5-3.1	45	1,199	37.5	0.7
3.2-6.0	48	1,191	40.3	0.7
Number of activities				
Short-term				
0-10	43	1,050	41.0	1.0
11-15	44	1,191	36.9	0.9
16-20	30	672	44.6	1.1
21-25	45	998	45.1	1.1
≥26	35	851	41.1	1.0
Average 0 -12.7	60	1,193	50.3	1.0
12.8-17.2	41	1,188	34.5	0.7
17.3-22.2	42	1,198	35.1	0.7
22.3-54.0	54	1,184	45.6	0.9
Social life				
Frequency of social gatherings				
More than once a week	89	2,163	41.1	1.0
Once a week	52	1,187	43.8	1.1
At least once a month	2[illegible]	744	30.9	0.8
Less than once a month	33	669	49.3	1.2
Social life				
Very satisfying	49	1,847	26.5	1.0
Rather satisfying	84	2,101	40.0	1.5
Unsatisfying	64	815	78.5	3.0

TABLE 4.41 (continued)

LIFESTYLE HABIT	Falls n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Member of social group				
No	117	2,328	50.3	1.0
Yes	80	2,435	32.9	0.7
Own cat or dog				
No	173	4,140	41.8	1.0
Yes	24	623	38.5	0.9
Smokes cigarettes				
No	157	3,777	41.6	1.0
Yes	40	986	40.6	1.0
Use of alcohol				
Frequency of alcohol consumption				
Don't drink	72	1,609	44.7	1.0
Less than once a month	39	917	42.5	1.0
One or more times a month	34	551	61.7	1.4
At least once a week	36	944	38.1	0.9
Every day	16	730	21.9	0.5
Number of alcoholic drinks				
Short-term				
0	137	3,022	45.3	1.0
1-3	32	798	40.1	0.9
4-10	16	529	30.2	0.7
11-70	12	412	29.1	0.6
Average				
0	82	1,931	42.5	1.0
0.1-0.3	24	492	48.8	1.1
0.4-2.8	56	1,149	48.7	1.1
2.9-70.0	35	1,191	29.4	0.7

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on time dependent exposures were extracted from the nearest preceding completed interview and data on falls were extracted from the next completed follow-up interview. Totals for each variable may differ because of missing data.

TABLE 4.42

ASSOCIATIONS BETWEEN HEALTH STATUS AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

HEALTH STATUS	Falls n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
TOTAL	**197**	**4,763[3]**	**41.4**	•
Self-reported health				
Self-perceived health status				
Excellent	57	1,511	37.7	1.0
Good	76	1,920	39.6	1.1
Average	38	1,085	35.0	0.9
Poor	26	247	105.3	2.8
Satisfaction with health				
Very satisfied	74	1,943	38.1	1.0
Somewhat satisfied	56	1,831	30.6	0.8
Not too satisfied	40	763	52.4	1.4
Not at all satisfied	27	226	119.5	3.1
Two-week disability				
Bed-days				
Short-term				
No	190	4,502	42.2	1.0
Yes	7	261	26.8	0.6
Average				
None	156	3,826	40.8	1.0
Less than half	29	795	36.5	0.9
Half or more	12	142	84.5	2.1
Activity-limitation days				
Short-term				
No	147	4,117	35.7	1.0
Yes	50	645	77.5	2.2
Average				
None	89	2,788	31.9	1.0
Less than half	72	1,600	45.0	1.4
Half or more	36	375	96.0	3.0
Symptoms				
Dizziness on standing				
Short-term				
No	178	4,458	39.9	1.0
Yes	19	305	62.3	1.6
Average				
None	136	3,518	38.7	1.0
Less than half	42	898	46.8	1.2
Half or more	19	347	54.8	1.4
Other dizziness				
Short-term				
No	155	4,264	36.4	1.0
Yes	42	499	84.2	2.3
Average				
None	87	3,109	28.0	1.0
Less than half	67	1,173	57.1	2.0
Half or more	43	481	89.4	3.2

TABLE 4.42 (continued)

HEALTH STATUS	Falls n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Palpitations				
Short-term				
No	181	4,373	41.4	1.0
Yes	16	390	41.0	1.0
Average				
None	135	3,619	37.3	1.0
Less than half	44	772	57.0	1.5
Half or more	18	372	48.4	1 3
Short of breath at rest				
Short-term				
No	178	4,403	40.4	1.0
Yes	19	360	52.8	1.3
Average				
None	150	3,746	40.0	1.0
Less than half	32	727	44.0	1.1
Half or more	15	290	51.7	1 3
Short of breath on exertion				
Short-term				
No	148	3,802	38.9	1.0
Yes	49	960	51.0	1.3
Average				
None	85	2,406	35.3	1.0
Less than half	59	1,355	43.5	1.2
Half or more	53	1,002	52.9	1.5
Number of symptoms				
Short-term				
0	117	3,228	36.2	1.0
1	38	866	43.9	1.2
2	23	442	52.0	1.4
3-5	19	227	83.7	2.3
Average				
0	42	1,514	27.7	1.0
0.1-0.3	36	955	37.7	1.4
0.4-0.9	33	1,053	31.3	1.1
1.0-5.0	77	1,241	62.0	2.2
Chronic health problems				
High blood pressure				
No	106	2,842	37.3	1.0
Yes	91	1,921	47.4	1.3
Heart Trouble				
No	140	3,366	37.3	1.0
Yes	57	1,397	40.8	1.1
Diabetes				
No	176	4,311	40.8	1.0
Yes	21	452	46.5	1.1
Respiratory disorder				
No	151	4,038	37.4	1.0
Yes	46	725	63.4	1.7

TABLE 4.42 (continued)

HEALTH STATUS	Falls n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Arthritis or rheumatism				
No	83	2,137	38.8	1.0
Yes	114	2,626	43.4	1.1
Vision problem				
No	123	3,379	36.4	1.0
Yes	74	1,384	53.5	1.5
Hearing problem				
No	153	3,667	41.7	1.0
Yes	44	1,096	40.1	1.0
Stroke				
No	180	4,427	40.7	1.0
Yes	17	336	50.6	1.2
Other long-term problem				
No	112	3,017	37.1	1.0
Yes	85	1,746	48.7	1.3
Number of chronic health problems				
0	25	708	35.3	1.0
1	51	1,259	40.5	1.1
2	42	1,357	31.0	0.9
3	46	862	53.4	1.5
4	13	362	35.9	1.0
5-7	20	215	93.0	2.6
Long-term disability				
Experiences trouble:				
Walking 400 meters				
No	120	3,625	33.1	1.0
Yes	77	1,146	67.2	2.0
Walking up and down stairs				
No	112	3,147	35.6	1.0
Yes	85	1,624	52.3	1.5
Carrying a 12-pound object				
No	109	3,181	34.7	1.0
Yes	88	1,590	55.3	1.6
Standing for long periods				
No	111	3,318	33.5	1.0
Yes	86	1,453	59.2	1.8
Bending down				
No	108	3,375	32.0	1.0
Yes	89	1,396	63.8	2.0
Cutting toenails				
No	97	3,116	31.1	1.0
Yes	100	1,655	60.4	1.9
Using fingers to grasp				
No	134	4,027	33.2	1.0
Yes	63	744	84.7	2.6
Reaching				
No	144	4,187	34.4	1.0
Yes	53	584	90.8	2.6

TABLE 4.42 (continued)

HEALTH STATUS	Falls n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Number of disabilities				
0	40	1,740	23.0	1.0
1-2	58	1,412	41.1	1.8
3-5	44	940	46.8	2.0
6-8	55	671	82.0	3.6
Fell in year preceding initial interview				
No	126	3,587	35.1	1.0
Yes	71	1,176	60.4	1.7
Follow-up fall				
Short-term				
No	170	4,493	37.8	1.0
Yes	27	270	100.0	2.6
Average				
None	87	3,130	27.8	1.0
Less than half	88	1,363	64.6	2.3
Half or more	22	270	81.5	2.9
Quetelet Index				
14.19-21.33	51	1,143	44.6	1.0
21.36-23.529	49	1,224	40.0	0.9
23.5-25.965	40	1,081	37.0	0.8
25.97-41.51	49	1,151	42.6	1.0
Missing	8	164	48.8	1.1

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on time dependent exposures were extracted from the nearest preceding completed interview and data on falls were extracted from the next completed follow-up interview. Totals for each variable may differ because of missing data.

those who were satisfied with their health. Data on two-week disability suggested that, while short-term exposure to bed-days was associated with a decreased rate of falls, increased average bed-day exposure was associated with a higher fall rate. However, both short-term and increased average exposure to activity-limitation days were associated with a substantial increase in the rate of falls.

Among the nonspecific symptoms, both short-term and average exposure to dizziness on standing and to other dizziness were associated with an increased rate of falls. In addition the fall rate increased as average exposure to palpitations and to short of breath on exertion increased. Finally, both the short-term and average indicators of the number of nonspecific symptoms showed that the fall rate increased as the number of symptoms reported increased.

Among the chronic health problems studied, only respiratory disorders and vision problems were associated with falls. Subjects with five or more chronic health problems were much more likely to fall than subjects with fewer problems. Similarly, the rate of falls increased with the presence of any disability and as the number of disabilities increased. Subjects who reported that they had fallen in the year preceding the initial interview had a higher fall rate than those who did not report falls. Not surprisingly both short-term and average follow-up falls suggested that the fall rate increased substantially among subjects with a history of falls during the year preceding the initial interview and/or during the follow-up period.

Health status indicators not associated with the rate of falls in the univariate analysis included short of breath at rest, high blood pressure, heart trouble, diabetes, arthritis or rheumatism, hearing problems, other long-term problems and Quetelet Index.

Indicators of both short-term and average exposure to a variety of medications were associated with falls during the follow-up period (Table 4.43). Short-term exposure to other pain relievers, antibiotics, laxatives, and cough or cold remedies were associated with an increased rate of falls. Increased average exposure to other pain relievers, tranquilizers, medicine for the heart, antibiotics, cough or cold remedies, vitamins or minerals, medicine for asthma or chronic obstructive pulmonary disease, other major medications and other minor medications were all associated with an increased rate of falls. Finally, both the short-term and average indicators of number of medications showed that the fall rate increased as the number of medications used increased.

Medications not associated with the rate of falls in the univariate analyses included medicine for arthritis, medicine for blood pressure, stomach remedies, anticoagulants and medicine for diabetes.

Table 4.44 shows that all the indicators of the use of health services were associated with falls sustained during the follow-up period.

4.5.1.2 - Multivariate analysis

As indicated earlier, two series of analyses were undertaken. The first series included all potential risk factors to create a full model, and the second series included only those potential risk factors for which a direct etiologic explanation seemed plausible (to create the etiologic model).

TABLE 4.43

ASSOCIATIONS BETWEEN USE OF MEDICATION AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

MEDICATION	Falls n	Person-months(1) n	Incidence density(2) n	Incidence density ratio
Total	**197**	**4,763(3)**	**41.4**	-
Medicine for arthritis				
Short-term				
No	160	4,043	39.6	1.0
Yes	37	708	52.3	1.3
Average				
None	142	3,615	39.3	1.0
Less than half	19	439	43.3	1.1
Half or more	36	709	50.8	1.3
Other pain relievers				
Short-term				
No	166	4,316	38.5	1.0
Yes	31	434	71.4	1.9
Average				
None	126	3,552	35.5	1.0
Less than half	38	765	49.7	1.4
Half or more	33	446	74.0	2.1
Tranquilizers				
Short-term				
No	160	3,902	41.0	1.0
Yes	37	848	43.6	1.1
Average				
None	130	3,434	37.9	1.0
Less than half	18	425	42.4	1.1
Half or more	49	904	54.2	1.4
Medicine for blood pressure				
Short-term				
No	126	3,074	41.0	1.0
Yes	71	1,676	42.4	1.0
Average				
None	114	2,845	40.1	1.0
Less than half	10	226	44.3	1.1
Half or more	73	1,692	43.1	1.1
Medicine for the heart				
Short-term				
No	166	3,860	43.0	1.0
Yes	31	890	34.8	0.8
Average				
None	146	3,601	40.5	1.0
Less than half	20	266	75.2	1.9
Half or more	31	896	34.6	0.9
Antibiotics				
Short-term				
No	186	4,654	40.0	1.0
Yes	11	96	114.6	2.9
Average				
None	176	4,426	39.8	1.0
Less than half	11	267	41.2	1.0
Half or more	10	70	142.9	3.6

TABLE 4.43 (continued)

MEDICATION	Falls n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Laxatives				
Short-term				
No	166	4,206	39.5	1.0
Yes	31	544	57.0	1.4
Average				
None	151	3,747	40.3	1.0
Less than half	18	450	40.0	1.0
Half or more	28	566	49.5	1.2
Stomach remedies				
Short-term				
No	178	4,300	41.4	1.0
Yes	19	450	42.2	1.1
Average				
None	163	3,850	42.3	1.0
Less than half	16	455	35.2	0.8
Half or more	18	458	39.3	0.9
Cough or cold remedies				
Short-term				
No	186	4,591	40.5	1.0
Yes	11	158	69.6	1.7
Average				
None	165	4,149	39.8	1.0
Less than half	23	509	45.2	1.1
Half or more	9	105	85.7	2.2
Vitamins or minerals				
Short-term				
No	121	3,239	37.4	1.0
Yes	76	1,511	50.3	1.3
Average				
None	99	2,798	35.4	1.0
Less than half	16	470	34.0	1.0
Half or more	82	1,495	54.9	1.6
Anticoagulants				
Short-term				
No	181	4,382	41.3	1.0
Yes	16	372	43.0	1.0
Average				
None	173	4,284	40.4	1.0
Less than half	6	120	50.0	1.2
Half or more	18	359	50.1	1.2
Medicine for diabetes				
Short-term				
No	184	4,413	41.7	1.0
Yes	13	349	37.2	0.9
Average				
None	182	4,382	41.5	1.0
Less than half	1	26	38.5	0.9
Half or more	14	355	39.4	0.9

TABLE 4.43 (continued)

MEDICATION	Falls n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Medicine for asthma or COPD[4]				
Short-term				
No	185	4,506	41.1	1.0
Yes	12	250	48.0	1.2
Average				
None	181	4,454	40.6	1.0
Less than half	5	92	54.4	1.3
Half or more	11	217	50.7	1.2
Other major medication				
Short-term				
No	180	4,245	42.4	1.0
Yes	17	511	33.3	0.8
Average				
None	172	4,049	42.5	1.0
Less than half	13	238	54.6	1.3
Half or more	12	476	25.2	0.6
Other minor medication				
Short-term				
No	182	4,470	40.7	1.0
Yes	15	285	52.6	1.3
Average				
None	173	4,247	40.7	1.0
Less than half	9	259	34.8	0.9
Half or more	15	257	58.4	1.4
Number of medications				
Short-term				
0	20	836	23.9	1.0
1	53	1,211	43.8	1.8
2	52	1,324	39.3	1.6
3	36	711	50.6	2.1
4	23	441	52.2	2.2
5-8	13	240	54.2	2.3
Average				
0 -0.9	35	1,095	32.0	1.0
1.0-1.8	43	1,323	32.5	1.0
1.9-2.7	53	1,154	45.9	1.4
2.8-8.5	66	1,191	55.4	1.7

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on time dependent exposures were extracted from the nearest preceding completed interview and data on falls were extracted from the next completed follow-up interview. Totals for each variable may differ because of missing data.
(4) Chronic obstructive pulmonary disease.

TABLE 4.44

ASSOCIATIONS BETWEEN THE USE OF HEALTH SERVICES AND FALL SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

USE OF HEALTH SERVICES	Falls n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
TOTAL	**197**	**4,763[3]**	**41.4**	-
Number of ophthalmologist consultations				
0	59	1,789	33.0	1.0
1	97	2,062	47.0	1.4
2	18	495	36.4	1.1
3	5	119	42.0	1.3
4-50	18	298	60.4	1.8
Number of physician consultations				
0-1	42	1,236	34.0	1.0
2-3	44	1,314	33.5	1.0
4-5	34	973	34.9	1.0
6-10	33	786	42.0	1.2
12-72	44	454	96.9	2.9
Consultated other health professionals				
No	116	3,423	33.9	1.0
Yes	81	1,340	60.5	1.8
Hospitalized in 12 months preceding initial interview				
No	145	3,774	38.4	1.0
Yes	52	989	52.6	1.4
Received homecare				
No	156	4,147	37.6	1.0
Yes	41	616	66.6	1.8

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on time dependent exposures were extracted from the nearest preceding completed interview and data on falls were extracted from the next completed follow-up interview. Totals for each variable may differ because of missing data.

(i) Full Model

Table 4.45 lists the variables associated with falls in the univariate analyses and therefore included in the early multivariate analyses. Table 4.46 shows the adjusted incidence density ratios and 95 percent confidence intervals for the 17 risk factors identified in the multivariate analyses including the stable exposure variables and both short-term and average measures of exposure to the time dependent exposure variables. The data show that the risk factors with the largest incidence density ratios were not at all satisfied with health (incidence density ratio=2.8) followed by other dizziness (incidence density ratio for half or more=2.7) and then use of antibiotics (incidence density ratio=2.4). Factors which appeared to be protective against falls included French-speaking, bed-days, palpitations, use of tranquilizers, use of stomach remedies and use of other major medication. Figure 4.1 shows that the incidence density of falls increased substantially as the number of risk factors present in a single individual increased.

(ii) Etiologic Model

Table 4.47 lists the variables selected for study in the etiologic model. Table 4.48 shows the adjusted incidence density ratios and 95 percent confidence intervals for etiologic risk factors identified in the multiple logistic-regression analyses containing all independent predictors. Six of the 17 risk factors for falls identified in the full model were retained in the etiologic model. These included bed-days, activity-limitation days, other dizziness, and use of antibiotics, vitamins or minerals or other major medication. The incidence density ratios for these six variables were very similar in the two models. The etiologic model identified a further six risk factors for falls, none of which had been retained in the full model. These included two indicators of level of physical activity, daily consumption of alcohol, trouble hearing, trouble walking 400 meters and use of medicine for the heart.

TABLE 4.45
VARIABLES INCLUDED IN THE EARLY MULTIVARIATE ANALYSES OF RISK FACTORS FOR FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

VARIABLES	VARIABLES
Sociodemographic Characteristics	**Use of Medication**
Age group	Other pain relievers (short-term, average)
Marital status	Tranquilizers (average)
Income	Medicine for the heart (average)
Number of persons in household	Antibiotics (short-term, average)
Years of schooling	Laxatives (short-term)
	Cough or cold remedies (short-term, average)
Lifestyle Habits	Vitamins or minerals (average)
Physical activity compared to peers	Medicine for asthma or COPD[1] (average)
Physical effort in daily activities	Other major medications (average)
Number of different activities (average)	Other minor medications (average)
Number of acticitivies (average)	Number of medications (short-term, average)
Member of social group	
Satisfaction with social life	
Frequency of alcohol consumption	
Number of alcoholic drinks (short-term, average)	**Use of Health Services**
	Number of ophthalmologist consultations
Health Status	Number of physician consultations
Self-perceived health status	Consulted other health professionals
Satisfaction with health	Hospitalized in 12 months preceding initial interview
Bed-days (short-term, average)	Received homecare
Activity-limitation days (short-term, average)	
Dizziness on standing (short-term, average)	
Other dizziness (short-term, average)	
Palpitations (average)	
Short of breath on exertion (average)	
Number of symptoms (short-term, average)	
Respiratory disorder	
Vision problem	
Number of chronic health problems	
Trouble walking 400 meters	
Trouble walking up and down stairs	
Trouble carrying a 12-pound object	
Trouble standing for long periods	
Trouble bending down	
Trouble cutting toenails	
Trouble using fingers to grasp	
Trouble reaching	
Number of disabilities	
Fell in year preceding initial interview	
Follow-up fall (short-term, average)	

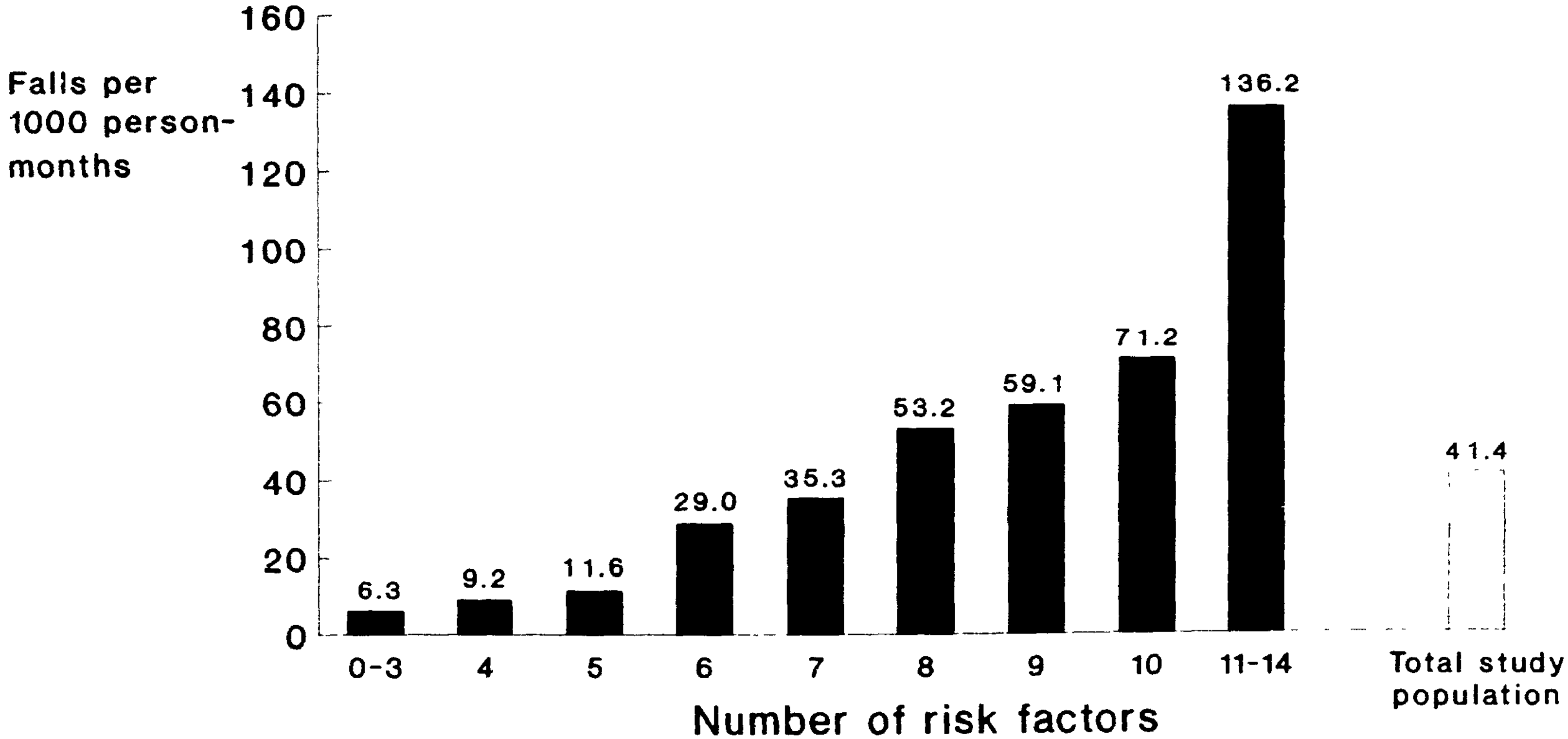
Note: (1) Chronic obstructive pulmonary disease.

TABLE 4.46
RISK FACTORS FOR FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD (FULL MODEL)

RISK FACTOR	Incidence density ratio[1] (95% CI)[2]	p
Sociodemographic Characteristics		
Live alone		
No	1.0	
Yes	1.4 (1.1-1.9)	0.023
Language		
English, Other	1.0	
French	0.7 (0.5-0.9)	0.011
Lifestyle Habits		
Social life		
Satisfying	1.0	
Unsatisfying	1.7 (1.2-2.4)	0.004
Member of social group		
No	1.0	
Yes	1.5 (1.1-2.1)	0.006
Health Status		
Satisfaction with health		
Very, Somewhat, Not too	1.0	
Not at all	2.8 (1.7-4.8)	<0.001
Bed-days (average)		
None	1.0	
Less than half, Half or more	0.5 (0.4-0.8)	0.002
Activity-limitation days (short-term)		
No	1.0	
Yes	1.6 (1.1-2.3)	0.024
Other dizziness(average)		
None	1.0	
Less than half	1.8 (1.3-2.6)	
Half or more	2.7 (1.7-4.2)	<0.001
Palpitations (short-term)		
No	1.0	
Yes	0.6 (0.3-1.0)	0.045
Trouble using fingers to grasp		
No	1.0	
Yes	1.6 (1.1-2.3)	0.011
Follow-up fall (average)		
None	1.0	
Less than half, Half or more	1.5 (1.1-2.1)	0.008
Use of Medication		
Tranquilizers (short-term)		
No	1.0	
Yes	0.7 (0.4-1.0)	0.028
Antibiotics (average)		
None,Less than half	1.0	
Half or more	2.4 (1.1-5.3)	0.036
Stomach remedies (average)		
None, Less than half	1.0	
Half or more	0.6 (0.3-1.0)	0.037
Vitamins or minerals (average)		
None, Less than half	1.0	
Half or more	1.5 (1.1-2.0)	0.013
Other major medication (average)		
None, Less than half	1.0	
Half or more	0.4 (0.2-0.7)	0.001
Use of Health Services		
Number of physician consultations (per 10 consultations)	1.3 (1.1-1.5)	0.002

Notes: (1) Estimated by the adjusted odds ratios obtained from multiple logistic-regression analyses containing all independent predictors.
(2) 95 percent confidence interval.

FIGURE 4.1
Incidence density of falls by number of risk factors [1] (Full Model)



	0-3	4	5	6	7	8	9	10	11-14	Total study population
Number of falls	1	3	7	27	31	39	34	23	32	197
Person-months	158	327	603	930	879	733	575	323	235	4763

Note: (1) The risk factors included those listed in Table 4.46.

TABLE 4.47
VARIABLES SELECTED FOR STUDY IN THE ETIOLOGIC MODELS OF RISK FACTORS FOR FALLS AND FALL-RELATED INJURY SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

VARIABLES	VARIABLES
Sociodemographic Characteristics	**Use of Medication**
-	Medicine for arthritis (short-term, average)
	Other pain relievers (short-term, average)
Lifestyle Habits	Tranquilizers (short-term, average)
Physical effort in daily activities	Medicine for blood pressure (short-term, average)
Number of different activities (short-term, average)	Medicine for the heart (short-term, average)
Number of activities (short-term, average)	Antibiotics (short-term, average)
Frequency of alcohol consumption	Laxatives (short-term, average)
Number of alcoholic drinks (short-term, average)	Stomach remedies (short-term, average)
	Cough or cold remedies (short-term, average)
Health Status	Vitamins or minerals (short-term, average)
Bed-days (short-term, average)	Anticoagulants (short-term, average)
Activity-limitation days (short-term, average)	Medicine for diabetes (short-term, average)
Dizziness on standing (short-term, average)	Medicine for asthma or COPD[2] (short-term, average)
Other dizziness (short-term, average)	Other major medication (short-term, average)
Palpitations (short-term, average)	Other minor medication (short-term, average)
Short of breath at rest (short-term, average)	Number of medications (short-term, average)
Short of breath on exertion (short-term, average)	
Number of symptoms (short-term, average)	
High blood pressure	
Heart trouble	
Diabetes	**Use of Health Services**
Respiratory disorder	-
Arthritis or rheumatism	
Vision problem	
Hearing problem	
Number of chronic health problems	
Trouble walking 400 meters[1]	
Trouble walking up and down stairs[1]	

Notes: (1) Of the eight long-term disabilities studied, only trouble walking 400 meters and trouble walking up and down stairs were selected for testing in the etiologic model, because they were the closest proxy indicators available for mobility problems.

(2) Chronic obstructive pulmonary disease.

TABLE 4.48
RISK FACTORS FOR FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD. ETIOLOGIC MODEL

RISK FACTOR	Incidence density ratio[1] (95% CI)[2]	p
Lifestyle Habits		
Number of different activities (average)		
0-1.9	1.0	
≥2.0	0.6 (0.4-0.9)	0.008
Number of activities (short-term)		
0-10	1.0	
≥10	1.9 (1.2-3.0)	0.004
Frequency of alcohol consumption		
Less often than every day	1.0	
Every day	0.5 (0.3-0.9)	0.005
Health Status		
Bed-days (short-term)		
No	1.0	
Yes	0.4 (0.2-0.9)	0.011
Activity-limitation days (short-term)		
No	1.0	
Yes	1.9 (1.3-2.7)	0.001
Other dizziness (average)		
None	1.0	
Less than half	2.0 (1.4-2.8)	<0.001
Half or more	3.2 (2.1-4.8)	
Trouble hearing		
No	1.0	
Yes	0.7 (0.5-1.0)	0.047
Trouble walking 400 meters		
No	1.0	
Yes	1.8 (1.3-2.5)	0.001
Use of Medication		
Medicine for the heart (average)		
None, Less than half	1.0	
Half or more	0.6 (0.4-0.9)	0.017
Antibiotics (average)		
None, Less than half	1.0	
Half or more	2.3 (1.1-4.7)	0.041
Vitamins or minerals (average)		
None, Less than half	1.0	
Half or more	1.5 (1.1-2.0)	0.013
Other major medication (average)		
None, Less than half	1.0	
Half or more	0.4 (0.2-0.7)	0.001

Notes: (1) Estimated by the adjusted odds ratios obtained from multiple logistic-regression analyses containing all independent predictors.
(2) 95 percent confidence interval.

Among the etiologic risk factors, other dizziness had the highest incidence density ratio (incidence density ratio for half or more=3.2), followed by use of antibiotics (incidence density ratio for half or more=2.3), number of activities (incidence density ratio for ≥10=1.9), activity-limitation days (incidence density ratio=1.9), and trouble walking 400 meters (incidence density ratio=1.8). Factors which appeared to be protective against falls included number of different activities, daily alcohol consumption, bed-days, trouble hearing, use of medicine for the heart and use of other major medication.

Figure 4.2 shows that the incidence density of falls increased as the number of etiologic risk factors present in a single individual increased. Finally, Table 4.49 shows the results of the analyses which examined age and then sex interactions[1].

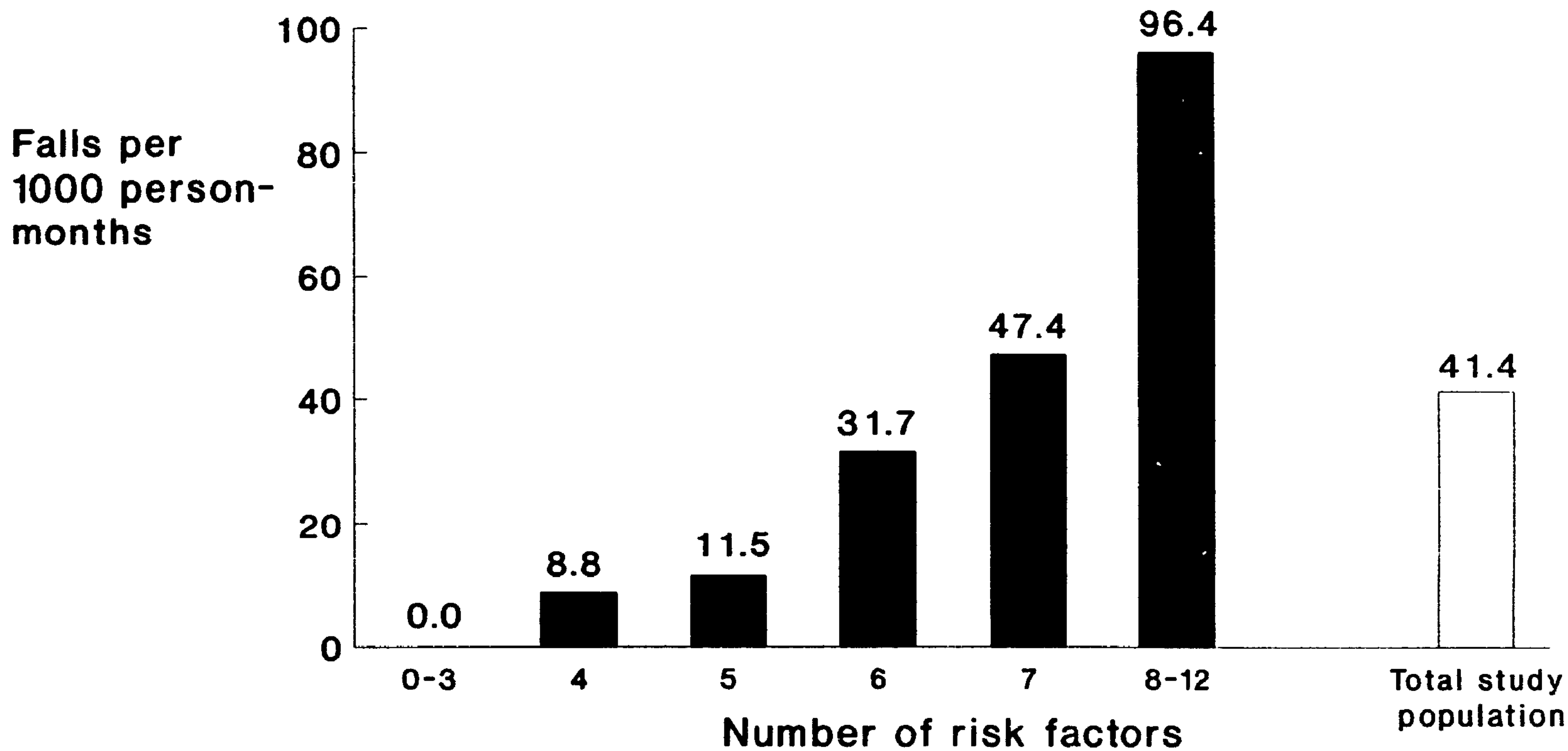
4.5.2 - RISK FACTORS FOR FALL-RELATED INJURY

4.5.2.1 - Univariate analysis

Tables 4.50 to 4.54 present the univariate associations between each potential risk factor and fall-related injury. Among the sociodemographic characteristics, age group, marital status, paid employment and number of persons in household were associated with the rate of fall-related injury (Table 4.50). The rate of fall-related injury was highest among subjects in the oldest age group. Subjects living alone had a higher rate of fall-related injury, and those who were married or single had lower rates than those who were widowed, divorced or separated. Finally those who were employed sustained fewer fall-related injuries than those who were not employed.

[1] Appendix VII shows the univariate associations between each potential etiologic risk factor and falls, first for males and females, and then for subjects aged 65-74 years and ≥75 years.

FIGURE 4.2
Incidence density of falls by number of risk factors[1] (Etiologic Model)



	0-3	4	5	6	7	8-12	Total study population
Number of falls	0	2	9	54	60	72	197
Person-months	31	228	786	1704	1267	747	4763

Note: (1) The risk factors included those listed in Table 4.48.

TABLE 4.49

INTERACTION TERMS RETAINED IN THE ETIOLOGIC MODEL OF RISK FACTORS FOR FALLS

	Incidence density ratio[1] (95% CI)[2]	
Interactions with sex	**Male**	**Female**
Frequency of alcohol consumption		
Less often than every day	1.0	1.0
Every day	0.3 (0.1-0.7)	0.8 (0.3-2.2)
Tranquilizers (average)		
None, Less than half	1.0	1.0
Half or more	3.0 (1.6-5.4)	0.7 (0.3-1.7)
Antibiotics (average)		
None, Less than half	1.0	1.0
Half or more	5.8 (2.2-15.7)	0.6 (0.2-2.0)
Other major medication (average)		
None, Less than half	1.0	1.0
Half or more	0.9 (0.4-2.0)	0.2 (0.1-0.5)
Interactions with age	**65-74 years**	**≥75 years**
Short of breath at rest (average)		
None, Less than half	1.0	1.0
Half or more	1.4 (0.7-2.8)	0.2 (0.1-0.6)
Vision problem		
No	1.0	1.0
Yes	1.7 (1.1-2.9)	0.9 (0.3-2.2)
Other minor medication		
None, Less than half	1.0	1.0
Half or more	3.1 (1.6-5.8)	0.5 (0.2-1.0)

Notes: (1) Estimated by the adjusted odds ratios obtained from multiple logistic-regression analyses containing all independent predictors.

(2) 95 percent confidence intervals. There wese computed using the following: $SE(\hat{B}_1+\hat{B}_2) = \sqrt{SE_1^2 + SE_2^2 + 2\,COV(\hat{B}_1+\hat{B}_2)}$;

95 percent confidence interval = $e^{(\hat{B}_1+\hat{B}_2) \pm 1.96\,SE(\hat{B}_1+\hat{B}_2)}$.

TABLE 4.50

ASSOCIATIONS BETWEEN SOCIODEMOGRAPHIC CHARACTERISTICS AND FALL-RELATED INJURY SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

SOCIODEMOGRAPHIC CHARACTERISTIC	Fall-related injury n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Total	**91**	**4,763[3]**	**19.1**	-
Sex				
Female	64	2,996	21.4	1.0
Male	27	1,767	15.3	0.7
Age group (years)				
65-69	24	1,251	19.2	1.0
70-74	16	1,295	12.4	0.6
75-79	20	1,088	18.4	1.0
80-92	31	1,129	27.5	1.4
Marital Status				
Married (incl. common law)	28	2,092	13.4	1.0
Single (never married)	14	763	18.3	1.4
Widowed	44	1,680	26.2	2.0
Divorced, Separated	5	228	21.9	1.6
Language				
English	55	2,561	21.5	1.0
French	26	1,722	15.1	0.7
Other	10	480	20.8	1.0
Paid employment				
No	84	4,165	20.2	1.0
Yes	7	598	11.7	0.6
Income				
<$10,000	19	913	20.8	1.0
$10,000 - $20,000	32	1,192	26.8	1.3
>$20,000 - $40,000	14	913	15.3	0.7
>$40,000	15	767	19.6	0.9
No answer	11	986	11.2	0.5
Number of persons in household				
One	46	1,857	24.8	1.0
Two	35	2,305	15.2	0.6
Three or more	9	601	15.0	0.6
Years of schooling				
0-7	20	1,249	16.0	1.0
8-10	20	1,109	18.0	1.1
11	24	1,144	21.0	1.3
12 or more	22	1,117	19.7	1.2
No answer	6	144	41.7	2.6

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on time dependent exposures were extracted from the nearest preceding completed interview and data on falls were extracted from the next completed follow-up interview. Totals for each variable may differ because of missing data.

Table 4.51 shows the univariate associations between lifestyle habits and the rate of fall-related injury. Several indicators of level of physical activity suggested that those who were most active had lower rates of fall-related injury. Compared to subjects whose usual physical effort in daily activities was light or moderate, the fall-related injury rate was lower among those who reported heavy physical effort. Also the indicators of average exposure to number of different activities and to number of activities suggested that the fall-related injury rate was higher among those who reported fewer physical activities.

Several indicators of social life suggested that social interaction was associated with the rate of fall-related injury. Data on the frequency of social gatherings suggested a U-shaped pattern of association, with the fall injury rate higher among those who socialize frequently and those who socialize infrequently. Subjects who reported dissatisfaction with their social lives had higher rates of fall-related injury, than those who were satisfied with their social lives. Finally, the rate of fall-related injury was 13.7 per 1,000 person-months among subjects who did not belong to any social group, compared to 24.2 per 1,000 person-months among those who were members of a social group.

The health status indicators suggested that persons in poor health were more likely to sustain fall-related injury and in particular, those who were not at all satisfied with their health (Table 4.52). Data on short-term disability showed that although short-term bed-days was not associated with fall-related injury, increased average exposure to bed-days was associated with an increased fall-injury rate. The fall-related injury rate increased from 17.8 per 1,000 person-months among subjects with no bed-days to 28.2 per 1,000 person-months among subjects who reported bed-days frequently. Both short-term and average activity-limitation days were associated with the fall injury rate, the rate increasing with increased exposure to activity-limitation days.

TABLE 4.51

ASSOCIATIONS BETWEEN LIFESTYLE HABITS AND FALL-RELATED INJURY SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

LIFESTYLE HABIT	Fall-related injury n	Person-months[(1)] n	Incidence density[(2)] n	Incidence density ratio
TOTAL	**91**	**4,763[(3)]**	**19.1**	-
Physical activity				
Physical activity compared to peers				
Much more active	32	1,519	21.1	1.0
Somewhat more active	20	1,112	18.0	0.9
Same	12	1,037	11.6	0.5
Somewhat less active	14	485	28.9	1.4
Much less active	12	499	24.0	1.1
Physical effort in daily activities				
Light	26	1,274	20.4	1.0
Moderate	63	3,311	19.0	0.9
Heavy	1	144	6.9	0.3
Number of different activities				
Short-term				
0-1	15	694	21.6	1.0
2	39	1,810	21.5	1.0
3	22	1,428	15.4	0.7
4-7	15	831	18.1	0.8
Average				
0 -1.9	31	1,010	30.7	1.0
2.0-2.4	20	1,363	14.7	0.5
2.5-3.1	17	1,199	14.2	0.5
3.2-6.0	23	1,191	19.3	0.6
Number of activities				
Short-term				
0-10	20	1,050	19.0	1.0
11-15	20	1,191	16.8	0.9
16-20	14	672	20.8	1.1
21-25	26	998	26.1	1.4
≥26	11	851	12.9	0.7
Average				
0 -12.7	32	1,193	26.8	1.0
12.8-17.2	22	1,188	18.5	0.7
17.3-22.2	14	1,198	11.7	0.4
22.3-54.0	23	1,184	19.4	0.7
Social life				
Frequency of social gatherings				
More than once a week	47	2,163	21.7	1.0
Once a week	20	1,187	16.8	0.8
At least once a month	6	744	8.1	0.4
Less than once a month	18	669	26.9	1.2
Social life				
Very satisfying	23	1,847	12.5	1.0
Rather satisfying	36	2,101	17.1	1.4
Unsatisfying	32	815	39.3	3.1

TABLE 4.51 (continued)

LIFESTYLE HABIT	Fall-related injury n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Member of social group				
No	32	2,328	13.7	1.0
Yes	59	2,435	24.2	1.8
Own cat or dog				
No	79	4,140	19.0	1.0
Yes	12	623	19.3	1.0
Smokes cigarettes				
No	69	3,777	18.3	1.0
Yes	22	986	22.3	1.2
Use of alcohol				
Frequency of alcohol consumption				
Don't drink	28	1,609	17.4	1.0
Less than once a month	26	917	28.4	1.6
One or more times a month	9	551	16.3	0.9
At least once a week	17	944	18.0	1.0
Every day	11	730	15.1	0.9
Number of alcoholic drinks				
Short-term				
0	58	3,022	19.2	1.0
1-3	15	798	18.8	1.0
4-10	9	529	17.0	0.9
11-70	9	412	21.8	1.1
Average				
0	33	1,931	17.1	1.0
0.1-0.3	13	492	26.4	1.5
0.4-2.8	27	1,149	23.5	1.4
2.9-70.0	18	1,191	15.1	0.9

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on time dependent exposures were extracted from the nearest preceding completed interview and data on falls were extracted from the next completed follow-up interview. Totals for each variable may differ because of missing data.

TABLE 4.52

ASSOCIATIONS BETWEEN HEALTH STATUS AND FALL-RELATED INJURY SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

HEALTH STATUS	Fall-related injury n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
TOTAL	**91**	**4,763[3]**	**19.1**	-
Self-reported health				
Self-perceived health status				
Excellent	26	1,511	17.2	1.0
Good	32	1,920	16.7	1.0
Average	21	1,085	19.4	1.1
Poor	12	247	48.6	2.8
Satisfaction with health				
Very satisfied	36	1,943	18.5	1.0
Somewhat satisfied	24	1,831	13.1	0.7
Not too satisfied	18	763	23.6	1.3
Not at all satisfied	13	226	57.5	3.1
Two-week disability				
Bed-days				
Short-term				
No	86	4,502	19.1	1.0
Yes	5	261	19.2	1.0
Average				
None	68	3,826	17.8	1.0
Less than half	19	795	23.9	1.3
Half or more	4	142	28.2	1.6
Activity-limitation days				
Short-term				
No	67	4,117	16.3	1.0
Yes	24	645	37.2	2.3
Average				
None	43	2,788	15.4	1.0
Less than half	30	1,600	18.8	1.2
Half or more	18	375	48.0	3.1
Symptoms				
Dizziness on standing				
Short-term				
No	86	4,458	19.3	1.0
Yes	5	305	16.4	0.8
Average				
None	72	3,518	20.5	1.0
Less than half	13	898	14.5	0.7
Half or more	6	347	17.3	0.8
Other dizziness				
Short-term				
No	77	4,264	18.1	1.0
Yes	14	499	28.1	1.6
Average				
None	46	3,109	14.8	1.0
Less than half	26	1,173	22.2	1.5
Half or more	19	481	39.5	2.7

TABLE 4.52 (continued)

HEALTH STATUS	Fall-related injury n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Palpitations				
Short-term				
No	85	4,373	19.4	1.0
Yes	6	390	15.4	0.8
Average				
None	65	3,619	18.0	1.0
Less than half	18	772	23.3	1.3
Half or more	9	372	24.2	1.3
Short of breath at rest				
Short-term				
No	82	4,403	18.6	1.0
Yes	9	360	25.0	1.3
Average				
None	70	3,746	18.7	1.0
Less than half	14	727	19.3	1.0
Half or more	7	290	24.1	1.3
Short of breath on exertion				
Short-term				
No	69	3,802	18.1	1.0
Yes	22	960	22.9	1.3
Average				
None	43	2,406	17.9	1.0
Less than half	25	1,355	18.5	1.0
Half or more	23	1,002	23.0	1.3
Number of symptoms				
Short-term				
0	58	3,228	18.0	1.0
1	20	866	23.1	1.3
2	6	442	13.6	0.8
3-5	7	227	30.8	1.7
Average				
0	21	1,514	13.9	1.0
0.1-0.3	15	955	15.7	1.1
0.4-0.9	18	1,053	17.0	1.2
1.0-5.0	33	1,241	26.6	1.9
Chronic health problems				
High blood pressure				
No	49	2,842	17.2	1.0
Yes	42	1,921	21.9	1.3
Heart Trouble				
No	66	3,366	19.6	1.0
Yes	25	1,397	17.9	0.9
Diabetes				
No	80	4,311	18.6	1.0
Yes	11	452	24.3	1.3
Respiratory disorder				
No	66	4,038	16.3	1.0
Yes	25	725	34.5	2.1

TABLE 4.52 (continued)

HEALTH STATUS	Fall-related injury n	Person-months(1) n	Incidence density(2) n	Incidence density ratio
Arthritis or rheumatism				
No	34	2,137	15.9	1.0
Yes	57	2,626	21.7	1.4
Vision problem				
No	56	3,379	16.6	1.0
Yes	35	1,384	25.3	1.5
Hearing problem				
No	71	3,667	19.4	1.0
Yes	20	1,096	18.2	0.9
Stroke				
No	78	4,427	17.6	1.0
Yes	13	336	38.7	2.2
Other long-term problem				
No	45	3,017	14.9	1.0
Yes	46	1,746	26.3	1.8
Number of chronic health problems				
0	10	708	14.1	1.0
1	23	1,259	18.3	1.3
2	19	1,357	14.0	1.0
3	19	862	22.0	1.6
4	6	362	16.6	1.2
5-7	14	215	65.1	4.6
Long-term disability				
Experiences trouble:				
Walking 400 meters				
No	57	3,625	15.7	1.0
Yes	34	1,146	29.7	1.9
Walking up and down stairs				
No	47	3,147	14.9	1.0
Yes	44	1,624	27.1	1.8
Carrying a 12-pound object				
No	55	3,181	17.3	1.0
Yes	36	1,590	22.6	1.3
Standing for long periods				
No	49	3,318	14.8	1.0
Yes	42	1,453	28.9	2.0
Bending down				
No	57	3,375	16.9	1.0
Yes	34	1,396	24.4	1.4
Cutting toenails				
No	46	3,116	14.8	1.0
Yes	45	1,655	27.1	1.8
Using fingers to grasp				
No	67	4,027	16.6	1.0
Yes	24	744	32.3	1.9
Reaching				
No	67	4,187	16.0	1.0
Yes	24	584	41.1	2.6

TABLE 4.52 (continued)

HEALTH STATUS	Fall-related injury n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Number of disabilities				
0	20	1,740	11.5	1.0
1-2	28	1,412	19.8	1.7
3-5	20	940	21.3	1.9
6-8	23	671	34.3	3.0
Fell in year preceding initial interview				
No	58	3,587	16.2	1.0
Yes	33	1,176	28.1	1.7
Follow-up fall				
Short-term				
No	80	4,493	17.8	1.0
Yes	11	270	40.7	2.3
Average				
None	40	3,130	12.8	1.0
Less than half	41	1,363	30.1	2.4
Half or more	10	270	37.0	2.9
Quetelet Index				
14.19-21.33	24	1,143	21.0	1.0
21.36-23.529	25	1,224	20.4	1.0
23.5-25.965	15	1,081	13.9	0.7
25.97-41.51	24	1,151	20.9	1.0
Missing	3	164	18.3	0.9

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on time dependent exposures were extracted from the nearest preceding completed interview and data on falls were extracted from the next completed follow-up interview. Totals for each variable may differ because of missing data.

Among the nonspecific symptoms, only other dizziness was associated with the fall injury rate. Both the short-term and average indicators of other dizziness showed that the rate increased with (increasing) exposure. Also, both the short-term and average indicators of number of nonspecific symptoms showed that the fall-related injury rate increased as the number of nonspecific symptoms reported increased.

Among the chronic health problems studied, subjects with respiratory disorders, vision problems or other long-term problems were more likely to sustain fall-related injury, and persons with 5-7 chronic health problems had a higher fall-related injury rate than those with fewer chronic health problems. Similarly the fall-related injury rate increased with the presence of any disability and as the number of disabilities increased. The fall-related injury rate was 28.1 per 1,000 person-months among subjects who fell one or more times in the year preceding the initial interview - higher than the rate of 16.2 per 1,000 person-months observed for subjects who did not fall in the year preceding the initial interview. Both the short-term and average indicators of follow-up falls showed substantially increased fall-related injury rates among subjects with a history of falls during the year preceding the initial interview and/or during the follow-up period.

Health status indicators not associated with the rate of fall-related injury in the univariate analysis included dizziness on standing, palpitations, short of breath on exertion, short of breath at rest, high blood pressure, heart trouble, arthritis or rheumatism, diabetes, hearing problems and Quetelet Index.

Exposure to many medications was associated with fall-related injury (Table 4.53). Short-term exposure to other pain relievers, tranquilizers, medicine for the heart, antibiotics, laxatives, and cough or cold remedies were each associated with an increased rate of fall-related injury. Average exposure to medicine for arthritis, other pain relievers, tranquilizers, medicine for blood pressure, medicine for the heart, laxatives, cough or cold remedies,

TABLE 4.53

ASSOCIATIONS BETWEEN USE OF MEDICATION AND FALL-RELATED INJURY SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

MEDICATION	Fall-related injury n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
Total	**91**	**4,763[3]**	**19.1**	-
Medicine for arthritis				
Short-term				
No	76	4,043	18.8	1.0
Yes	15	708	21.2	1.1
Average				
None	63	3,615	17.4	1.0
Less than half	14	439	31.9	1.8
Half or more	14	709	19.7	1.1
Other pain relievers				
Short-term				
No	78	4,316	18.1	1.0
Yes	13	434	21.0	1.2
Average				
None	61	3,552	17.2	1.0
Less than half	15	765	19.6	1.1
Half or more	15	446	33.6	2.0
Tranquilizers				
Short-term				
No	68	3,902	17.4	1.0
Yes	23	848	27.1	1.6
Average				
None	56	3,434	16.3	1.0
Less than half	11	425	25.9	1.6
Half or more	24	904	26.5	1.6
Medicine for blood pressure				
Short-term				
No	57	3,074	18.5	1.0
Yes	34	1,676	20.3	1.1
Average				
None	52	2,845	18.3	1.0
Less than half	6	226	26.5	1.4
Half or more	33	1,692	19.5	1.1
Medicine for the heart				
Short-term				
No	80	3,860	20.7	1.0
Yes	11	890	12.4	0.6
Average				
None	70	3,601	19.4	1.0
Less than half	8	266	30.1	1.6
Half or more	13	896	14.5	0.7
Antibiotics				
Short-term				
No	88	4,654	18.9	1.0
Yes	3	96	31.3	1.6
Average				
None	84	4,426	19.0	1.0
Less than half	5	267	18.7	1.0
Half or more	2	70	28.6	1.5

TABLE 4.53 (continued)

MEDICATION	Fall-related injury n	Person-months n	Incidence density n	Incidence density ratio
Laxatives				
Short-term				
No	75	4,206	17.8	1.0
Yes	16	544	29.4	1.7
Average				
None	70	3,747	18.7	1.0
Less than half	5	450	11.1	0.6
Half or more	16	566	28.3	1.5
Stomach remedies				
Short-term				
No	80	4,300	18.6	1.0
Yes	11	450	24.4	1.3
Average				
None	73	3,850	19.0	1.0
Less than half	8	455	17.6	0.9
Half or more	10	458	21.8	1.1
Cough or cold remedies				
Short-term				
No	84	4,591	18.3	1.0
Yes	7	158	44.3	2.4
Average				
None	75	4,149	18.1	1.0
Less than half	12	509	23.6	1.3
Half or more	4	105	38.1	2.1
Vitamins or minerals				
Short-term				
No	55	3,239	16.9	1.0
Yes	36	1,511	23.8	1.4
Average				
None	48	2,798	17.2	1.0
Less than half	8	470	17.0	1.0
Half or more	35	1,495	23.4	1.4
Anticoagulants				
Short-term				
No	83	4,384	18.9	1.0
Yes	8	372	21.5	1.1
Average				
None	79	4,284	18.4	1.0
Less than half	3	120	25.0	1.4
Half or more	9	359	25.1	1.4
Medicine for diabetes				
Short-term				
No	85	4,413	19.3	1.0
Yes	6	349	17.2	0.9
Average				
None	84	4,382	19.2	1.0
Less than half	0	26	0.0	-
Half or more	7	355	19.7	1.0

TABLE 4.53 (continued)

MEDICATION	Fall-related injury n	Person-months n	Incidence density n	Incidence density ratio
Medicine for asthma or COPD[4]				
Short-term				
No	85	4,506	18.9	1.0
Yes	6	250	24.0	1.3
Average				
None	82	4,454	18.4	1.0
Less than half	3	92	32.6	1.8
Half or more	6	217	27.6	1.5
Other major medication				
Short-term				
No	82	4,245	19.3	1.0
Yes	9	511	17.6	0.9
Average				
None	80	4,049	19.8	1.0
Less than half	5	238	21.0	1.1
Half or more	6	476	12.6	0.6
Other minor medication				
Short-term				
No	86	4,470	19.2	1.0
Yes	5	285	17.5	0.9
Average				
None	84	4,247	19.8	1.0
Less than half	1	259	3.9	0.2
Half or more	6	257	23.3	1.2
Number of medications				
Short-term				
0	8	836	9.6	1.0
1	23	1,211	19.0	2.0
2	26	1,324	19.6	2.0
3	17	711	23.9	2.5
4	8	441	18.1	1.9
5-8	8	240	33.3	3.5
Average				
0 -0.9	16	1,095	14.6	1.0
1.0-1.8	18	1,323	13.6	0.9
1.9-2.7	27	1,154	23.4	1.7
2.8-8.5	30	1,191	25.2	1.7

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on time dependent exposures were extracted from the nearest preceding completed interview and data on falls were extracted from the next completed follow-up interview. Totals for each variable may differ because of missing data.
(4) Chronic obstructive pulmonary disease.

medicine for asthma or chronic obstructive pulmonary disease, other major medications, and other minor medications were each associated with an increased rate of fall-related injury. Finally, both the short-term and average indicators of number of medications were associated with an increased rate of fall-related injury. Medications not associated with the rate of fall-related injury in the univariate analyses included stomach remedies, vitamins or minerals, anticoagulants and medicine for diabetes.

Table 4.54 shows that all indicators of the use of health services were associated with the rate of fall-related injury.

4.5.2.2 - Multivariate analysis

(i) Full Model

Table 4.55 lists the variables associated with fall-related injury in the univariate analyses and therefore included in the early multivariate analyses. Table 4.56 shows the adjusted incidence density ratios and 95 percent confidence intervals for the risk factors identified from multiple logistic-regression analyses including the stable exposure variables and both short-term and average measures of exposure to the time dependent exposure variables. A total of ten risk factors for fall-related injury were identified. With the exceptions of marital status (widowed), dizziness on standing and use of cough or cold remedies, all other risk factors were identified in the full or etiologic models of risk factors for falls. The risk factors with the largest incidence density ratios were use of cough or cold remedies (incidence density ratio=2.7), not at all satisfied with health (incidence density ratio=2.3), other dizziness (incidence density ratio for less than half, half or more=2.3) and unsatisfying social life (incidence density ratio=2.1). Factors which appeared to be protective against fall-related injury included dizziness on standing and palpitations.

TABLE 4.54

ASSOCIATIONS BETWEEN THE USE OF HEALTH SERVICES AND FALL-RELATED INJURY SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

USE OF HEALTH SERVICES	Fall-related injury n	Person-months[1] n	Incidence density[2] n	Incidence density ratio
TOTAL	**91**	**4,763[3]**	**19.1**	-
Number of ophthalmologist consultations				
0	25	1,789	14.0	1.0
1	48	2,062	23.3	1.7
2	8	495	16.2	1.2
3	0	119	0.0	0
4-50	10	298	33.6	2.4
Number of physician consultations				
0-1	21	1,236	17.0	1.0
2-3	20	1,314	15.2	0.9
4-5	11	973	11.3	0.7
6-10	19	786	24.2	1.4
12-72	20	454	44.1	2.6
Consultated other health professionals				
No	51	3,423	14.9	1.0
Yes	40	1,340	29.9	2.0
Hospitalized in past 12 months				
No	65	3,774	17.2	1.0
Yes	26	989	26.3	1.5
Received homecare				
No	75	4,147	18.1	1.0
Yes	16	616	26.0	1.4

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Includes 4,445 completed follow-up interviews and 318 "missing" interviews for which data on time dependent exposures were extracted from the nearest preceding completed interview and data on falls were extracted from the next completed follow-up interview. Totals for each variable may differ because of missing data.

TABLE 4.55
VARIABLES INCLUDED IN THE EARLY MULTIVARIATE ANALYSES OF RISK FACTORS FOR FALL-RELATED INJURY SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD

VARIABLES	VARIABLES
Sociodemographic Characteristics	**Use of Medication**
Age group	Medicine for arthritis (average)
Marital status	Other pain relievers (short-term, average)
Paid employment	Tranquilizers (short-term, average)
Number of persons in household	Medicine for blood pressure (average)
Lifestyle Habits	Medicine for the heart (short-term, average)
Physical effort in daily activities	Antibiotics (short-term)
Number of different activities (average)	Laxatives (short-term, average)
Number of activities (average)	Cough or cold remedies (short-term, average)
Frequency of social gatherings	Medicine for asthma or COPD[1] (average)
Satisfaction with social life	Other major medications (average)
Health Status	Other minor medications (average)
Self-perceived health status	Number of medications (short-term, average)
Satisfaction with health	**Use of Health Services**
Bed-days (average)	Number of ophthalmologist consultations
Activity-limitation days (short-term, average)	Number of physician consultations
Other dizziness (short-term, average)	Consulted other health professional
Number of symptoms (short-term, average)	Hospitalized in the 12 months preceding the initial interview
Respiratory disorder	Received homecare
Vision problem	
Other long-term problem	
Number of chronic health problems	
Trouble walking 400 meters	
Trouble walking up and down stairs	
Trouble carrying a 12-pound object	
Trouble standing for long periods	
Trouble bending down	
Trouble cutting toenails	
Trouble using fingers to grasp	
Trouble reaching	
Number of disabilities	
Fell in year preceding initial interview	
Follow-up fall (short-term, average)	

Note: (1) Chronic obstructive pulmonary disease.

TABLE 4.56
RISK FACTORS FOR FALL-RELATED INJURY SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD (FULL MODEL)

RISK FACTOR	Incidence density ratio[(1)] (95% CI)[(2)]	p
Sociodemographic Characteristics		
Marital Status		
Married, Single, Divorced, Separated	1.0	
Widowed	1.6 (1.1-2.5)	0.029
Lifestyle Habits		
Social life		
Satisfying	1.0	
Unsatisfying	2.1 (1.3-3.4)	0.005
Member of social group		
No	1.0	
Yes	1.9 (1.2-3.0)	0.004
Health Status		
Satisfaction with health		
Very, somewhat, not too	1.0	
Not at all	2.3 (1.2-4.6)	0.026
Dizziness on standing (average)		
None	1.0	
Less than half, Half or more	0.5 (0.3-0.9)	0.009
Other dizziness (average)		
None	1.0	
Less than half, Half or more	2.3 (1.3-4.0)	0.010
Palpitations (short-term)		
No	1.0	
Yes	0.5 (0.2-1.1)	0.067
Follow-up fall (average)		
None	1.0	
Less than half, Half or more	1.9 (1.2-3.0)	0.005
Use of Medication		
Cough or cold remedies (short-term)		
No	1.0	
Yes	2.7 (1.2-6.0)	0.035
Use of Health Services		
Number of physician consultations (per 10 consultations)	1.4 (1.1-1.7)	0.013

Notes: (1) Estimated by the adjusted odds ratios obtained from multiple logistic-regression analyses containing all independent predictors.
(2) 95 percent confidence interval.

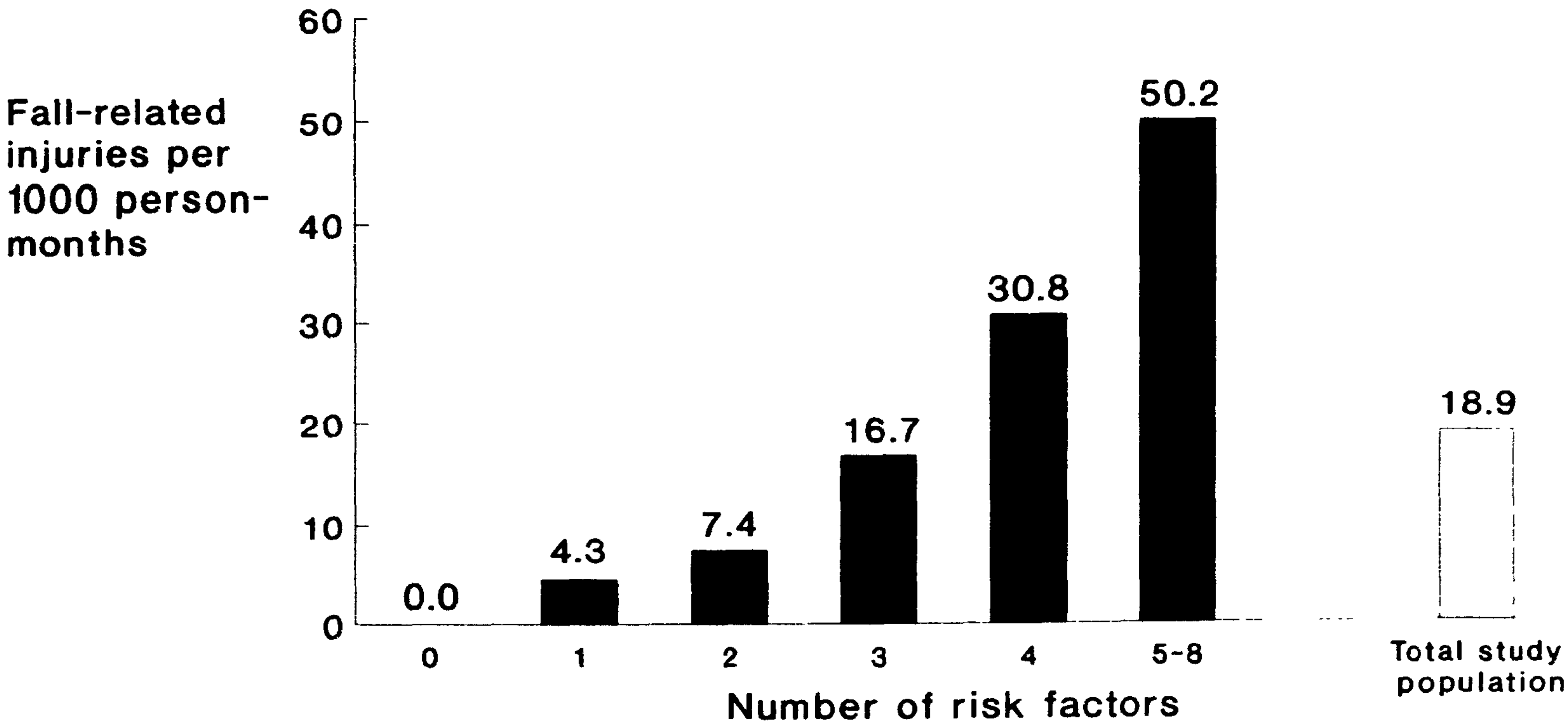
Figure 4.3 shows that the incidence density of fall-related injury increased substantially as the number of risk factors present increased.

(ii) Etiologic Model

The etiologic risk factors listed in Table 4.47 were studied as risk factors for fall-related injury. Table 4.57 shows the adjusted incidence density ratios and 95 percent confidence intervals for etiologic risk factors identified in the multiple logistic-regression analyses containing all independent predictors. Two risk factors for fall-related injury identified in the full model (dizziness on standing and other dizziness) were also retained in the etiologic model. The incidence density ratios for these two variables were similar in the two models. The etiologic model identified another five independent predictors of fall-related injury, none of which had been retained in the full model. These included activity-limitation days, history of stroke, respiratory disorder, trouble walking 400 meters and use of medicine for the heart. Among the etiologic risk factors for fall-related injury, history of stroke had the largest incidence density ratio (incidence density ratio=2.1), followed by activity-limitation days (incidence density ratio=1.9), respiratory disorder (incidence density ratio=1.8), other dizziness (incidence density ratio for less than half, half or more=1.8), and trouble walking 400 meters (incidence density ratio=1.7). Factors which appeared to be protective against fall-related injury included dizziness on standing and use of medicine for the heart.

Figure 4.4 shows that as the number of etiologic risk factors present in a single individual increased, so did the rate of fall-related injury.

FIGURE 4.3
Incidence density of fall-related injury by number of risk factors[1] (Full Model)



	0	1	2	3	4	5-8	Total study population
Number of fall-related injuries	0	3	10	20	26	31	90
Person-months	50	696	1357	1199	844	617	4763

Note: (1) The risk factors included those listed in Table 4.56

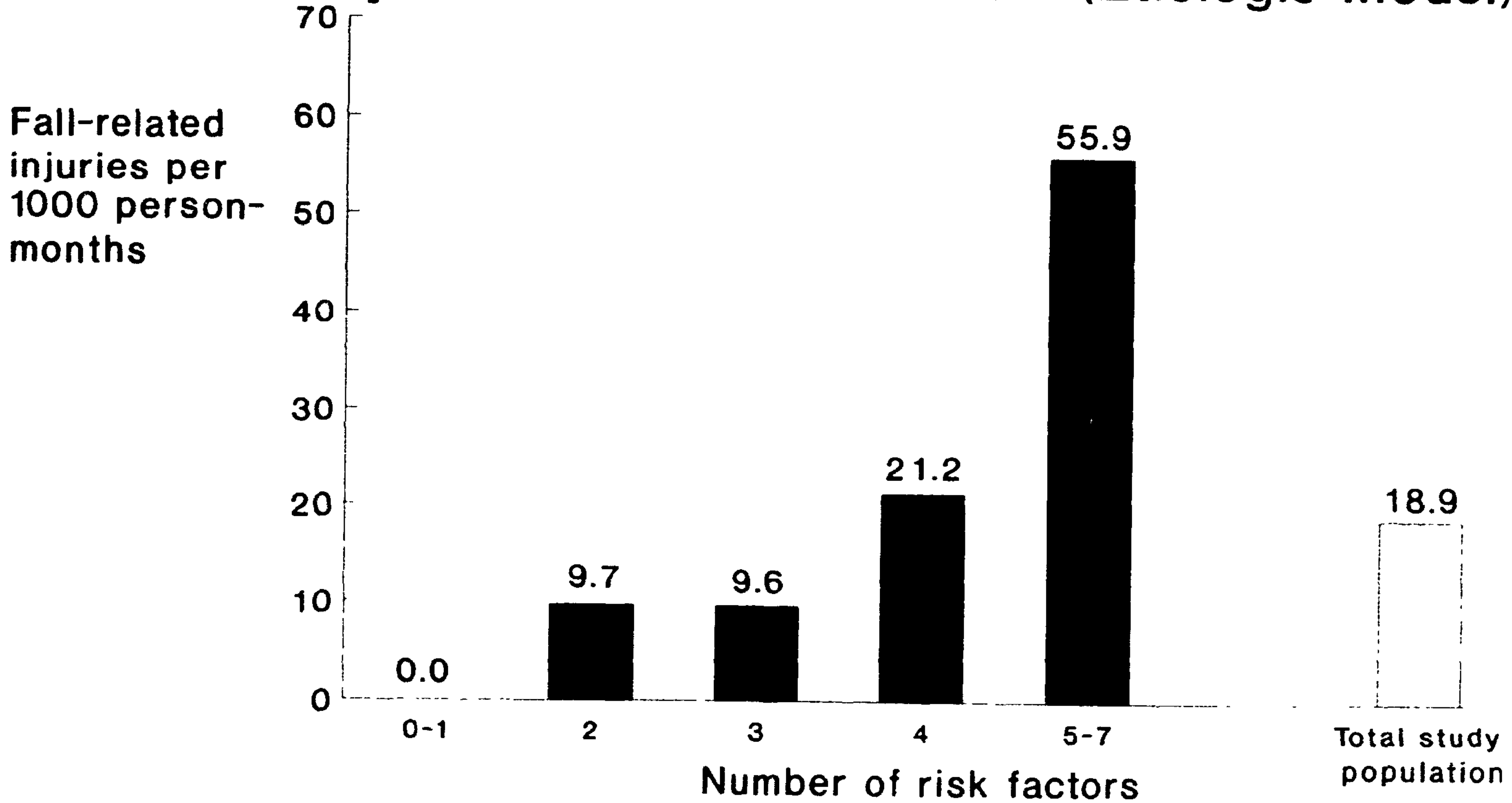
TABLE 4.57

RISK FACTORS FOR FALL-RELATED INJURY SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD. ETIOLOGIC MODEL

RISK FACTOR	Incidence density ratio[1] (95% CI)[2]	p
Health Status		
Activity-limitation days (short-term)		
No	1.0	
Yes	1.9 (1.2-3.2)	0.014
Dizziness on standing (average)		
None	1.0	
Less than half, Half or more	0.4 (0.3-0.8)	0.002
Other dizziness (average)		
None	1.0	
Less than half, Half or more	1.8 (1.1-2.8)	0.014
Stroke		
No	1.0	
Yes	2.1 (1.1-4.0)	0.027
Respiratory disorder		
No	1.0	
Yes	1.8 (1.1-2.9)	0.030
Trouble walking 400 meters		
No	1.0	
Yes	1.7 (1.1-2.7)	0.029
Use of Medication		
Medicine for the heart (short-term)		
No	1.0	
Yes	0.5 (0.3-0.9)	0.023

Notes: (1) Estimated by the adjusted odds ratios obtained from multiple logistic-regression analyses containing all independent predictors.
(2) 95 percent confidence interval.

FIGURE 4.4
Incidence density of fall-related injury by number of risk factors (1) (Etiologic Model)



	0-1	2	3	4	5-7	Total study population
Number of fall-related injuries	0	7	20	26	37	90
Person-months	61	723	2093	1224	662	4763

Note: (1) The risk factors included those listed in Table 4.57.

4.6 - SUMMARY OF RESULTS

The main findings of the study include the following:

4.6.1 - RESPONSE

- Among the 556 persons eligible to participate in the study, 417 (75 percent) completed the initial at-home interview.

- A total of 409 subjects completed one or more follow-up interviews, and 90 percent or more of study participants completed each of the 12 follow-up interviews.

- The distribution of subjects by sex, number of persons in household and paid employment was similar to that of persons aged 65 years or older living in private households according to the 1986 Census.

- 1986 Census data suggested that males and females aged 65-69 years were underrepresented in the sample and those aged 80 years or older were overrepresented.

4.6.2 - CHARACTERISTICS OF STUDY PARTICIPANTS

- One-third of study participants were male and two-thirds were female.

- The average ages of males and females were 73.7 and 75.5 years, respectively.

- Almost three-quarters of study participants reported that their health was excellent or good. On average, subjects had 2.0 chronic health problems and 2.5 long-term disabilities. The most common chronic health problems were arthritis or rheumatism, high blood pressure, heart trouble, vision problems and hearing problems. On average, subjects had used 2.1 different medications in the two days preceding the interview.

4.6.3 - DESCRIPTION OF FALLS

- Fifty-nine percent of 197 falls occurred inside a building and 41 percent occurred outdoors. The circumstances and characteristics of indoor and outdoor falls were quite different. Subjects' self-reports suggested that indoor falls were more often caused by health problems, while outdoor falls were more often related to environmental factors. Although the proportion of indoor and outdoor falls which resulted in injury were similar, subjects were more likely to consult a health professional after an indoor fall.

- The most common activity by far at the time of falling was walking. The majority of outdoor falls occurred while the subject was walking. Indoor fallers tended to fall while getting up and for a wide variety of other reasons.

4.6.4 - FREQUENCY OF FALLS AND FALL-RELATED INJURY

- Twenty-nine percent of study participants fell during the 48-week follow-up period; 60.5 percent of fallers fell once and 39.5 percent fell two or more times. The incidence density of falls was 41.4 falls per 1,000 person-months.

- While the incidence rate of indoor falls remained constant over seasons (with a slight increase during the summer months), outdoor falls were more frequent during the fall and winter months than during spring and summer.

- Forty-six percent of 197 falls resulted in injury, but by far the majority of injuries were minor (i.e. minor soft tissue injury). Only five falls resulted in fracture including three hip fractures, one of the arm, and one fall which caused fractures of the nose and of two fingers.

- Comparison of the frequency of falls and fall-related injury during the 12 months preceding the initial interview and the 48-week follow-up period suggested that in a 12-month recall, study participants might overestimate the incidence of falls which result in more serious injury such as fracture.

4.6.5 - RISK FACTORS FOR FALLS AND FALL-RELATED INJURY

- Many sociodemographic, lifestyle and health characteristics were associated with falls and fall-related injury in univariate analyses. Table 4.58 summarizes the risk factors identified in the full and etiologic logistic-regression models of risk factors for falls. Table 4.59 summarizes the risk factors identified in the full and etiologic logistic-regression models of risk factors for fall-related injury. The strongest independent predictors of falls and fall-related injury were similar and included dissatisfaction with social life, dissatisfaction with health and dizziness (other than on standing). In addition, use of antibiotics was a strong predictor of falls in both the full and etiologic models, and use of cough or cold remedies and history of stroke were strong predictors of fall-related injury.

TABLE 4.58
COMPARISON OF RISK FACTORS FOR FALLS IDENTIFIED IN THE FULL AND ETIOLOGIC MODELS

Full Model: Risk factor	Full Model: Incidence density ratio (95% CI)[1]	Etiologic Model: Risk factor	Etiologic Model: Incidence density ratio (95% CI)[1]
Sociodemographic Characteristics			
Live alone	1.4 (1.1-1.9)	[2]	
French-speaking	0.7 (0.5-0.9)	[2]	
Lifestyle Habits			
Unsatisfying social life	1.7 (1.2-2.4)	[2]	
Member of social group	1.5 (1.1-2.1)	[2]	
		Number of different activities (average) ≥2.0	0.6 (0.4-0.9)
		Number of activities (short-term) ≥10	1.9 (1.2-3.0)
		Drink alcohol every day	0.5 (0.3-0.9)
Health Status			
Not at all satisfied with health	2.8 (1.7-4.8)	[2]	
Bed-days (average) (Less than half, Half or more)	0.5 (0.4-0.8)	Bed-days (short-term)	0.4 (0.2-0.9)
Activity-limitation days (short-term)	1.6 (1.1-2.3)	Activity-limitation days (short-term)	1.9 (1.3-2.7)
Other dizziness (average) (Half or more)	2.7 (1.7-4.2)	Other dizziness (average) (Half or more)	3.2 (2.1-4.8)
Palpitations (short-term)	0.6 (0.3-1.0)		
Trouble using fingers to grasp	1.6 (1.1-2.3)	[2]	
Follow-up fall (average) (Less than half, Half or more)	1.5 (1.1-2.1)	[2]	
		Trouble hearing	0.7 (0.5-1.0)
		Trouble walking 400 meters	1.8 (1.3-2.5)
Use of Medication			
Tranquilizers (short-term)	0.7 (0.4-1.0)		
Antibiotics (average) (Half or more)	2.4 (1.1-5.3)	Antibiotics (average) (Half or more)	2.3 (1.1-4.7)
Stomach remedies (average) (Half or more)	0.6 (0.3-1.0)		
Vitamins or minerals (average) (Half or more)	1.5 (1.1-2.0)	Vitamins or minerals (average) (Half or more)	1.5 (1.1-2.0)
Other major medication (average) (Half or more)	0.4 (0.2-0.7)	Other major medication (average) (Half or more)	0.4 (0.2-0.7)
		Medicine for the heart (average) (Half or more)	0.6 (0.4-0.9)
Use of Health Services			
Number of physician consultations (per 10 consultations)	1.3 (1.1-1.5)	[2]	

Notes: [1] 95 percent confidence interval.
[2] Risk factor identified in full model was not investigated in the etiologic model.

TABLE 4.59

COMPARISON OF RISK FACTORS FOR FALL-RELATED INUJURY IDENTIFIED IN THE FULL AND ETIOLOGIC MODELS

Full Model: Risk factor	Full Model: Incidence density ratio (95% CI)(1)	Etiologic Model: Risk factor	Etiologic Model: Incidence density ratio (95% CI)(1)
Sociodemographic Characteristics			
Widowed	1.6 (1.1-2.5)	(2)	
Lifestyle Habits			
Unsatisfying social life	2.1 (1.3-3.4)	(2)	
Member of social group	1.9 (1.2-3.0)	(2)	
Health Status			
Not at all satisfied with health	2.3 (1.2-4.6)	(2)	
Dizziness on standing (average) (Less than half, Half or more)	0.5 (0.3-0.9)	Dizziness on standing (average) (Less than half, Half or more)	0.4 (0.3-0.8)
Other dizziness (average) (Less than half, Half or more)	2.3 (1.3-4.0)	Other dizziness (average) (Less than half, Half or more)	1.8 (1.1-2.8)
Palpitations (short-term)	0.5 (0.2-1.1)		
Follow-up fall (average) (Less than half, Half or more)	1.9 (1.2-3.0)	(2)	
		Activity-limitation days (short-term)	1.9 (1.2-3.2)
		Stroke	2.1 (1.1-4.0)
		Respiratory disorder	1.8 (1.1-2.9)
		Trouble walking 400 meters	1.7 (1.1-2.7)
Use of Medication			
Cough or cold remedies (short-term)	2.7 (1.2-6.0)	Medicine for the heart	0.5 (0.3-0.9)
Use of Health Services			
Number of physician consultations (per 10 consultations)	1.4 (1.1-1.7)	(2)	

Notes: (1) 95 percent confidence interval
(2) Risk factor identified in full model was not investigated in the etiologic model.

CHAPTER 5 - DISCUSSION

This chapter discusses the results of the study and their implications for the prevention of falls among community-dwelling elderly. It begins with a discussion of the external validity of the results based on the inclusion and exclusion criteria applied to potential participants, the response to the interviews, and the characteristics of study participants. The where, when, and how of falls sustained during the 48-week follow-up period are discusseed in the next section. The frequency of falls and of fall-related injuries measured in this study are then compared to frequencies reported in other similar studies. The quality of the evidence for the risk factors identified in this study is discussed in the following section. Finally, the implications of the results for the design of preventive interventions for elderly persons living at home is discussed.

5.1 - EXTERNAL VALIDITY

External validity refers to the extent to which the results of a study are generalizable to other, usually larger, reference populations. This kind of validity can be compromised in several ways. For example, the application of many and/or stringent exclusion criteria to the pool of potential study subjects can restrict generalizability. Also, if the characteristics of potential study participants who refuse to participate in the study differ substantially from those who accept to participate, a nonresponse bias may occur, affecting external validity.

Subjects eligible for inclusion in this study included all those aged 65 years or older living at home in the community. Excluded were those living in any kind of institutional setting, those who could not communicate in either French or English, and those hospitalized or on vacation at the time of the first at-home visit, persons who did not live at the address indicated on the electoral list and who could not be traced, those who had died, and those less than 65 years of age. Overall, one-third of persons selected from the electoral list were ineligible for inclusion in the study.

Given the expense and difficulties in conducting community-based at-home surveys of elderly persons (Nickens, 1985), the response rate of 75 percent achieved in this study is good. This response rate might even be underestimated if the 8.3 percent of nonrespondents who could not be contacted during the recruitment period included persons who were ineligible for inclusion in the study. Overall, as indicated earlier, one-third of persons selected from the electoral lists were ineligible for the study. If one-third of the 46 individuals who could not be contacted were in fact ineligible for the study, then the response rate was actually 77.1 percent. Because no data were collected on the characteristics of those who did not participate in the study, it is not possible to determine how nonresponse might have biased the results. If nonrespondents included a high proportion of persons in poor health and if poor health is associated with an increased risk of falling, then the incidence rate of falls might be underestimated.

A comparison of the sociodemographic characteristics of study participants with those of the at-home elderly from the 1986 Census suggested that both males and females aged 65-69 were underrepresented in the study population and that those aged 75 years or older were overrepresented. Selection of potential study subjects from the electoral lists was carried out in October 1986, and recruitment of study participants was supposed to begin in October 1986. Because of unforeseen delays, recruitment actually began seven months later in May 1987. Thus, potential study subjects already selected from the electoral list had all aged seven months at the time of actual recruitment, accounting for the discrepancy. If the age-specific proportion of fallers observed in this study is adjusted according to the distribution of elderly persons observed in the 1986 Census, the overall prevalence proportion of fallers is 28.3

percent, very similar to the overall prevalence proportion actually observed in this study (29.1 percent).

The distribution of study subjects by other sociodemographic characteristics including gender, number of persons in household, and paid employment, was the same as that observed in the 1986 Census, providing some evidence that, with the exception of age distribution, the study population was similar to the population of at-home elderly.

The response to the follow-up interviews was excellent. The majority of subjects completed ten or more follow-up interviews and there was minimal loss to follow-up. Once recruited, the subjects were willing and eager to continue to participate. In fact, the interviewers frequently commented that many subjects were socially isolated and that, in these cases, the phonecalls regarding the falls study were important social contacts.

Given the response rates to the initial and follow-up interviews, and the similarity of the study population to the Census population, the results of this study are probably generalizable to the population of elderly persons living at home.

5.2 - DESCRIPTION OF FALLS

An important contribution of this research is the descriptive data on falls experienced over the 48-week follow-up period. Because of the frequency of follow-up contacts and the excellent response to the follow-up interviews, a very good description of falls experienced by community-dwelling elderly was obtained. Of particular importance is the finding that a little more than half of all falls occurred indoors and a little less than half occurred outdoors. The data which describe the when, where, and how of falls suggest that the etiologic factors might differ depending on whether the fall occurred indoors or outdoors. For example, self-reported reasons for falls which occurred indoors differed markedly from those for outdoor falls. Health-related reasons were cited as the cause for the majority of indoor falls, while environmental reasons were cited more often for outdoor falls. Similarly, activities engaged in at the time of indoor versus outdoor falls were very different. Although the proportions of indoor and outdoor falls which resulted in injury were similar, subjects appeared to worry more about indoor falls, as evidenced by a higher frequency of subsequent physician consultations. If the etiologic mechanisms for different kinds of falls vary, risk factor identification becomes even more complex. Future studies may have to focus on risk factor identification for specific kinds of falls in specific subgroups of community-dwelling elderly. Indeed, as detailed earlier in Section 1.1.1, some investigators have restricted their studies to include only certain kinds of falls (i.e., injurious falls, falls which require medical treatment, recurrent falls, falls during ambulation, falls on the stairs, falls in the home). Future analyses of this data base could attempt to differentiate risk factors for indoor versus outdoor falls, or for health-related versus environment-related falls.

5.3 - FREQUENCY OF FALLS AND FALL-RELATED INJURY

5.3.1 - FREQUENCY OF FALLS

As discussed in the introduction, many previous studies which measured the frequency of falls among the elderly were cross-sectional studies subject, theoretically at least, to the problems of recall bias and underestimation of the frequency of falls. An important strength of this study, in terms of the measurement of the frequency of falls, is that it followed subjects prospectively at frequent intervals (once every four weeks), so that the problem of recall bias was minimized. In addition to the frequent follow-up interviews, each subject was provided with a "Falls Memory-Aid Calendar" on which they recorded the dates and details of any falls which occurred. According to subjective reports by the interviewers, many subjects enjoyed using these calendars and often referred to them to recount details about their falls during the follow-up interviews. The frequent follow-up interviews probably encouraged increased reporting of all falls whether trivial or severe, so that more accurate measurements of the frequency of falls and fall-related injury were obtained.

The majority of community-based surveys, including those which follow subjects prospectively, report the prevalence proportion of fallers as the primary measure of the frequency of falls. Few reports provide data on the incidence rate of falls which provides a more precise measure of the frequency of falls because it takes multiple falls by single subjects as well as subjects lost to follow-up into account. Table 5.1 compares the frequency of falls measured in this study with that reported in similar studies. With the exception of Nevitt et al. (1989), the reported prevalence proportions were quite similar, and the (minimal) differences observed are undoubtedly, in part, attributable to differences in the characteristics of the populations studied. Perry (1982a) studied 64 residents in a high-rise publicly-supported apartment for the elderly in Seattle, Washington. His study was limited by a small sample size, the select nature of the study population, and a high attrition rate. Tinetti et al. (1988) reported that 32.0 percent of community-dwelling elderly aged 75 years or older fell during the one-year follow-up. The prevalence proportion of fallers aged 75 years or older in the present study (30.5 percent) is similar to that reported by Tinetti et al. (1988).

Sorock & Shimkin (1988) followed a convenience sample of 169 English-speaking nonwheelchair-bound tenants aged 60-94 years living in six senior citizens buildings in New York. Only 15.5 percent of the 1,096 tenants gave consent to enter the study, and no data were available to study how respondents differed from nonrespondents. The average follow-up time in this study was 5.6 months, but the reported frequency of falls was similar to that in the other studies with one-year follow-ups.

TABLE 5.1

ESTIMATES OF THE ANNUAL FREQUENCY OF FALLS AMONG PERSONS AGED 65 YEARS OR OLDER FROM COMMUNITY-BASED FOLLOW-UP SURVEYS

Investigators	Prevalence proportion of fallers %	Incidence density[1] n
Perry (1982a)	37.5	-
Tinetti et al. (1988)	32.0	-
Sorock & Shimkin (1988)[2]	34.0	-
Campbell et al. (1988, 1989, 1990)	35.2	68.3
Nevitt et al. (1989)	56.6	-
Current study	29.1	53.8[3]

Notes:
[1] Number of falls per 100 person-years.
[2] Subjects were followed an average of 5.6 months.
[3] $\dfrac{\text{197 falls}}{\text{(4,763 person-months x 4 weeks)} \div \text{52 weeks}}$ x 100 years = 53.8 falls per 100 person-years

Campbell et al. (1988, 1989, 1990) studied falls sustained during one year in people aged 70 years or older registered at the Mosgiel Health Centre near Dunedin, New Zealand, and Nevitt et al. (1989) followed a convenience sample of subjects aged 60 years or older with a history of falls, recruited from senior centers, senior residences, churches, and university-affiliated medical clinics in San Francisco. A history of falls appears to increase the risk of falling, possibly accounting for the particularly elevated prevalence proportion reported (56.6 percent) in the San Francisco study. Compared to participants in these studies, subjects in the present study were, on the whole, younger and also the general level of health might have been better since institutionalized elderly were excluded.

It is interesting to compare the prevalence proportion of fallers reported in cross-sectional and follow-up studies. Despite the concern for recall bias in cross-sectional studies, the proportion of fallers reported is, with a few exceptions, relatively consistent, indicating that about one-third of elderly people fall each year. In fact, when data from the initial interview of the present study were compared to data from the follow-up interviews, the proportion of fallers, repeat fallers, and subjects with fall-related injuries were quite similar. Although recall bias may be a less important problem in terms of recalling whether or not a fall occurred, it might be more important in recounting the number of times an individual has fallen within a specific period of time, and specific details about each fall such as time of day or place where fall occurred and whether or not the fall resulted in injury.

Table 5.1 illustrates that only one of the previous community-based follow-up studies reported an incidence rate of falls. The incidence density reported by Campbell et al. (1990) was higher than that reported in this study, possibly because the study population included only persons aged 70 years or older. Also, six percent of the sample in the New Zealand study lived in residential homes. Institution-based studies, however, often report incidence rates and suggest that the frequency of falls in institutionalized elderly ranged from a low of

1.8 falls per 1000 person-days (Gryfe et al., 1977) to a high of 9.4 falls per 1000 person-days (Brody et al., 1984). Again, the wide variability in reported rates is probably related to the characteristics of the study populations. For example, Gryfe et al. (1977) studied 441 active ambulatory persons living in a standard care residential unit of the Baycrest Centre for Geriatric Care in Toronto, a milieu which, according to the investigators, essentially mirrors the open community of elderly. In fact, the incidence density of 1.5 falls per 1,000 person-days reported in the present study is quite similar to the rate reported by Gryfe et al. (1977). In obvious contrast, Brody et al. (1984) studied frail elderly women with senile dementia of the Alzheimer type living in the Philadelphia Geriatric Centre.

Table 5.2 compares the proportion of repeat fallers in this study with those reported in other community-based follow-up studies. Again, differences in reported frequencies might be due to age differences between study populations, inclusion or exclusion of institutionalized elderly, and variable lengths of follow-up. In particular, the much higher proportions observed by Nevitt et al. (1989) is probably related to the fact that all study participants had a history of falls. Although estimates vary between studies, these data suggest that falling repeatedly is common, particularly among elderly persons with a history of falls. In the present study, almost 40 percent of those who fell once sustained further falls.

The present study then, confirms earlier findings that falls are a common occurrence among elderly people. The slightly lower prevalence proportion observed in this study probably reflects a younger and possibly healthier study population, since it excludes institutionalized elderly. Also, it is possible that the frequent telephone calls made during the study became a kind of preventive intervention. Because of the frequent reminders, some subjects might have increased their awareness about falls and about the prevention of falls. It is possible that some subjects actually undertook preventive action, thereby reducing their risk of falls and lowering the overall frequency of falls observed in the study population.

TABLE 5.2

ESTIMATES FROM COMMUNITY-BASED FOLLOW-UP STUDIES OF THE PROPORTION OF COMMUNITY-DWELLING PERSONS AGED 65 YEARS OR OLDER WHO SUSTAIN MULTIPLE FALLS EACH YEAR

Investigators	All subjects %	Fallers %
Perry (1982a)	9.4	25.0
Tinetti et al. (1988)	17.3	53.7
Sorock & Shimkin (1988)[1]	8.3	24.5
Nevitt et al. (1989)	31.0	55.0
Current study	11.5	39.5

Note : [1] Sujects were followed for an average of 5.6 months.

5.3.2 - FREQUENCY OF FALL-RELATED INJURY

Only four community-based follow-up studies of the elderly provide estimates of the frequency of fall-related injury (Table 1.7). The data from this study confirm earlier findings that although falls are a common occurrence among community-dwelling elderly, few falls result in serious injury. Also similar to other studies, very few falls came to medical attention and only 6.6 percent of falls were actually treated by a physician.

The frequency of serious fall-related injury in the present study is lower than that reported in other similar studies, reflecting a lower overall frequency of falls (thus decreasing the probability of serious fall-related injury). Also, if the population studied here is younger and healthier as suggested earlier, the decreased frequency of injury might reflect differences in the kinds of falls sustained or the ability of the individual to withstand or prevent injury during the fall.

5.4 - RISK FACTORS FOR FALLS AND FALL-RELATED INJURY

This section discusses the quality of the evidence for the identification of risk factors in this study. It begins with a description of the strengths and weaknesses of the study design and analytic methods as they relate to risk factor identification. It then discusses the risk factors for falls and injurious falls identified in the study.

Measurement of risk factors for falls in this study differed in four important ways from other recent community-based follow-up studies. First, measurements of time dependent exposure variables were made repeatedly during the 48-week follow-up. Second, risk factors for falls and fall-related injury were identified using pooled logistic-regression. Third, all measurements of exposure to potential risk factors were based on subject self-reports (as opposed to clinical or biochemical measurements). Finally, this study did not include measures of gait, balance or sway as potential risk factors for falls.

In addition to the above, this study did not attempt to systematically measure environmental risks in the home, for example, which could have increased the risk of falls or fall-related injury. Nor did it systematically investigate individual behavioral factors (avoidance of high-risk activities, removal of environmental risks) which might also have influenced the risk of falls.

5.4.1 - REPEATED MEASUREMENTS OF TIME DEPENDENT EXPOSURE VARIABLES

The time dependent exposure variables including two-week disability, use of alcohol, level of physical activity, nonspecific symptoms and use of medication were measured in the initial at-home interview and in each follow-up interview. Most previous follow-up studies on falls among the elderly measured potential risk factors which could change over time in an initial interview and then used this baseline data to predict falls which occurred during a defined period of follow-up (usually one year)[1]. In adopting this approach, researchers have assumed that the measure of exposure obtained in the initial interview is a valid indicator of exposure, which can be used to predict falls which occur at any time during the follow-up period. Risk factors which cause falls either through short-term exposure just preceding the

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[1] Some investigators have attempted to identify risk factors for falls among the elderly using data from cross-sectional surveys. Both the data on potential risk factors and the data on falls experienced during some reference period preceding the interview, were collected in a single interview (Prudham & Evans, 1981; Campbell et al., 1981; Blake et al., 1988; Wickham et al., 1989). In addition to the problem of recall bias affecting both the measurement of potential risk factors and the measurement of falls, it may be difficult to establish temporality of exposure to potential risk factors with reference to falls. For example, use of medication may have preceded the fall and therefore perhaps contributing to the risk of falling, or use of medication may have been altered because of the fall.

fall, or through chronic (intermittent) exposure over time, may not be detected. Also if a change in exposure (e.g. increase or decrease in medication dosage) is the causal agent, then measurement of exposure in a single initial interview may not permit identification of the variable as a risk factor for falls.

To date, the literature provides little, if any, direction on the kinds of hypotheses which should be tested with regard to the risk of falls and specific time dependent exposure variables. For example, for use of medication, the risk of falls could increase as the individual begins to take a new medication. It could increase with increased duration of exposure to the drug or the risk could decrease over time as the individual habituates to the effects of the drug on the underlying medical problem and to the side effects of the drugs. Finally, the risk of falls could be affected as drug dosage is altered, when the drug is stopped or restarted, or as the profile of other medications taken concurrently is altered. The pattern of risk might vary considerably for individual drugs or classes of drugs. As indicated earlier, most studies which examine the effects of medications on the risk of falls obtain a single measurement of exposure (usually exposed or not during a defined time period) at the beginning of the study. This measurement is then used to study the association between the medication and falls which occur during the study. If any of the causal mechanisms described above are relevant, the association between the specific medication and falls may not be detected. Similar reasoning can be applied for other potential risk factors which fluctuate over time.

Although risk factor identification was one of the objectives, this study was not designed specifically to enable investigation of all the complex etiologic mechanisms described above. In fact, this study permits only partial investigation of some of these possibilities. The risk of falls due to changes in time dependent exposures could not be investigated because the timing of data collection did not permit accurate assessment of when changes in exposure might have occurred. For example, the time interval between the measurement of a fall event and the measurement of short-term time dependent exposures in this study could vary between one or two days and six weeks, depending on the reference period for the collection of data for a particular variable, whether the variable studied was dichotomous or continuous, and finally, if a fall occurred, when that fall occurred. Table 5.3 and Figure 5.1 depict the potential variability in this study in the length of time between the measurement of a fall event and the measurements of the short-term time dependent exposure variables. For example, if a fall was reported in Interview 3, it could have occurred on any day in the preceding four-week period. The length of time between the fall and the measure of short-term exposure obviously varied according to the day on which the fall occurred. The figure shows that the time interval also varied because of the reference period for each time dependent variable (two days preceding the interview for use of medication, one week preceding the interview for use of alcohol and level of physical activity, and two weeks preceding the interview for nonspecific symptoms and short-term disability). Finally, both use of alcohol and level of physical activity were continuous variables, reflecting exposure over an entire seven-day period, while the other variables were dichotomous, reflecting whether or not exposure occurred on any of the days during the reference period. Accurate assessment of whether or not a change in exposure had occurred, and exactly when that change might have occurred was not possible, given the variable and lengthy reference periods.

The timing of data collection is less important with the measures of average exposure to the time dependent exposure variables, since these measures reflect averages over time, minimizing the importance of any single measurement of exposure. A more important difficulty with the measures of average exposure (especially for dichotomous variables) is that, as the number of interviews increased, the value tended to regress towards the mean. At the first interview, for example, exposure to a dichotomous variable was either zero or one; at the second interview, the average exposure over the two interviews was zero, 0.5, or one,

TABLE 5.3

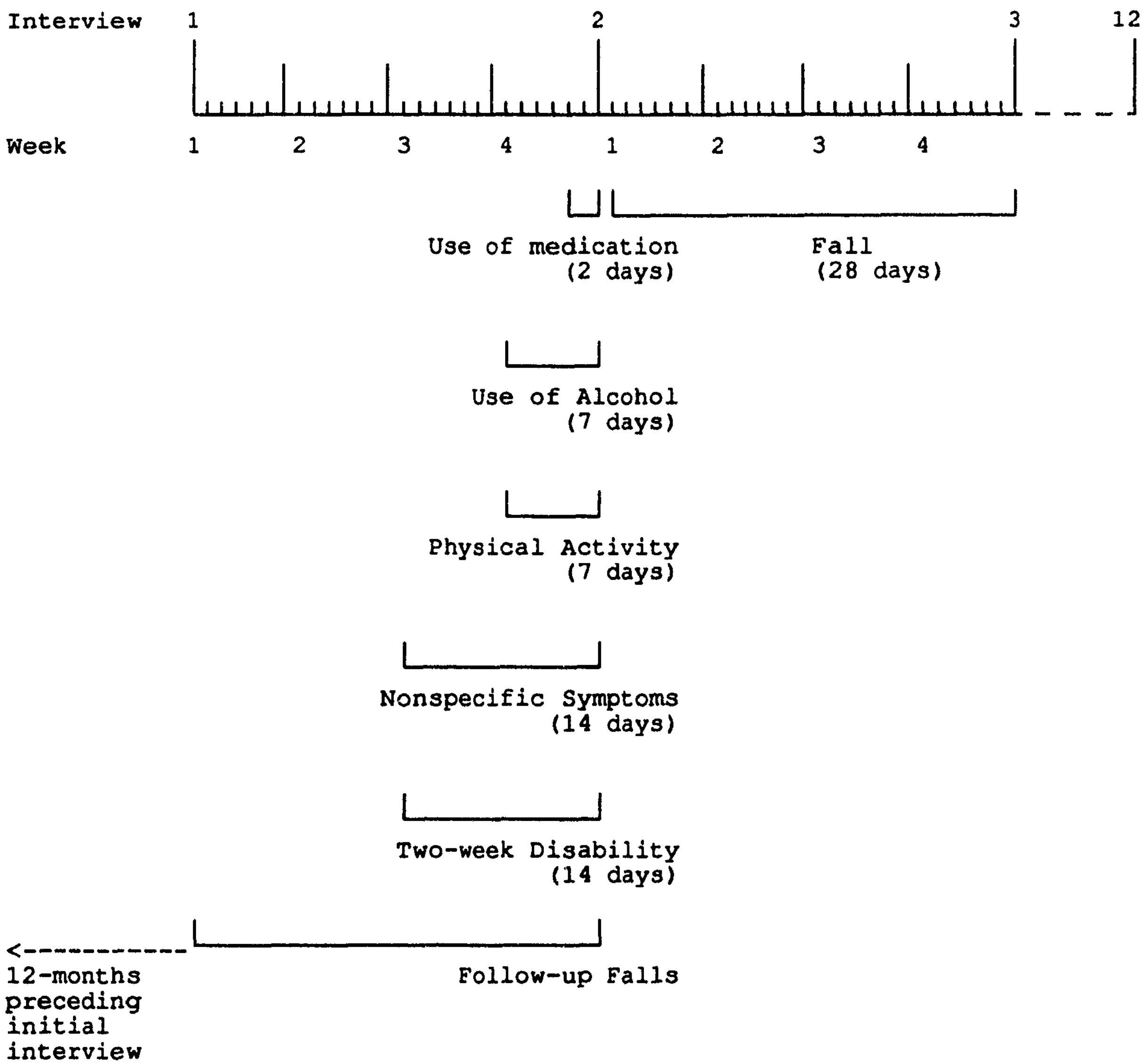
RANGE OF TIME INTERVAL BETWEEN A FALL AND MEASUREMENT OF SHORT-TERM TIME-DEPENDENT EXPOSURE VARIABLES

VARIABLE	RANGE OF TIME INTERVAL days
Use of medication	1 - 30
Use of alcohol[1]	1 - 28
Level of physical activity[1]	1 - 28
Nonspecific symptoms	1 - 42
Short-term disability	1 - 42

Note: [1] Both use of alcohol and level of physical activity were continuous variables, reflecting exposure over a seven-day period.

FIGURE 5.1

TIMING OF DATA COLLECTION



etc. However, this will probably not result in bias in the identification of risk factors because average exposure for fallers and nonfallers was calculated using the same method.

Despite these drawbacks, the results shown in Appendix VI suggest that many time dependent exposure variables fluctuated considerably during the 48-week follow-up period and therefore repeated measurements of these variables are required to obtain valid measures of exposure over time. This ability to relate change in exposure to the outcomes of interest may be particularly important in studies in which the outcome can occur repeatedly in a single individual (such as falls), and when the etiologic factors for one fall may be very different from the etiologic factors for the next fall experienced by the same individual. In fact, in an analysis not shown in this thesis, predictors of falls were identified in multiple logistic-regression analysis, from among all potential risk factors as measured in the initial interview only (i.e., only the measures of the time dependent exposure variables obtained in the initial interview were included in the analysis). A comparison of the model so created with the full model presented in this thesis showed that, while the stable exposure variables retained were similar, there was no similarity in the time dependent exposure variables retained in the two models.

For the majority of time dependent exposure variables, the univariate associations observed between falls and short-term exposure and between falls and average exposure were similar. This suggests that some of the complex etiologic mechanisms described above (increased risk with first or renewed exposure, habituation to exposure over time, fluctuating risk with fluctuating exposure status) may not be relevant for some exposures. Alternatively (and more likely), the short term exposures measured in this study may, in fact, really reflect average exposure more than single, separate or sporadic exposures, since the 12 observations for a single subject included in the data set are not independent. In general, the measures of average exposure were more likely to be retained in the multivariate models, showing that they tended to be stronger predictors of the outcomes than the short-term measures.

As suggested in Appendix VI, future prospective follow-up studies on risk factors for falls should give careful consideration to the extent to which a given exposure can be expected to fluctuate over time, and to how these fluctuations might affect the accurate identification of risk factors. Decisions on the frequency with which data on certain exposures should be collected and on how the exposure score should be calculated, should be based on sound hypotheses regarding the degree to which the exposure might fluctuate and how that fluctuation will affect the outcome.

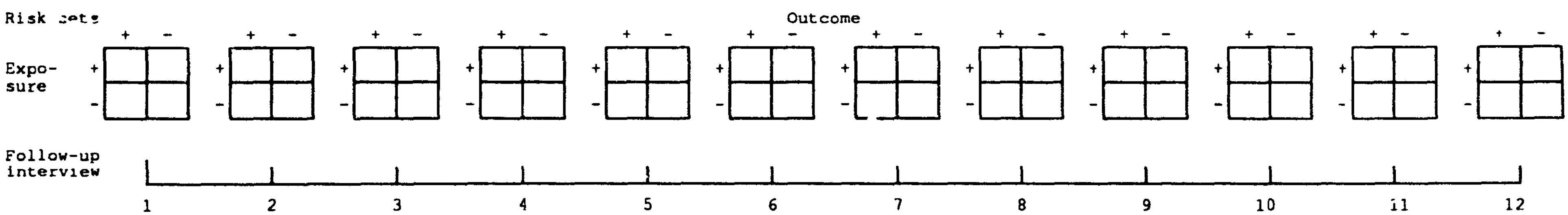
5.4.2 - POOLED LOGISTIC-REGRESSION

In order to take repeated falls in a single individual and changes in the time dependent exposure variables into account, the analytic approach consisted of creating 12 risk sets, one for each follow-up interval, then conducting regression analysis in each interval, and finally summarizing the results of these analyses over the 12 intervals. A risk set is the subdivision of person-time for a single follow-up interview into a 2x2 table of observed outcome on falls or fall-related injury by exposure to a potential risk factor (Figure 5.2). To identify each of the 12 interval strata, a dummy variable was used to indicate interviews 1 to 12. In any of the models tested, this dummy variable was not significant. Therefore, the final models presented in this thesis did not take the interval number into account.

The more classic approach to analyses where time to the outcome of interest is considered is survival analysis using Cox's proportional hazards model with time dependent covariates. This approach was rejected for several reasons. First, in survival analysis, entry into the study is usually a relatively well-defined point in time (i.e., date of cancer diagnosis,

FIGURE 5.2

ANALYSIS OF RISK FACTORS USING A PERSON-TIME APPROACH WITH RISK SETS



Note: (1) Each follow-up interview comprised four weeks of observation, so that the person-months of follow-up for a single follow-up interview was equivalent to the number of persons interviewed.

date of beginning treatment, first employment, age at first exposure). Time to the outcome of interest (i.e., death, remission, relapse) is therefore a meaningful variable, since it measures the amount of time from the exposure of interest to the outcome of interest. Time to outcome can meaningfully be compared between two different exposures, for example. In the present study, date of entry into the study was arbitrary in terms of exposure to any of the potential risk factors of interest. At study entry, the pool of study participants simply comprised a random cross-section of the at-home elderly population aged 65 years or older. Exposure level was undistinguished by any meaningful marker of time, and time from study entry to first fall or fall-related injury was therefore not meaningful. A second reason for rejecting the Cox model was technical. The pooled logistic method uses less computer time than a Cox continuous model in which exact times of events are used. Finally, the outcomes of interest in this study (falls and fall-related injury) were measured in each four-week follow-up interval. Cox's model would have considered the 15-20 events measured in each follow-up interval as ties, resulting in a violation of the assumptions underlying this model.

Choice of Time Axis

The selection of the axis of time for a person-time analysis is critical, since the creation of risk sets is dependent on the choice. Once the time axis has been specified, its effects on the outcome are estimated nonparametrically in $\lambda_0(t)$, and the effects of the remaining time dependent factors are then modelled in the regression variables $x(t)$ (Breslow & Day, 1987). Time axes in person-time analyses are usually any one of age, calendar time, time since first exposure or time since entry into the study. One rationale for the choice of the time axis is that the particular time dimension selected is highly correlated with the outcome of interest (Breslow & Day, 1987).

As indicated earlier, the time axis selected for this analysis was follow-up interview or time since entry into the study. (Calendar time was essentially equivalent to time since entry.) Although there is some evidence in the literature that age is correlated with falls, age was not selected for the time axis because of technical reasons - the length of follow-up was short (48 weeks) and the age span among study subjects was wide (65-99 years), limiting the feasibility of creating meaningful risk sets at each age.

Time since first exposure was rejected since many potential risk factors were studied, and data on time since first exposure was not collected systematically for each exposure. In addition, the notion of time since first exposure (for example, time since first use of alcohol) did not appear to be meaningful in this research.

5.4.3 - SELF-REPORTS OF EXPOSURE

All measures of risk in this study were based on self-reports of exposure from study subjects. Although some variables such as use of medication might be subject to considerable recall bias, this methodology was selected for several reasons. The expense and response burden to study participants would have been prohibitive if clinical measurements or validation of self-reports had been required in all follow-up interviews. In addition, in the event of implementing a community-based fall prevention program, use of self-reports of risk factors to identify those at risk would be more efficient (less costly) than an identification process which involves clinical measurements of risk factors.

5.4.4 - LACK OF MEASURES OF POSTURAL CONTROL

As indicated earlier, many recent investigators have suggested that deficits in the components of balance control are the major intrinsic factors causing falls in the elderly, possibly because they reflect the combined effects of sensory, neurological and musculoskeletal impairments on postural stability (McVey & Studenski, 1988; Nevitt, 1990). Gait, balance, and sway (all indicators of postural control) have been studied repeatedly as risk factors for falls, and in spite of variable definitions and measurement techniques, the results usually indicate that impairments in balance or postural control do indeed increase the risk of falls. Data on postural control were not collected in this study for two reasons. First, at the time the study was undertaken, the literature was not as clear as it is now on its possible etiologic role. Second, at that time there were no validated methods of measuring postural control easily and inexpensively, in the context of at-home interviews.

If deficits in postural control are a major risk factor for falls in the elderly, the lack of specific data on this variable in this study undoubtedly affected the identification of risk factors for falls and fall-related injury. If data had been available, postural control would probably have emerged as a predictor of falls, possibly displacing one or more of the variables retained in the multivariate models. Tinetti et al. (1988), for example, found that although poor vision was associated with the risk of falls in univariate analysis, it was strongly correlated with balance and gait abnormalities, and was in fact displaced by the balance and gait score in the multivariate models. Because of the lack of data on a potentially important risk factor in this study, caution must be exercised in the interpretation of the results on risk factors. It is possible that one or more risk factors retained in the multivariate models were correlated with and in fact, represented proxy indicators of postural control. Interpretation of these variables as factors contributing to the risk or causing falls could therefore be misleading.

5.4.5 - RISK FACTORS

Identification of risk factors for an outcome of interest can focus on one of three general purposes. First and foremost, by identifying factors associated with the outcome, a better understanding of the etiology of disease can be achieved. The selection of the potential risk factors to be included in these analyses will be based on hypotheses and findings on etiology reported in the literature, as well as intuitive reasoning regarding the probable and possible causes of disease. A second purpose in identifying risk factors is to develop a questionnaire or screening tool which can be used to identify persons at higher risk for the outcome (e.g. who might benefit from preventive intervention). The potential risk factors studied in these analyses may provide little information about etiology, but instead are quick and easily obtainable indicators of increased risk. Sociodemographic characteristics such as age, sex, marital status and income often provide little direct information about etiology, but can be easily available markers of increased risk. Finally, a third objective in identifying risk factors is to provide information about risk factors which are amenable to preventive intervention in a particular setting. The potential risk factors studied in these analyses will be carefully selected because they indicate not only factors involved in etiology, but also those for which intervention is feasible and likely to be effective in a particular setting.

This study focused on identification of risk factors useful for identifying subgroups of elderly persons at higher risk of falls and fall-related injury. It also investigated in the etiologic models, risk factors which might increase our understanding of the causes of falls. Further work on this data base could focus on identifying risk factors amenable to preventive intervention in a community setting. The following paragraphs discuss each of the independent predictors of falls identified in this study. Discussion of the independent predictors of fall-related injury ensues.

5.4.5.1 - Risk factors for falls

(i) Full Model

In the first series of multivariate analyses, the strongest independent predictors of falls were identified from among a large number of variables describing the sociodemographic characteristics of study participants, their lifestyle habits, health status, use of medication and use of health services. Although these factors help identify subgroups of community-dwelling elderly at higher risk of falls and fall-related injury, some provide little information about the etiology of falls. The variables identified in this analysis may eventually prove more useful in the creation of a simple, easy to administer screening questionnaire to identify elderly persons at higher risk of falls and fall-related injury, for targeting preventive intervention for example. Indeed, the questions in the study questionnaires addressing these risk factors are simple, easy to administer and applicable to community-dwelling elderly. The data suggested that, as the number of these risk factors present in a single individual increased, the incidence rate of falls increased. Further analyses of this data base could explore the utility of a screening questionnaire, incorporating all or a subset of the variables retained in the multivariate analysis.

Seventeen of the 72 potential risk factors investigated in this study were retained in the full model of independent predictors of falls. The number and variety of risk factors retained in the model probably reflect the wide variety in the kinds of falls sustained by study participants, and the complex causal mechanisms involved in these different kinds of falls. As indicated earlier, if etiologic factors are different for different kinds of falls, risk factor identification becomes even more complex when different kinds of falls are included in the same analyses.

Despite the large number of variables identified as independent predictors of falls in the full (and the etiologic) model, many factors previously reported to be associated with falls were not retained in the models including age, sex, number of health problems, arthritis, vision problems, cardiovascular disorders, number of long-term disabilities, use of antihypertensive drugs and number of medications. These variables, most of which were associated with falls in the univariate analyses, were obviously displaced by stronger predictors in the multivariate analyses. The following paragraphs discuss each risk factor identified in the logistic-regression analyses.

This is the only community-based study to date which has examined language as a risk factor for falls. The results suggest that French-speaking persons were less likely to fall than English-speaking persons or persons of other language groups. This finding probably reflects a reporting bias more than differences in the incidence rate of falls. Because of differing perceptions and attitudes related to health, individuals of different language and cultural backgrounds may be more or less likely to remember and/or to report falls.

Despite the well-recognized link between social relationships and physical health and longevity (Berkman, 1986), there are few studies which have systematically investigated psychosocial factors such as psychological well-being, quality of life, stressful life events, life satisfaction, social networks and social interactions with family, friends, and neighbours as risk factors for falls in the elderly. As indicated earlier, there is much more focus in the literature on the psychosocial consequences of falls such as fear of falling and self-imposed restrictions in social and physical activities.

Campbell et al. (1981) studied the association between social interaction and falls in the elderly and reported that men who fell repeatedly were less likely to attend church or a club compared to men with occasional falls or those who had never fallen. Living alone, a situation common to the elderly, has been reported to be associated with an increased risk of falls (Wickham et al., 1989; Craven & Bruno, 1986). In addition there are some reports of institutionalized elderly who fall deliberately possibly to attract attention to themselves, as a sign of distress (Albarede et al., 1989) or to inflict self-injury. This study has identified several indicators of social interaction and isolation including living alone, dissatisfaction with social life and membership in a social group as independent predictors of falls.

According to Goldberg et al. (1985), social support provides a sense of security, a sharing of concerns, a feeling of worthiness, a feeling of belonging, a chance to give nurturing, a way of getting guidance and a mutual exchange of services. Social isolation has a powerfully negative impact on life satisfaction, and loneliness is the single most feared aspect of old age (Berkowitz et al., 1988). The social networks of the elderly are often significantly reduced in size due to loss of the workplace role and losses of spouses, other family members and contemporaries, leading to a reduction in the amount of support that social networks are able to provide. These losses are often cited as a cause of lowered self-esteem and depression or to explain depressive symptoms in the elderly Indeed, Goldberg et al. (1985) showed that the quality of social networks was strongly associated with level of depressive symptoms reported.

Satisfaction with social life then, could be a marker of depression, poor morale, inability to adapt to aging or general unhappiness with life. Some of the symptoms associated with depression such as trouble sleeping, loss of interest and energy, distraction, impaired judgement, poor concentration, loss of appetite, negative affect, and less incentive to avoid risk could well contribute to an increased risk of falls. As shown earlier, a review of the literature is very suggestive that indicators of poor mental health including confusion, poor memory, depression, anxiety, poor morale, and agitated behavior are indeed associated with an increased risk of falls.

In addition to the psychosocial distress described above, elderly persons who are socially isolated might have a tendency to be particularly concerned and fearful about falls and their potential consequences, especially if injury is incurred. This heightened concern or anxiety might result in an increased likelihood to recall and to report falls (which might, in part, explain the higher rates of falls and fall-related injury observed in these subgroups). In fact, since this study pertained to falls, socially isolated subjects might have been particularly encouraged to recall their falls because of the increased attention and interest received from the interviewers in the follow-up phonecalls. These telephone conversations provided an opportunity to talk about the reasons and circumstances of their falls, perhaps allaying their fears to a certain extent.

The rate of falls was higher among members of social groups such as senior citizens' groups, Golden Age Clubs, or parishes. This finding seems contradictory to the finding that social isolation and dissatisfaction with social life increase the risk of falls. Rather than a marker for increased social interaction, being a member of a social group is perhaps a marker for increased activity (i.e., attendance at weekly meetings, participation in club or parish activities) which might, in turn, increase exposure to circumstances which precipitate falls, such as walking. By far the majority of falls occurred during walking. Membership in a social group might have increased the amount of walking engaged in, thus increasing the opportunity to fall.

Bed-days are markers of acute illnesses such as colds and flu, and of exacerbations of chronic conditions. Unlike previous studies in which confinement to bed (Tinetti et al., 1988) and acute illness (Tinetti et al., 1986) were associated with an increased risk of falls, bed-days were protective in this study. Confinement to bed during episodes of acute illness in an otherwise healthy, active individual, could reduce the number of opportunities in which a fall could occur in the course of normal indoor and outdoor activities, thereby reducing the incidence rate of falls.

Like bed-days, activity-limitation days are markers of acute episodes of illness or exacerbations of chronic illness, when the subject cuts down on usual activities because of a health problem. Unlike bed-days, activity-limitation days were associated with an increased incidence of falls. It appears that, while the subject who remains in bed during an acute episode of illness is protected against falls (possibly through reduced exposure to the opportunity to fall), the subject who remains mobile and continues to engage, at least partially, in normal daily activities has an increased risk of falls. This might be related to the symptoms or severity of the illness or to changes in medication due to the illness. Medications usually taken for acute illness such as pain relievers, antibiotics, and cough or cold remedies, although not all retained in the multivariate analyses, were each associated with falls in the univariate analyses (incidence density ratios ranged between 1.7 and 3.4).

Dizziness is a common complaint in the elderly. Common causes include vestibular dysfunction, drugs, metabolic disorders, cerebral ischemia and anxiety or depression. In a recent cross-sectional study of 1,622 community-dwelling elderly aged 60 years and older who were interviewed as part of the Duke Epidemiological Catchment Area study, 20 percent reported having had dizziness severe enough to interfere with life activities within one year before the interview (Sloane et al., 1989). Based on the results of their survey, the researchers suggested that there are two general categories of dizzy elderly. One group consists of individuals with anxiety, depression, somatization, and other primarily psychological disorders that heighten the awareness of feelings of postural or positional disorientation. The other consists of those primarily with neurosensory or cardiovascular, and possibly drug-related problems. The investigators suggested that this second category of individuals might be at increased risk for falls.

Dizziness, vertigo, and light-headedness have been studied repeatedly as risk factors for falls in community-based studies. Prudham & Evans (1981) compared the frequency of nonspecific symptoms among fallers and nonfallers, and found that episodes of dizziness and faints or blackout, light-headedness, and episodes of numbness or weakness were all more common among fallers. They suggested that these symptoms may represent a generalized failure of proprioceptive mechanisms. Perry (1982) and Blake et al. (1988) also reported that dizziness was associated with falling, although neither Droller (1955) or Tinetti et al. (1988) found an association. In this study, about one-fifth of study participants reported that they had experienced dizziness at some time during the follow-up. Subjects who reported occasional dizziness were approximately twice as likely as subjects who never reported dizziness to sustain falls while those who experienced dizziness frequently were approximately three times more likely to sustain falls. Dizziness then, appears to be a strong predictor of falls among community-dwelling elderly, and as the number of episodes of dizziness increases, so does the incidence rate of falls.

Palpitations have not been studied as a risk factor for falls among community-dwelling elderly. This study suggests that persons who report recent palpitations (sensation of the heart beating in a rapid or irregular way) were less likely to sustain falls. Fearful or anxious because of the palpitations, these individuals might have reduced their levels of activity remaining sedentary or resting quietly, thereby reducing the number of occasions or opportunities in which a fall could occur.

Among the eight indicators of disability, trouble using fingers to grasp was retained as an independent predictor of falls in the full model. This variable in itself, yields little information about the etiology of falls and may eventually prove more useful in the creation of a screening tool to identify elderly people at risk of falling.

Subjects with a history of falls were more likely to sustain further falls during follow-up. As indicated earlier, this finding is consistent across community-, clinic-, and institution-based studies (Tinetti et al., 1988; Nevitt et al., 1989; Campbell et al., 1989; Waller, 1978; Wild et al., 1981b; Tinetti et al., 1986). As previous investigators have suggested, a history of falls is possibly a marker of frailty, poor mobility, and acute or chronic health impairment. It reveals little about the etiology of falls, but suggests that if the causes of past falls are not investigated and corrected, the chances of sustaining further falls due to the same causes are increased[1].

Several medications including tranquilizers, antibiotics, stomach remedies, vitamins or minerals, and other major medications were each independent predictors of falls. Drugs are metabolized differently in the elderly because of slowed absorption rates from decreased intestinal tract mobility and reduced hepatic and renal clearance rates (Hindmarsh & Estes, 1989). Many researchers have suggested that specific medications (especially at inappropriate dosages), and polypharmacy contribute to unsteadiness and the risk of falls by decreasing alertness, depressing psychomotor function, or causing fatigue, dizziness, and postural hypotension (Nevitt, 1987; McVey & Studenski, 1988; Duthie, 1989; Nevitt, 1990). Evidence is strongest for an increased risk of falls with use of hypnotic-anxiolytic drugs and in particular, benzodiazepines (Nevitt, 1990).

Surprisingly, this study suggested that the short-term use of tranquilizers, medicine for the nerves or medicine to help you sleep, was associated with a decreased incidence of falls

[1] Further work on this data base could investigate risk factors for repeated falls in the study population as a whole and then only among those who fell.

in the study group[1]. There are several possible explanations for this unusual finding. First, because of the general nature of the question asked to study respondents, and because there was no validation of subject self-reports of drug use, it is possible that misclassification of exposure obscured the result. Alternatively, it is possible that subjects using these kinds of drugs were knowledgeable about and/or habituated to their side-effects, and therefore took precautions to reduce their risk of falls.

Frequent use of antibiotics was associated with a two-fold increase in the fall incidence rate. Persons reporting frequent use of antibiotics were probably in poor health suffering repeated episodes of infectious illness. The combined effects of illness and use of antibiotics might increase the risk of falls.

Use of vitamins or minerals was also associated with an increased fall incidence rate. This variable might have been a proxy indicator for (poor) health status, such that those in poorer health took vitamins or minerals on a regular basis in the belief that they could improve their health. The incidence rate would be higher in this subgroup then because of poor health status rather than use of vitamins or minerals.

Both stomach remedies, and other major medications appeared to be protective. These findings are difficult to interpret and need further investigation.

Finally number of physician consultations in the past year was correlated with and displaced both number of chronic health problems, and number of disabilities in the

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[1] Interaction analysis, on the other hand, suggested that use of tranquilizers, medicine for the nerves or medicine to help you sleep, was a risk factor for falls among males, associated with a five-fold increase in the rate of falls. Use of these medications did not appear to be associated with the rate of falls in women.

multivariate analysis. In addition, dissatisfaction with health was retained as a more powerful predictor of falls than either self-ratings of health or other health indicators. These variables are indicative of (poor) health status and disabilities, confirming what many other investigators have suggested, that the elderl with more chronic health problems and disabilities are at greater risk of falling (Waller, 1978; Tinetti et al., 1986; Nevitt, 1989; McVey & Studenski, 1988; Duthie, 1989). Although neither number of physician consultations nor dissatisfaction with health provide much insight into the specific mechanisms by which disease and disability increase the risk of falls, they do permit identification of subgroups of elderly in which preventive intervention is warranted.

(ii) Etiologic Model

By removing a number of variables investigated in the full model, for which a direct etiologic link with falls was not apparent, several variables which appeared to have a more direct etiologic link were retained in the etiologic model. These variables provide more information about the possible causes of falls, providing a broader range of ideas for preventive intervention. Not surprisingly, some of the risk factors identified in the full model including bed-days, activity-limitation days, other dizziness, and use of antibiotics, vitamins or minerals, and other major medications were retained in the etiologic model. In addition, six other variables including number of different activities, number of activities, use of alcohol, trouble walking 400 meters, trouble hearing, and use of medicine for the heart were identified as independent predictors of falls.

Two indicators of level of physical activity were retained as independent predictors of falls in the etiologic model. One indicator (average number of different activities) showed that subjects who, on average, engaged in few different activities, had a higher incidence rate of falls that those who participated in more different activities. On the other hand, the short-term measure of the frequency of activities suggested that those who engaged recently in more than ten activities fell more frequently than those who engaged in fewer activities. Theoretically at least, level of physical activity could both protect against falls as well as increase the risk of falls. Those who remain physically active on a regular basis could maintain the balance, flexibility, reflexes, muscle strength, coordination and reaction time required to successfully counteract displacements of the body from its support base. Essentially, these individuals maintain the components of postural stability through regular physical activity. It is not necessarily contradictory that engagement in frequent physical activity is associated with a higher rate of falls. Engagement in frequent physical activity obviously increases the number of opportunities to fall. A physically fit individual (one who maintains the components of postural stability through regular physical activity) could be at higher risk of falls simply because there is more opportunity to fall. He/she may be more likely to fall because of environmental hazards encountered during frequent physical activity, rather than because of impaired postural control. For example, the elderly person who adheres to the "walk-a-day" regime "rain or shine" places himself at increased risk of falls due to environmental factors, especially during winter snow and ice storms.

It seems then, that the association between level of physical activity and falls is complex. Further work is essential to investigate these seemingly contradictory findings, especially since preventive intervention focused on physical activity might be particularly relevant for community-dwelling elderly.

Interestingly, daily use of alcohol was associated with a decreased incidence of falls in the elderly. Analysis of interactions according to gender suggested that this finding was relevant for males only. Use of alcohol was included among the potential etiologic risk factors based on the hypothesis that increased exposure would be associated with a higher incidence of falls because of slowed reaction time, decreased alertness, unsteadiness, dizziness or poor judgment associated with (excessive) alcohol consumption. Because self-ratings of health and number of chronic health problems and disabilities were excluded from the etiologic analysis, it is possible that daily use of alcohol emerged as a general indicator of (good) health in the etiologic model. In fact, Campbell et al. (1989) found that women who did not take alcohol, took it infrequently or only in small amounts were more likely to fall than those who took alcohol regularly. They suggested that poor physical health was one of the main reasons for subjects reducing their alcohol intake. In this study, daily use of alcohol might be an indicator of good health, at least among males. In any case, it appears that the results of this study do not provide any evidence that use of alcohol increases the incidence of falls among community-dwelling elderly.

Trouble walking was identified as an independent predictor of falls in the etiologic model. Tinetti (1989) discussed pathologic gait patterns as causes of instability and falling in the elderly. Common features of gait disorders include flexed posture, step-to-step variability, path deviation, decreased step height that results in shuffling if severe, worsening on uneven surfaces and when changing surfaces (such as floor to rug) and inability to walk tandem. Tinetti (1989) stated that persons with gait disorders often complain of unsteadiness and fear of falling. Mobility problems have been studied repeatedly as risk factors for falls in community-based research. The results are mixed and probably reflect whether or not stronger indicators of postural stability were studied concurrently. For example, Tinetti et al. (1988) reported that lower extremity disability was retained in multivariate analysis, although other indicators of mobility such as level of mobility and gross impairment of mobility were significant in univariate analyses. Similarly, Campbell et al. (1989) reported that body sway was a significant predictor of falls, while none of mobility (measured with a timed 15-meter walk), or use of cane, frame, or elbow crutches were retained in logistic-regression analyses.

Trouble walking may well have been a proxy indicator for postural stability in this study. Possibly because of its lack of specificity, trouble walking was not a strong predictor of falls and, therefore, was not retained in the full model which investigated all potential risk factors. Its retention in the etiologic model however, supports the theory that postural instability contributes to falls in the elderly. Future research on the etiology of falls in the elderly should include specific indicators of the sensory, neurological and musculoskeletal components of postural stability in order to investigate their relative importance as causes of falls.

Trouble hearing was identified as an independent predictor of falls in the elderly. Tinetti (1989) suggested that hearing contributes directly to stability through detection and interpretation of auditory stimuli which help localize and orient the individual in space, especially when other sensory modalities are impaired. Age- and disease-related decline in vestibular function have been attributed to head trauma, ear surgery, middle ear infections and conditions such as Ménière's disease (Tinetti, 1989). In the only community-based research to date which has reported on hearing difficulties as a risk factor for falls, Blake et al. (1988) found that hard of hearing was not retained as an independent predictor of falls in discriminant analysis. Gerson et al. (1989) however studied hearing problems as a risk factor for imbalance (rather than falls) in a representative sample of 977 elderly people living in a medium-sized Ohio city and its suburbs. In multiple logistic-regression analysis in which other known risk factors were taken into account, the relative risk for impaired hearing was 1.6. Gerson et al. (1989) concluded that impaired sensory input due to hearing problems contributes to imbalance and perhaps to falls and injury. Tinetti et al. (1986) found that "hearing loss at least moderate" was a risk factor for falls among institutionalized elderly.

Surprisingly, the results of this study suggest that difficulty hearing is associated with a decreased incidence rate of falls. Community-dwelling elderly with hearing difficulties might adapt their behaviour to compensate for the loss of auditory stimuli, perhaps by restricting or slowing their movements, and therefore decreasing their risk of falls.

Finally, use of medicine for the heart was protective against falls, perhaps by reducing symptoms related to heart problems such as dizziness secondary to decreased cardiac output.

(iii) Age and Sex Interactions

All variables studied in the etiologic model were tested for interactions with each of age and sex in the final model. These analyses, exploratory in nature, were undertaken to provide direction for future research. Indeed, there appear to be several particularly interesting findings which should be investigated in future research. For example, use of tranquilizers was associated with an increased rate of falls in community-dwelling males, but not in their female counterparts. Similarly daily use of alcohol was protective against falls in males whereas in females, there was no association between use of alcohol and the rate of falls. These and other findings provide hypotheses to be tested in future studies.

5.4.5.2 - Risk factors for fall-related injury

In addition to increasing our understanding of etiology, the purpose of studying risk factors for fall-related injury among community-dwelling elderly was to determine if the risk factors for falls are similar to the risk factors for fall-related injury. If the risk factors are indeed similar, then preventive intervention aimed at decreasing the incidence rate of falls will also be effective in decreasing the incidence rate of fall-related injury. Because of its focus on the population of community-dwelling elderly, this research has identified predictors of fall-related injury in the study group as a whole. Further work on this data base could explore risk factors for fall-related injury only among elderly persons who have fallen. This work might provide some insight on why some falls result in injury while other falls do not.

Many of the risk factors identified for falls were the same as those identified for fall-related injury, and the incidence density ratios associated with specific risk factors were also similar. This is not surprising, given that the two analyses were conducted with the same data base, and that falls in which injury occurred comprised almost half of all falls. In order to have an adequate number of outcome events, all falls in which injury was reported, whether minor, moderate or severe, were included in the analyses of risk factors for fall-related injury. By far the majority of fall-related injuries were minor. The similarity of results observed is explicable if the risk factors for all falls were similar to the risk factors for falls with minor injury. Alternatively, other factors not studied in this research, such as environmental or behavioral factors, might account for whether or not a fall results in injury.

(i) Full Model

With the exceptions of marital status, dizziness on standing and use of cough or cold remedies, all the risk factors identified in the full model of predictors of fall-related injury were identified as predictors of falls either in the full or the etiologic model. Marital status was correlated with number of persons living in household and therefore being widowed is probably a proxy indicator for living alone. Interestingly, dizziness on standing was protective against fall-related injury. Persons who experience this symptom frequently have perhaps learned to compensate for it by arising very slowly and carefully (e.g., by holding onto a bedside table or chair) thereby reducing the risk of injury if a fall occurs. In addition, they may have modified the floor areas around the bed or commonly used seating areas (e.g., by installing thick carpeting), so that, if a fall occurs, it is less likely to result in injury.

Use of cough or cold remedies was associated with a higher incidence rate of fall-related injury. Many of these medications are available over-the-counter in pharmacies, and some contain ingredients such as codeine and antihistamines which could decrease alertness and cause fatigue or dizziness, predisposing the individual to falls and/or fall-related injury, especially if the drug was not taken as recommended on the package.

(ii) Etiologic Model

Two of the seven risk factors for fall-related injury retained in the etiologic model including dizziness on standing and other dizziness were identified in the full model of risk factors for fall-related injury. The etiologic model also identified stroke and respiratory disorders as independent predictors of fall-related injury, both associated with approximately a two-fold increase in the fall-injury rate. Persons with these diseases could be at increased risk for fall-related injury if the manifestations of their illnesses make them more vulnerable to injury during a fall. Finally, activity-limitation days, trouble walking 400 meters and medicine for the heart were also retained in the etiologic model. These risk factors were discussed earlier in Section 5.4.5.1.

5.5 - PREVENTION OF FALLS AND FALL-RELATED INJURY

The goal of the prevention of falls in the elderly should be to minimize the risk of falling without compromising mobility and functional independence (Tinetti & Speechley, 1989). Preventing the adverse consequences of falls including injury, long lies, and long-lasting fear after a fall, may also be important goals since, as discussed earlier, any fall, injurious or not, may precipitate maladaptive behavioral responses and lead to physical deconditioning and further falls (Nevitt, 1987). The design of effective preventive intervention requires knowledge of treatable impairments and conditions that contribute to functional disability, frailty and falls in older people (Nevitt, 1990). However, in spite of our still limited understanding of the relative importance of the many risk factors for falls in the elderly, numerous innovative preventive strategies addressing a wide range of possible risk factors have been proposed for the elderly living at home and for those who are institutionalized (Table 5.4).

Although there are many suggestions on how to prevent falls, very few strategies have been systematically evaluated to determine if they actually reduce the risk of falls or fall-related injury. Appendix VII describes several fall prevention programs for the elderly, some of which have been subjected to some form of evaluation. The majority of the interventions described are multifactorial, addressing several possible risk factors at the same time. Most include components which address environmental risks, as well as components which address intrinsic, health-related factors. A difficulty in evaluating multifactorial fall prevention programs is that, if a positive impact is observed, it might be difficult to ascertain which component(s) were influential in reducing the risk of falls and which were not useful. Unfortunately, few conclusions can be drawn about the impact of the programs described in Appendix VIII because of weak study designs, small sample sizes, and incorrect analyses.

This study has identified many factors which appear to be associated with an increase in the fall and fall-related injury rate among community-dwelling elderly. As indicated, some factors such as language, satisfaction with health and trouble using fingers to grasp provide little insight into the etiology of falls, but may be more useful in identifying subgroups of elderly persons for whom preventive interventions is warranted. Others provide insight into the causes of falls and are therefore suggestive of the kinds of interventions which, if feasible in a community setting, might prevent falls and fall-related injury. As discussed earlier in Section 5.4.5.1., the number and variety of risk factors identified in this research probably reflect a wide variety in the kinds of falls sustained by study participants, and the complex etiologic mechanisms involved in these different kinds of falls. Given the number and

TABLE 5.4

Preventive strategies to reduce the risk of falls among the elderly

POSSIBLE RISK FACTOR AND INTERVENTIONS

Hazardous Clothing

. Assess frequently worn clothing (long nightgowns or house coats)
. Educate the elderly about the hazards of loose, tight-fitting or long garments

Use of alcohol

. Assess patterns of alcohol use
Educate the elderly about the hazards of alcohol use.

Use of medication : (eg. psychoactive medication including sedatives, antidepressants, and antipsychotics, antihypertensives, anti-arrhythmias, anti-convulsants, diuretics)

Train health professionals about the special needs of the elderly (eg appropriate dosage, interactive effects of different medications, avoidance of certain drugs, side-effects, cautious prescribing, selection of short-acting drugs, clear communication with the patient, counselling regarding over-the-counter drug use).
. Regular evaluation of the risks and benefits of all medication taken; attempt to reduce the number of medications taken
. Surveillance of medication use (dosage and timing) to ensure that medication is taken as prescribed
Educate the public about the hazards of medication use in the elderly.

Inactivity

. Regular recreational activity, physical and occupational therapy or exercise programs to improve decreased strength, poor endurance, impaired flexibility and balance.
. Educate elderly to stimulate and reinforce physical activity levels.

Poor health

. Improved education and training of physicians to recognize and treat medical problems in the elderly.
. Regular comprehensive medical evaluations of the elderly for existing disease, use of medication, and history of previous falls. Early and careful diagnosis
. Educate the elderly that certain diseases may increase the risk of falling.
. Train the elderly to compensate for physical deficits and normal age-related changes in gait, mobility, and balance through recreational or therapeutic exercises

Impaired hearing

. Audiologic evaluation.
Removal of cerumen
. Hearing aid, if appropriate, with training.
. Reduction in background noise

Impaired vision

. Screening, treatment, and monitoring of visual problems (refraction, cataracts, glaucoma)
. Improve corrective eyewear by updating prescription, cleaning, or replacement due to excessive scratching
. If bifocals produce conflicting visual information, replace with separate pairs of glasses for far and near distance
. Referral to physical or occupational therapist for compensatory training to increase awareness of visual field cuts related to vascular accidents or glaucoma.
Educate the elderly about the importance of wearing eyeglasses as prescribed, cleaning eyeglasses, proper use of bifocals, difficulties of visual adaptation to the dark.
. Home safety assessment.

POSSIBLE RISK FACTOR AND INTERVENTIONS

Foot disorders

Routine inspection of feet for bunions, calluses or deformities which could lead to gait impairment
Assessment of footwear worn frequently. Optimize footwear for comfort, stability, and traction
. Referral to a chiropodist for correction and management of foot disorders (shaving of calluses, bunionectomy, trimming nails)
. Educate the elderly about the importance of wearing well-fitting shoes with laces and non-skid soles. Emphasize the importance of low, broad heels or wedge heels. Discourage the elderly from wearing loose slippers or stockings during the day

Postural hypotension

To evaluate postural hypotension, physicians should assess pulse pressure changes instead of absolute systolic and/or diastolic blood pressure changes
. Educate the elderly on techniques to minimize the effects of postural hypotension (eg exercising legs and flexing feet and ankles before a position change, use elastic stockings to minimize venous pooling in the legs, rise to an upright position slowly)
Evaluate effects of medication taken for hypotensive effects

Reduced peripheral neurosensation

Use canes or walkers to replace reduced sensory input from the legs.
Increase physical activity (walking programs, therapeutic balance exercises) to improve mobility and balance
Screen for deficiencies in vitamins which affect the peripheral and central nervous system functioning including B_{12}, folate, pyridoxine, and thiamine
Home safety assessment.

Dementia

. Evaluation to detect reversible causes
Avoid sedative or centrally acting drugs.
. Supervise exercise and ambulation
Home safety assessment.

Musculoskeletal Disorders

Appropriate diagnostic evaluation
Supervise exercise and ambulation
Balance and gait training
Muscle strengthening exercises
Appropriate walking aids
Home safety assessment.

Vestibular Dysfunction

Avoid drugs which affect the vestibular system
Neurologic or ear, nose, and throat evaluation, if indicated
. Habituation exercises for sensory stimulation and balance practice

Light-headedness, weakness

A trial of small meals may be considered for falls related to post prendial hypotension

TABLE 5.4 (continued)

POSSIBLE RISK FACTOR AND INTERVENTIONS

Previous Fall

- Educate patient on premonitory signs of falling and how to rise after falling. Supervised practice of rising methods.
  Keep blankets and pillows close at hand.
  Install emergency electronic alerting systems to avoid "long lies" after a fall.
  Develop social support or buddy network for regular surveillance of elderly at risk of falls.
  Thorough medical evaluation and search for intrinsic causes of falls. Appropriate treatment of cause.
  After a fall, graded supervised functional activity program to assure return to normal activity.
  Home safety assessment.
  Counselling for psychological trauma experienced after a fall to reassure and restore self-confidence.
  Relocate person to a safer environment.

Environmental hazards

- Regulations on design of housing, furniture and equipment for the elderly should be made through legislation and social policy. Health service organizations and the elderly should be involved in the process.
  Educate the elderly and their families on how to correct or minimize risks from environmental hazards.
  Establish programs to help finance and execute major home alterations to improve safety.
  Assess safety of home environment.
- Train visiting health professionals to identify hazards and provide counselling.
  Recommendations for specific areas include:

Floors:

Select non-skid, nonglare floor coverings that increase discrimination and depth perception.
- Carpets, scatter rugs, slip mats should be kept in good repair, well-anchored, with edges tacked down.
- Floor surfaces should be kept clean and free of clutter and small objects. Remove trailing electric cords or telephone wires. Wipe up spills immediately.

Stairs:

Bilateral handrails should be securely mounted, easy to grip, preferably round and should extend beyond the top and bottom step. They should be marked or textured to alert elderly to stair ending.
Lighting should be adequate, with switches at top and bottom of stairs.
- Edge of each stair should be marked in contrasting colour.
  Repair worn or defective stairs, steps, handrails.
  Remove clutter from stairs.
- Top and bottom steps should be in contrasting colour for easy identification.
  Stairs should not have a gradient of more than 37°, the height of steps should not exceed 15 cm, and the depth of steps should not be less than 25 cm.
  Nonslip treads or carpets should be added to stairs. Avoid patterned floor surfaces.
- Raised doorway thresholds should be removed to prevent tripping.

Bathrooms:

Bathrooms should be near bedrooms or at least on same level.
Bathtubs should have nonslip rubber mats or adhesive non-skid strips applied to tub or shower floor and around toilet area.
- Sturdy grabrails should be installed on front and side wall of bathtubs and showers, and next to toilet.
- Bathtubs should not be too high. Special seats enable the elderly to sit on edge of bathtub and swing legs over.
- Toilet seats should be raised if too low.
  Detachable, long length shower hose should be provided with stable tub seats with armrests, to allow elderly to sit while bathing.

POSSIBLE RISK FACTOR AND INTERVENTIONS

Lighting:

- Light switches should be accessible at every room entrance and on stairways.
  Provide nightlights in bedroom, hall, and bathroom.
- Provide even, indirect nonglare, and high levels of illumination especially on stairways and pathways, as well as in storage areas such as basements. Avoid creation of shadows. Background light should not be brighter or more intense than the central field.

Kitchen and closets:

- Design shelving to minimize necessity for use of foot stools. If necessary, provide sturdy footstools for climbing.
- Store frequently used items in places which minimize reaching up or bending over.

Furniture.

- Assess bed, chairs and tables for proper height and stability.
- Furniture should have armrests that extend beyond the edge of the seat to provide leverage in rising.
  Avoid casters and sharp edges on furniture.
- Stepladders should be sturdy with a good base of support.
- Beds should be adjustable. Lower bed height to eliminate need for footstools.

Aids or Equipment

- Careful prescription of walking aids, crutches, canes, wheelchairs, or other assistive devices.
- Referral to a physiotherapist for correct sizing, counselling, and training on the proper use, maintenance, and safety of assistive devices.

Outdoor areas:

- Lawns, entrances, gardens, driveways, and walkways should be well-maintained, free of holes, uneven surfaces, or cracks, and cleared of leaves, ice, and snow.
- Walkways and stairs should be well-lit.

Miscellaneous:

- Place telephone jacks strategically so that the telephone can be moved about the home (near the bed at night).
- Large pieces of glass (shower or patio doors) should be shatterproof and marked so glass is visible to ageing eyes.

Public areas:

- Recommendations above for private dwellings apply to public dwellings and areas.
- Continued need for proper sidewalk and road maintenance, prompt snow-cleaning, well-lit streets, clearly marked intersections, and functioning traffic lights.
- Radio and television should broadcast warnings on icy, rainy or snowy days.

Institutions

- Recommendations above for private dwellings and public areas apply to institutions.
- Thorough orientation of patient to surroundings, and ongoing evaluation of adjustment to surroundings.
- Volunteer helpers or patient buddy systems to assist patients adapt to new routine.
- A photoelectric device (such infrared scanning) is useful to detect patients leaving bed or room.
- Judicious use of siderails on beds and other restraining devices.
- Call lights, bed alarms, or other signalling devices should be well-maintained and within easy reach of patient.
- Organize a fall incident reporting system.
- On-going in-service fall prevention education.

Note: For details, see Barbiera, 1983; Blumenthal & Davie, 1980; Chuat & Loew, 1987; Goutier, 1986; Heckler, 1985; Janelli, 1987; Kellogg International Work Group, 1987, Kulikowski, 1979, Livesley, 1984; McCabe, 1985; McVey & Studenski, 1988; Peck, 1986; Riffle, 1982; Rousseau, 1985; Rubenstein and Robbins, 1984; Schulman & Acquaviva, 1987; Swartzbeck, 1983; Tinetti and Speechley, 1989; Tideiksaar, 1986; Walshe & Rosen, 1979.

heterogeneity of independent predictors, it is probable that preventive interventions likely to be effective will be multifactorial, addressing several risk factors concurrently. Based on the results of this research, preventive programs should include, among other components, comprehensive medical diagnosis and treatment, ongoing assessments of all medications taken and possibly physical activity or exercise regimes.

The following discussion suggests some approaches for prevention, based on those factors identified in this research as increasing the fall or fall-related injury rate among community-dwelling elderly. To date there is little direct evidence that any of these approaches (or combination of approaches) might be effective in preventing falls and fall-related injury among community-dwelling elderly. Future research on falls in the elderly will undoubtedly focus on testing the effectiveness of these and other approaches[1]. If, as this research suggests, the risk factors for falls are similar to the risk factors for fall-related injury, then preventive intervention to reduce the incidence of falls will also reduce the incidence of fall-related injury.

This is the first community-based follow-up study in which number of physician consultations has been identified as predictive of falls in the elderly. It is an interesting finding because it suggests that preventive interventions mediated through the physician and directed towards elderly patients who consult frequently will target an important risk group. Indeed over 25 percent of community-dwelling elderly consult their physicians six or more times a year. Interventions mediated through the physician could include regular comprehensive medical evaluations of the elderly for existing disease, use of medication, and history of previous falls, early and careful diagnosis, education of the elderly by their

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[1] During the next few years, a variety of fall prevention interventions will be evaluated through research efforts sponsored by the National Institute on Aging, Bethesda, Maryland.

physicians that certain diseases and medications may increase the risk of falling and, finally, referral and training of the elderly to compensate for physical deficits and normal age-related changes in gait, mobility, and balance (through recreational or therapeutic exercises for example).

Several psychosocial indicators of social interaction and isolation were predictive of falls and fall-related injury. Although it is premature to design fall prevention programs for the elderly based solely on social interaction or psychological factors, future research should explore the possible pathways linking social interactions (and satisfaction with social life and health), mental and psychological health and the risk of falls. In the meantime, however, it may be possible to incorporate social activity into the more traditional fall prevention programs which focus on the intrinsic medical and extrinsic environmental risk factors, without detracting from the other aspects of the program or incurring much additional cost.

Subjects with a history of falls were more likely to sustain further falls. As Nevitt et al. (1989) pointed out, persons with a history of falls constitute a particularly interesting target group for prevention because they run a high risk of recurrence, and because they are easily identifiable. This underscores the importance of a careful history of falls to investigate intrinsic and extrinsic factors that contributed to a previous fall. Correction or treatment of these factors may help prevent further falls caused by the same factors. Other kinds of interventions suggested for persons with a history of falls are aimed at preventing the sequelae of falls such as injury, long lies or fear of further falls. These include patient education regarding the premonitory signs of falling and how to rise after a fall, development of social support or a buddy network for regular surveillance of those at risk, installation of emergency electronic alerting systems, home safety assessment, supervised functional activity programs to assure return to normal activity, and counselling for psychological trauma to reassure and restore self-confidence.

Dizziness was identified as a risk factor for falls and fall-related injury. Careful investigation of the many possible causes of dizziness in elderly persons who report this symptom frequently is warranted, and treatment of the cause(s) may help prevent falls. For example, Tinetti & Speechley (1989) suggest that, for those with vestibular dysfunction, medications which affect the vestibular system should be avoided and habituation exercises for sensory stimulation and balance practice might be beneficial. Subjects with postural hypotension can be educated on techniques to minimize the effects (e.g. exercising legs and flexing feet and ankles before a position change, rising to an upright position slowly, use of elastic stockings to minimize venous pooling in the legs).

Episodes of acute illness or exacerbations of chronic illness appear to increase the risk of falls among those who restrict (but do not cut out) their normal activities because of the illness. In addition, certain medications commonly used during acute illness such as antibiotics and cough or cold remedies also appear to increase the risk of falls. Elderly persons should be sensitized about the possible risk of falling during acute illness, and about the possible risks associated with certain medications taken for such illnesses. Health professionals should also be aware that an acutely ill elderly person is at increased risk for falls.

The result of this study suggest that the association between physical activity and falls in the elderly is complex. Many previous researchers have suggested that exercise and physical activity might prevent falls and injury by strengthening muscles and increasing endurance, maintaining and improving posture, joint motion and postural reflexes, stimulating cardiorespiratory function and improving alertness (Nevitt, 1990; Kellogg International Work Group, 1987; Sorock, 1988). Nevitt (1990) suggested that controlled studies to test the effectiveness of exercise and strength training regimes will be a key feature of future intervention trials, although techniques are needed to minimize the risk of exercise-induced injury. Also methods to control for possible increased exposure to situational and environmental fall risks resulting from exercise and physical activity programs, are required.

Trouble walking was identified as an independent risk factor for falls and fall-related injury in the etiologic models. Nevitt (1990) suggested that balance and gait abnormalities associated with falls may be modified through "focused rehabilitative strategies including strength training targeted to impaired muscle groups, habituation exercises for persons with vestibular problems, motor coordination and proprioception exercises for persons with balance problems, and gait training for individual with gait abnormalities".

Persons with a history of stroke or with respiratory disorders were at increased risk for fall-related injury (in the etiologic fall-related injury model) suggesting that persons with certain diseases are more vulnerable to injury on falling, possibly because of disease-related physical changes. Although there is little evidence linking environmental hazards to the risk of falling, it makes intuitive sense that persons at risk for falls and fall-related injury assess modifiable environmental risks, particularly in areas where they spend the most time. There exist many home hazard checklists (see Table 5.4 for a description of environmental hazards) which can be incorporated into fall prevention interventions. Unfortunately there is little evidence to suggest which modifications are most effective, so that it is not easy to justify at this point the difficulties and costs involved in major structural or design modifications of furniture or homes. Nevitt (1990) suggests that preventive interventions which combine medical and physical therapy evaluation with a home environment assessment may be particularly effective because physical disabilities and environmental factors interact to cause many falls.

Finally, the use of several medications were independent predictors of falls and fall-related injury. This study suggests that 84 percent of community-dwelling elderly used one or more medications in the two days preceding the interviews and that on average, they had used 2.1 medications. If the findings from this study are confirmed, then interventions regarding the use of medication among community-dwelling elderly are warranted. Both health professionals and the elderly should be well aware of the special needs and the hazards of medication use in the elderly. There should be regular evaluation of the risks and benefits of all medication taken, and medication use should be monitored regularly to ensure that dosage and timing are as prescribed.

CHAPTER 6 - SUMMARY AND RECOMMENDATIONS

This final chapter summarizes the main findings from this research and then makes recommendations based on the findings regarding the design of future studies on falls in the elderly, the approaches and methods used to study risk factors for falls and fall-related injury, further work on the current data base and finally, the design and content of fall prevention interventions.

6.1 - SUMMARY

A one-year prospective follow-up study of 417 persons aged 65 years or older living in west-central Montreal was conducted to obtain data on the incidence rate and risk factors for falls and fall-related injury among community-dwelling elderly. The data show that falls are a common occurrence among the elderly. Twenty-nine percent of study participants fell during the follow-up period; 60.5 percent of fallers fell once and 39.5 percent fell two or more times. The incidence rate of falls was 41.4 falls per 1,000 person-months. Although approximately half of all falls resulted in injury, by far the majority of injuries were minor. Only five of the 197 falls reported during the follow-up period resulted in fracture including three hip fractures, one of the arm, and one fall which caused fractures of the nose and of two fingers. Very few subjects indicated at the end of the follow-up period that they had modified their normal activities during the preceding year because of a fall or because of fear of falling.

Comparison of the frequency of falls and fall-related injury during the 12 months preceding the initial interview and the 48-week follow-up period suggested that, in a 12-month recall, study participants might overestimate the incidence of falls which result in more serious injury such as fracture.

Fifty-nine percent of the 197 falls recorded during the follow-up period occurred inside a building and 41 percent occurred outdoors. The circumstances and characteristics of indoor and outdoor falls were quite different and further research is needed to investigate whether the causes of these two kinds of falls differ.

Many sociodemographic, lifestyle and health characteristics were associated with falls and fall-related injury in univariate analyses. A total of 28 variables were retained in the full and etiologic logistic-regression models of independent predictors of falls and fall-related injury. These included sociodemographic characteristics (live alone, French-speaking, widowed), lifestyle habits (unsatisfying social life, member of social group, number of different activities, number of activities, drink alcohol every day), indicators of health status (not at all satisfied with health, bed-days, activity-limitation days, dizziness on standing, other dizziness, palpitations, trouble walking 400 meters, trouble using fingers to grasp, trouble hearing, follow-up fall, history of stroke, respiratory disorder), use of certain medications (tranquilizers, stomach remedies, cough or cold remedies, vitamins or minerals, medicine for the heart, antibiotics and other major medication) and finally use of health services (number of physician consultations). The strongest predictors of increased incidence rates were similar for falls and fall-related injury and included unsatisfying social life, not at all satisfied with health and other dizziness. Factors which appeared to be protective included French-speaking, number of different activities, drink alcohol every day, bed-days, dizziness on standing, palpitations, trouble hearing and use of tranquilizers, stomach remedies, medicine for the heart and other major medication.

The number and wide variety of independent predictors identified suggest that the etiology of falls and fall-related injury is complex and multifactorial. Fall prevention interventions, in order to be effective, should probably be multifactorial addressing several risk factors concurrently. Based on the results of this research, components of a multifactorial fall prevention program should probably include, among other components, comprehensive medical diagnosis and treatment, ongoing assessment of all medications taken, and possibly physical activity and exercise regimes. Since the risk factors for falls and fall-related injury were similar, programs aimed at decreasing the incidence rate of falls will in all likelihood also decrease the incidence rate of fall-related injury. Because of the heterogeneity in the lifestyle and health characteristics of elderly persons, preventive interventions may have to be modified and targeted to specific subgroups of the elderly population with specific constellations of risk factors.

6.2 - RECOMMENDATIONS

6.2.1 - DESIGN OF STUDIES ON FALLS IN THE ELDERLY

If feasible, a prospective follow-up design with frequent follow-up interviews should be used to study falls among community-dwelling elderly. This will increase the probability of accurate measurement of the incidence rate and characteristics of falls and especially fall-related injury which appears to be overestimated in a 12-month recall. Telephone interviewing has a high response rate and is an efficient method for collecting follow-up data in elderly persons.

6.2.2 - STUDIES ON RISK FACTORS FOR FALLS

Studies on risk factors for falls among community-dwelling elderly should differentiate between risk factors for indoor and outdoor falls. In fact, studies of this kind might be more useful if they focus on risk factors for specific types of falls among specific subgroups of community-dwelling elderly.

Risk factor studies should carefully define the purpose of risk factor identification (i.e. whether to create a screening index, to investigate etiology, or to identify risk factors amenable to preventive interventions). This will guide the selection of potential risk factors to be measured and the methods of measurement.

Because falls can occur repeatedly in a single individual, and because the etiology of a first fall could differ from the etiology of subsequent falls, it is important to consider if potential risk factors fluctuate significantly over time, and how these fluctuations might affect the identification of risk factors. Decisions on how often data on potential risk factors should be collected should be based on these considerations.

Further research is needed to confirm the findings from this research on independent predictors of falls and fall-related injury. In particular, the etiologic significance (if any) of dissatisfaction with health and dissatisfaction with social life warrant further work, since these two variables were among the strongest predictors of both falls and fall-related injury. The seemingly complex association between level of physical activity and falls should be thoroughly investigated since physical activity programs might be a particularly useful preventive intervention in a community setting. Finally, the apparent increased rate of falls and/or fall-related injury associated with the use of cough or cold remedies, vitamins or minerals and antibiotics, as well as the apparent protective effects of tranquilizers, stomach remedies and medicine for the heart require further investigation.

Future risk factor studies should incorporate measures of postural control as potential risk factors for falls and fall-related injury. How postural control abnormalities interact with other risk factors should be investigated.

6.2.3 - FURTHER WORK ON THE CURRENT DATA BASE

Further work on this data base should explore the validity and reliability of a quick, easy-to-administer screening tool to identify community-dwelling elderly persons at higher risk of falling (for the purpose of targeting preventive interventions more efficiently).

Further analysis of risk factors using the current data base could explore risk factors for indoor and outdoor falls, risk factors for fall-related injury among elderly fallers, and risk factors for repeat falls among elderly fallers.

The current data base could be used to identify risk factors amenable to preventive intervention in a community setting by restricting the list of potential risk factors studied in multivariate analysis to include only those risk factors amenable to preventive intervention.

6.2.4 - FALL PREVENTION INTERVENTIONS

Given the wide variety of independent predictors of falls and fall-related injury identified in this and other community-based studies, fall prevention interventions should probably be multifactorial, addressing several risk factors concurrently.

Based on the results of this research, components of a multifactorial fall prevention program for community-dwelling elderly should probably include, among other components, comprehensive medical diagnosis and treatment, ongoing assessment of all medications taken and possibly physical activity and exercise regimes.

If future research identifies specific risk factors as being more important in specific subgroups of community-dwelling elderly, preventive programs should be streamlined and targeted to specific subpopulations of elderly persons.

Since the risk factors for falls and fall-related injury were similar, programs aimed at decreasing the incidence rate of falls will in all likelihood also decrease the incidence rate of fall-related injury. The objectives of fall prevention programs should therefore also include objectives pertaining to reduction in the incidence rate of fall-related injury.

Randomized trials of fall prevention programs are needed. If the programs are multifactorial, the study design should allow testing the effectiveness of individual components of the program. Costs of prevention should be estimated against benefits derived.

6.2.5 - GENERAL RECOMMENDATIONS

Consensus should be reached about standardization of a definition and/or methods for describing and classifying falls and fall-related injury. Similarly researchers should report both the prevalence proportion of fallers as well as the incidence rate of falls.

Further research is needed to confirm the lack of long-term effects of falls on fear of further falls and activity restriction among community-dwelling elderly noted in this research.

Further work could explore the usefulness of the Falls Memory-Aid Calendar to assist elderly persons to recall and describe falls experienced and their sequelae.

STATEMENT OF ORIGINALITY

This research has provided data on the incidence rate and risk factors for falls and fall-related injury among community-dwelling elderly persons aged 65 years or older. Most previous studies which measure the frequency of falls among community-dwelling elderly are cross-sectional studies subject, at least theoretically, to the problems of recall bias and underestimation of the frequency of falls. An important feature of this study, in terms of the measurement of the frequency of falls, is that it followed subjects prospectively at frequent intervals (once every four weeks), so that the problem of recall bias was minimized. In addition to the frequent follow-up interviews, each subject was provided with a "Falls Memory-Aid Calendar" on which they recorded the dates and details of any falls which occurred. The frequent follow-up interviews and the use of the calendar encouraged increased reporting of all falls whether trivial or severe, so that more accurate measurements of the incidence rates of falls and fall-related injury were obtained.

This is the first time that risk factors for falls among the elderly have been studied using data on potential risk factors collected repeatedly during the study. Previous follow-up studies on falls among the elderly have measured potential risk factors which could change over time in an initial interview and then used this baseline data to predict falls which occurred during a defined period of follow-up (usually one year). In adopting this approach, previous researchers have assumed that the measure of exposure obtained in the initial interview is a valid indicator of exposure, which can be used to predict falls which occur at any time during the follow-up period. Risk factors which cause falls either through short-term exposure just preceding the fall or through chronic (intermittent) exposure over time, may not be detected. Also, if change in exposure (i.e. increase or decrease in medication dosage) is the causal agent, then measurement of exposure in a single interview may not permit identification of the variable as a risk factor for falls in the elderly. Although this study did not permit investigation of changes in exposure as risk factors for falls, it did investigate recent and average exposure to several time dependent exposure variables as potential risk factors for falls and fall-related injury. This innovative feature of the design permitted more accurate measurement of exposure over the follow-up period. The use of pooled logistic regression (necessitated by the possibility of repeated outcomes in a single individual and by repeated measurement of time dependent exposures) is also an innovative feature of this study.

Finally, this is the first community-based follow-up study of community-dwelling elderly persons in which risk factors for fall-related injury have been studied systematically using multiple logistic-regression analyses.

REFERENCES

Albarede JL, Lemieux A, Vellas B, Groulx B. Le problème psychologique de la chute chez la personne âgée. *Can J Psychiatry* 1989;34:94-6.

Baker S, O'Neill B, Karpf RS. The Injury Fact Book. Cambridge, MA: Lexington Books, 1984.

Barbiera EB. Patient falls are not patient accidents. *J Gerontol Nurs* 1983;9:165-73.

Berkman L. Social networks, support, and health: Taking the next step forward. *Am J Epidemiol* 1986;123:559-62.

Berkowitz, MV, Waxman R, Yaffe L. The effects of a resident self-help model on control, social involvement and self-esteem among the elderly. *Gerontologist*, 1988;28:620-4.

Berry G, Fisher RH, Lang S. Detrimental incidents, including falls, in an elderly institutional population. *J Am Geriatr Soc* 1981;29:322-4.

Blake C, Morfitt JM. Falls and staffing in a residential home for elderly people. *Public Health* 1986;100:385-91.

Blake AJ, Morgan K, Bendall MJ, Dallosso H, Ebrahim SBJ, Arie THD, Fentem PH, Bassey EJ. Falls by elderly people at home: prevalence and associated factors. *Age Ageing* 1988;17:365-72.

Blumenthal MD, Davie JW. Dizziness and falling in elderly psychiatric outpatients. *Am J Psychiatry* 1980;137:203-6.

BMDP Statistical Software Manual. Volume 2. Los Angeles: BMDP Statistical Software, Inc., 1990.

BMDP EM/286. User's Guide. Los Angeles: BMDP Statistical Software, Inc., 1990.

Breslow NE, Day NE. Statistical Methods in Cancer Research. Volume II - The Design and Analysis of Cohort Studies. London: Oxford University Press, 1987.

Brocklehurst JC, Robertson D, James-Groom P. Clinical correlates of sway in old age - sensory modalities. *Age Ageing* 1982;11:1-10.

Brody EM, Kleban MH, Moss MS, Kleban F. Predictors of falls among institutionalized women with Alzheimer's disease. *J Am Geriatr Soc* 1984;32:877-82.

Brummel-Smith K. Falls in the aged. *Prim Care* 1989;16:377-93.

Buchner DM, Larson EB. Falls and fractures in patients with Alzheimer-type dementia. *JAMA* 1987;257:1492-5.

Campbell AJ, Reinken J, Allan BC, Martinez GS. Falls in old age: a study of frequency and related clinical factors. *Age Ageing* 1981;10:264-70.

Campbell AJ, Spears GFS, Barrie MJ, Fitzgerald JL. Falls, elderly women and the cold. *Gerontology* 1988;34:205-8.

Campbell AJ, Borrie MJ, Spears GF. Risk factors for falls in a community-based prospective study of people 70 years and older. *J Gerontol* 1989;44:M112-7.

Campbell AJ, Borrie MJ, Spears GF, Jackson SL, Brown JS, Fitzgerald JL. Circumstances and consequences of falls experienced by a community population 70 years and over during a prospective study. *Age Ageing* 1990;19:136-41.

Catchen H. Repeaters: inpatient accidents among the hospitalized elderly. *Gerontologist* 1983;23:273-6.

Centers for Disease Control. Year 2000 health objectives for the nation: Prevent and control unintentional injuries. Report of the interagency workgroup. Division of Injury Epidemiology and Control, Center for Environmental Health and Injury Control, CDC, Atlanta, Georgia, 1989.

Chandler J, Duncan P, Studenski SA. Balance performance on the postural stress test: Comparison of young adults, healthy elderly, and fallers. *Phys Ther* 1990;70:410-5.

Chuat M, Loew F. Les chutes des personnes âgées: approche pratique. *Rev Med Suisse Romande* 1987;107:235-43.

Clark G. A study of falls among elderly hospitalized patients. *Aust J Adv Nurs* 1985;2:34-44.

Colton T. Statistics in Medicine. Boston: Little, Brown and Company, 1974.

Cook PJ, Exton-Smith AN, Brocklehurst JC, Lempert-Barber SM. Fractured femurs, falls and bone disorders. *J R Coll Physicians Lond* 1982;16:45-9.

Craven R, Bruno P. Teach the elderly to prevent falls. *J Gerontol Nurs* 1986;12:27-33.

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

D'Agostino RB, Lee M, Belanger AJ, Cupples LA, Anderson K, Kannel WB. Relation of pooled logistic regression to time dependent Cox regression analysis: The Framingham Heart Study. *Stat Med* 1990;9:1501-15.

Dillman DA. Mail and telephone surveys: The total design method. New York: John Wiley & Sons, 1978.

Droller H. Falls among elderly people living at home. *Geriatrics* 1955;10:239-45.

Duthie EH. Falls. *Med Clin North Am* 1989;73:1321-37.

Elliott DF. Accidents in nursing homes: implications for patients and administrators. In: Miller MB. ed. Current Issues in Clinical Geriatrics. New York: Tiresias Press, 1979.

Enquête Promotion de la Santé à Montréal 1986 : un rapport de recherche, 1988. Montreal: DSC Hôpital Sacré-Coeur, DSC Hôpital général de Montréal, DSC Hôpital Saint-Luc.

Feist R. A survey of accidental falls in a small home for the aged. *J Gerontol Nurs* 1978;4:15-7.

Fernie GR, Gryfe CI, Holliday PJ, Llewellyn A. The relationship of postural sway in standing to the incidence of falls in geriatric subjects. *Age Ageing* 1982;11:11-6.

Fife D. Injuries and deaths among elderly persons. *Am J Epidemiol* 1987;126:936-41.

Fleiss JL. Statistical Methods for Rates and Proportions. Second Edition. New York: John Wiley & Sons, 1981.

Gabell A, Simons MA, Nayak USL. Falls in the healthy elderly: predisposing causes. *Ergonomics* 1985;28:965-75.

Gehlsen G, Mitchell H, Whaley MS. Falls in the elderly: Part I, Gait. *Arch Phys Med Rehabil* 1990a;71:735-8.

Gehlsen G, Mitchell H, Whaley MS. Falls in the elderly: Part II, Balance, strength, and flexibility. *Arch Phys Med Rehabil* 1990b;71:739-41.

Goldberg EL, Van Natta P, Comstock G. Depressive symptoms, social networks and social support of elderly women. *Am J Epidemiol* 1985;121:448-56.

Goutier M. Hazardous mobility in the elderly. *Perspectives* 1986;10:11-2.

Grisso JA, Kelsey JL, Strom BL, Chiu GY, Maislin G, O'Brien LA, Hoffman S, Kaplan K. Northeast Hip Fracture Study Group. Risk factors for falls as a cause of hip fracture in women. *N Engl J Med* 1991;324:1326-31.

Gryfe CI, Amies A, Ashley MJ. A longitudinal study of falls in an elderly population: I. Incidence and morbidity. *Age Ageing* 1977;6:201-10.

Guimaraes RM, Isaacs B. Characteristics of the gait in old people who fall. *Int Rehabil Med* 1980;2:177-80.

Health and Welfare Canada/Statistics Canada. The Health of Canadians: Report of the Canada Health Survey. Minister of Supply and Services Canada, Catalogue No. 82-538, 1981.

Health and Welfare Canada. Canada's Health Promotion Survey: Technical Report. Eds., Irving Rootman, Reg Warren, Thomas Stephens and Larry Peters: Minister of Supply and Services Canada, Catalogue No. H39-1191, 1988.

Heckler MM. Health promotion for older Americans. *Public Health Rep* 1985;100:225-30.

Hindmarsh JJ, Estes EH. Falls in older persons. Causes and interventions. *Arch Intern Med* 1989;149:2217-22.

Hingson R, Howland J. Alcohol as a risk factor for injury or death resulting from accidental falls: a review of the literature. *J Stud Alcohol* 1987;48:212-19.

Hosmer DW, Lemeshow S. Applied Logistic Regression. New York: John Wiley & Sons, 1989.

Isaacs B. Clinical and laboratory studies of falls in old people. Prospects for prevention. In: Radebaugh TS, Hadley E, Suzman R. eds. Falls in the elderly: Biologic and behavioral aspects. Clinics in Geriatric Medicine. Philadelphia: WB Saunders, Vol.1, August, 1985.

Isaacs B. Why do the elderly fall? *Geriatr Med* 1981;March:17-23.

Iskrant AP, Joliet PV. Accidents and Homicide. Cambridge, MA: Harvard University Press, 1968.

Janelli LM. One method of reducing patient falls. *Perspectives* 1987;11:15.

Kalchthaler T, Bascon RA, Quintos V. Falls in the institutionalized elderly. *J Am Geriatr Soc* 1978;26:424-8.

Kellogg International Work Group on the Prevention of Falls by Elderly. The prevention of falls in later life. *Dan Med Bull* 1987;34(Suppl 4):1-24.

Kulikowski ES. A study of accidents in a hospital. *Superv Nurse* 1979;10:44-56.

Livesley B. Falls in older age. *Br Med J* 1984;289:568-9.

Louis M. Falls and their causes. *J Gerontol Nurs* 1983;9:142-9.

Lucht U. A prospective study of accidental falls and resulting injuries in the home among elderly people. *Acta Sociomed Scand* 1971;2:105-20.

Lund C, Sheafor ML. Is your patient about to fall? *J Gerontol Nurs* 1985;11:37-41.

Manjam NVB, Mackinnon HH. Patient, bed and bathroom. *Nova Scotia Medical Bull* 1973;52:23-5.

Margulec I, Librach G, Schadel M. Epidemiological study of accidents among residents of homes for the aged. *J Gerontol* 1970;25:342-6.

Mayo NE, Korner-Bitensky N, Becker R, Georges P. Predicting falls among patients in a rehabilitation hospital. *Am J Phys Med Rehabil* 1989;68:139-46.

Mayo N, Korner-Bitensky N, Kaizer F. Relationship between response time and falls among stroke patients undergoing physical rehabilitation. *Int J Rehabil Res* 1990;13:47-55.

McCabe F. Mind you don't fall. *Nurs Mirror* 1985;160:52-6.

McVey LJ, Studenski SA. Falls in the elderly. *Adv Clin Rehabil* 1988;1:108-31.

Melton LJ, Riggs BL. Risk factors for injury after a fall. In: Radebaugh TS, Hadley E, Suzman R. eds. Falls in the elderly: Biologic and behavioral aspects. Clinics in Geriatric Medicine. Philadelphia: WB Saunders, Vol. 1, August, 1985.

Mion LC, Gregor S, Buettner M, Chwirchak D, Lee O, Paras W. Falls in the rehabilitation setting: incidence and characteristics. *Rehabil Nurs* 1989;14:17-22.

Morgan VR, Mathison JH, Rice JC, Clemmer DI. Hospital falls: a persistent problem. *Am J Public Health* 1985;75:775-7.

Morris EV, Isaacs B. The prevention of falls in a geriatric hospital. *Age Ageing* 1980;9:181-5.

Morris JC, Rubin EH, Morris EJ, Mandel SA. Senile dementia of the Alzheimer's type: an important risk factor for serious falls. *J Gerontol* 1987;42:412-7.

Morse JM, Prowse MD, Morrow N, Federspeil G. A retrospective analysis of patient falls. *Can J Public Health* 1985;76:116-8.

Morse JM, Tylko SJ, Dixon HA. Characteristics of the fall-prone patient. *Gerontologist* 1987;27:516-22.

Mossey JM. Social and psychological factors related to falls among the elderly. In: Radebaugh TS, Hadley E, Suzman R. eds. Falls in the elderly: Biologic and behavioral aspects. Clinics in Geriatric Medicine. Philadelphia: WB Saunders, Vol.1, August, 1985.

Myers AH, Baker SP, Van Natta ML, Abbey H, Robinson EG. Risk factors associated with falls and injuries among elderly institutionalized persons. *Am J Epidemiol* 1991;133:1179-90.

National Safety Council: National Safety Council Accident Facts. Chicago, National Safety Council, 1987, p11.

Naylor R, Rosen AJ. Falling as a cause of admissions to a geriatric unit. *Practitioner* 1970;205:327-30.

Nevitt MC. Health promotion and aging. Falls and instability in the elderly: host and behavioral factors. A background paper prepared for the Surgeon General's Workshop on Health Promotion and Aging. Department of Medicine and Epidemiology, University of California, 1987.

Nevitt MC, Cummings SR, Kidd S, Black D. Risk factors for recurrent nonsyncopal falls: a prospective study. *JAMA* 1989;261:2663-8.

Nevitt MC. Falls in older persons. Risk factors and prevention. In: Berg LB, Cassells JS. eds. The Second Fifty Years. Promoting Health and Preventing Disability. Washington: National Academy Press, 1990.

Nickens H. Intrinsic factors in falling among the elderly. *Arch Intern Med* 1985;145:1089-93.

O'Loughlin J, Robitaille Y. Les traumatismes dus aux chutes. Les chutes chez les personnes âgées. In: *Les traumatismes au Québec : comprendre pour prévenir*. Les Publications du Québec, 1991.

Overstall PW, Exton-Smith AN, Imms FJ, Johnson AL. Falls in the elderly related to postural imbalance. *Br Med J* 1977;1:261-4.

Overstall PW, Johnson AL, Exton-Smith AN. Instability and falls in the elderly. *Age Ageing* 1978;7(Suppl):92-6.

Pablo RY. Patient accidents in a long-term care facility. *Can J Public Health* 1977;68:237-47.

Parrish HM, Weil TP. Patient accidents occurring in hospitals: epidemiologic study of 614 accidents. *New York State J Med* 1958;58:838-46.

Peck WA. Falls and hip fracture in the elderly. *Hosp Pract* 1986;21:72A-L.

Perry BC. Falls among the elderly living in high-rise apartments. *J Fam Pract* 1982a;14: 1069-73.

Perry BC. Falls among the elderly: a review of the methods and conclusions of epidemiologic studies. *J Am Geriatr Soc* 1982b;30:367-71.

Pfeiffer E. A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. *J Am Geriatr Soc* 1975;23:433-41.

Prudham D, Evans JG. Factors associated with falls in the elderly: a community study. *Age Ageing* 1981;10:141-6.

Radebaugh TS, Hadley E, Suzman R. eds. Falls in the elderly: Biologic and behavioral aspects. Clinics in Geriatric Medicine. Philadelphia: W.B. Saunders, Vol. 1, August, 1985.

Raz T, Baretich MF. Factors affecting the incidence of patient falls in hospitals. *Med Care* 1987;25:185-95.

Riffle KL. Falls: kinds, causes, and prevention. *Geriatr Nurs* 1982;May/June:165-9.

Ring C, Nayak USL, Isaacs B. Balance function in elderly people who have and who have not fallen. *Arch Phys Med Rehabil* 1988;69:261-4.

Robbins AS, Rubenstein LZ, Josephson KR, Schulman B, Osterweil D, Fine G. Predictors of falls among elderly people: results of two population-based studies. *Arch Intern Med* 1989;149:1628-33.

Robitaille Y, O'Loughlin J. Epidémiologie de la chute chez les personnes âgées. Communication présentée dans le cadre du Groupe du Travail OMS "Sécurité des personnes âgées" Toulouse, septembre, 1988.

Robitaille Y, O'Loughlin J. Epidemiology of falls among the elderly: trends and perspectives for prevention. Paper presented at the Conference on Injuries among the Elderly. Stockholm, Sweden, September 1989.

Rockett IRH, Smith GS. Homicide, suicide, motor vehicle crash, and fall mortality: United States' experience in comparative perspective. *Am J Public Health* 1989;79:1396-400.

Rothman KJ. Modern Epidemiology. Boston: Little, Brown and Company, 1986.

Rousseau PC. Falls in the elderly. *Postgrad Med* 1985;78:87-8.

Rubenstein LZ, Robbins AS. Falls in the elderly: a clinical perspective. *Geriatrics* 1984;39: 67-78.

Sattin RW, Lambert Huber DA, DeVito CA, Rodriguez JG, Ros A, Bacchelli S, Stevens JA, Waxweiler RJ. The incidence of fall injury events among the elderly in a defined population. *Am J Epidemiol* 1990;131:1028-37.

Schulman BK, Acquaviva T. Falls in the elderly. *Nurse Pract* 1987;12:30-7.

Sehested P, Severin-Nielsen T. Falls by hospitalized elderly patients: causes, prevention. *Geriatrics* 1977;32:101-13.

Sheldon JH. The Social Medicine of Old Age. London: Oxford University Press, 1948.

Sheldon JH. On the natural history of falls in old age. *Br Med J* 1960;4:1685-90.

Sim J. Problems of instability in old age. *J R Soc Health* 1984;4:144-6.

Sloane P, Blazer D, George L. Dizziness in a community elderly population. *J Am Geriatr Soc* 1989;37;101-8.

Sobel KG, McCart GM. Drug use and accidental falls in an intermediate care facility. *Drug Intell Clin Pharm* 1983;17:539-42.

Sorock GS. Falls among the elderly: epidemiology and preventior *Am J Prev Med* 1988;4:282-8.

Sorock GS, Shimkin EE. Benzodiazepine sedatives and the risk of falling in a community-dwelling elderly cohort. *Arch Intern Med* 1988;148:2441-4.

Statistics Canada. 1986 Census.

Statistique Canada. Enquête sociale générale, série analytique. Santé et aide du milieu, 1985. Ministre des approvisionnements et services, Canada, Catalogue no. 11-612F, no. 1, 1987.

Statistique Canada. Causes de décès. La statistique de l'état civil, vol. IV, 1986.

Stavig GR, Leonard AR, Igra A, Felten P. Indices of relative body weight and ideal weight charts. *J Chronic Dis* 1984;37:255-62.

Stegman MR. Falls among elderly hypertensives - are they iatrogenic? *Gerontology* 1983;29:399-406.

Stephens T. Fitness and lifestyle in Canada: a report of the Canada Fitness Survey. Government of Canada. Fitness and Amateur Sport, 1983.

Svanström L. Falls on stairs: an epidemiological accident study. *Scand J Soc Med* 1974;2:113-20.

Swartzbeck EM. The problem of falls in the elderly. *Nurs Manage* 1983;14:34-8.

Tideiksaar R. Preventing falls: home hazard checklists to help older patients protect themselves. *Geriatrics* 1986;41:26-8.

Tinetti ME, Williams TF, Mayewski R. Fall risk index for elderly patients based on number of chronic disabilities. *Am J Med* 1986;80:429-34.

Tinetti ME. Factors associated with serious injury during falls by ambulatory nursing home residents. *J Am Geriatr Soc* 1987;35:644-8.

Tinetti ME. Instability and falling in elderly patients. *Semin Neurol* 1989;9:39-45.

Tinetti ME, Speechley M. Prevention of falls among the elderly. *N Engl J Med* 1989;320:1055-9.

Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med* 1988;319:1701-7.

Tinker GM. Accidents in a geriatric department. *Age Ageing* 1979;8:196-8.

Tobis JS, Reinsch S, Swanson JM, Byrd M, Scharf T. Visual perception dominance of fallers among community-dwelling older adults. *J Am Geriatr Soc* 1985;33:330-3.

Tobis JS, Block M, Steinhaus-Donham C, Reinsch S, Tamaru K, Weil D. Falling among the sensorially impaired elderly. *Arch Phys Med Rehabil* 1990;71:144-7.

Tremblay J. Etude sur les chutes d'origine médicamenteuse chez les personnes âgées vivant en centre d'accueil d'hébergement. (Dissertation) Quebec, Quebec: Université Laval, 1988, 232p.

Vellas B, Cayla F, Bocquet H, dePemille F, Albarede JL. Prospective study of restriction in activity in old people after falls. *Age Ageing* 1987;16:189-93.

Venglarik JM, Adams M. Which client is a high risk? *J Gerontol Nurs* 1985;11:28-30.

Waller JA. Falls among the elderly - human and environmental factors. *Accid Anal Prev* 1978;10:21-33.

Walshe A, Rosen H. A study of patient falls from bed. *J Nurs Adm* 1979;9:31-5.

Weil TP, Parrish HM. How did it happen? *Hospitals* 1958;32:43-8.

Wickham C, Cooper C, Margetts BM, Barker DJP. Muscle strength, activity, housing and the risk of falls in elderly people. *Age Ageing* 1989;18:47-51.

Wild D. Falls in homes. *Nurs Times* 1983:320.

Wild D, Nayak USL, Isaacs B. Facts on falling. *Health Soc Serv J* 1981a:1413-5.

Wild D, Nayak USL, Isaacs B. How dangerous are falls in old people at home? *Br Med J* 1981b;282:266-8.

Wild D, Nayak USL, Isaacs B. Description, classification and prevention of falls in old people at home. *Rheumatol Rehabil* 1981c;20:153-9.

Wild D, Nayak USL, Isaacs B. Prognosis of falls in old people at home. *J Epidemiol Community Health* 1981d;35:200-4.

Wilkins R. Dossier population : compilations du recensement de 1981 par CLSC et DSC, région 6A (Montréal-métropolitain). Montréal : RDSCMM, 1987.

Winner SJ, Morgan CA, Grimley Evans J. Perimenopausal risk of falling and incidence of distal forearm fracture. *Br Med J* 1989;298:1486-8.

Wolfson L, Whipple R, Amerman P, Tobin JN. Gait assessment in the elderly: a gait abnormality rating scale and its relation to falls. *J Gerontol* 1990;45:M12-9

Wright BA, Aizenstein S, Vogler G, Rowe M, Miller C. Frequent fallers: leading groups to identify psychological factors. *J Gerontol Nurs* 1990;16:15-9.

APPENDIX I

PRETEST OF QUESTIONNAIRES, MEMORY-AID, AND STUDY PROCEDURES

1 - PRETEST OF QUESTIONNAIRES AND MEMORY-AID CALENDAR

The objectives of the pretest of questionnaires and Memory-Aid Calendar were fourfold:

(i) To test the acceptability, understandability, and sequencing of questions in the Initial, Follow-up, and Falls Questionnaires.

(ii) To establish categories of responses for open-ended questions.

(iii) To determine the length of time required to administer each questionnaire.

(iv) To study the usefulness of a preliminary version of the Memory-Aid Calendar.

A convenience sample of 27 volunteers 65 years of age or older was selected from three Golden Age Clubs located on the DSC-MGH territory (Projet Changement, NDG Senior Citizens Club, and Contactivité). One of the clubs had an English membership, one had a French membership, and one had a mixed French and English membership. The two principal investigators met with members of the Board of Directors at each club to explain the purpose of the pretest. The Board of Directors then solicited participation for the pretest from among its membership by posting a notice or by announcing the study during a club meeting.

Members who volunteered to participate were given appointments at their Golden Age Club to complete the Initial Questionnaire. These interviews were conducted by one of the principal investigators, the research coordinator, or one of two interviewers. Because the questionnaires were not administered in the subjects' home, the section of the Initial Questionnaire which collected data on characteristics of the stairways and bathrooms could not be completed. If the volunteers had experienced a fall during the four weeks preceding the interview, a Falls Questionnaire was also administered.

After completion of the questionnaire(s), the interviewer asked the volunteer to participate in a one-month follow-up telephone interview to pretest the Follow-up Questionnaire. Each volunteer received a preliminary version of the Memory-Aid Calendar and was instructed on its use. At the end of each interview, the interviewers recorded any difficulties encountered related to the conduct of the interview or to specific questions in the questionnaires.

Initial Questionnaires were administered during the first week of December 1986. Interviews were conducted in either French or English, depending on the volunteer's preference, and lasted on average one hour.

In January 1987, one month after the initial interviews, each of the 27 volunteers was telephoned and a Follow-up Questionnaire was administered by one of the two interviewers. After completing the questionnaire, volunteers were asked whether or not they used the Memory-Aid Calendar, and if so, whether or not they had any difficulty using it. A Falls Questionnaire was administered if the volunteer had experienced a fall since the initial interview.

Difficulties encountered in conducting the interviews and administering the questionnaires were discussed round-table style, by the principal investigators, research coordinator, and interviewers after the initial interviews and again after the follow-up interviews. Modifications were made to the questionnaires based on these discussions. Most of the volunteers had used the Memory-Aid Calendar during the one-month follow-up, and none had experienced any difficulty using it.

2 - PRETEST OF PROCEDURES

The objectives of this pretest were:

(i) To test the method of selection of potential participants from the electoral lists.

(ii) To estimate the proportion of potential participants eligible for inclusion in the study and of those, the proportion who would agree to participate.

(iii) To pretest the French and English versions of the Initial, Follow-up, and Falls Questionnaires following their revision after the pretest.

(iv) To provide an opportunity for the interviewers to practice the study procedures.

A sample of 50 persons aged 65 years or older was selected from the October 1985 provincial electoral list. Twenty-five names were randomly selected from five booklets, also randomly selected, containing addresses in Notre-Dame de Grâce - a predominantly English sector of the DSC-MGH territory. Five names were randomly selected from each booklet. Similarly 25 names were selected from five booklets containing addresses in the predominantly French sector of Saint-Henri.

The procedures after the selection of potential pretest participants were identical to those described for the main study, except that the introductory letter indicated that the current study was a pretest. Potential pretest subjects were mailed a bilingual letter of introduction. Two weeks later, an interviewer visited the home and invited the person selected from the electoral list to participate in the study. If the person accepted, he/she signed the consent form, and the interviewer proceeded with the administration of the Initial Questionnaire and the explanation of the follow-up procedures.

Administration of the Initial Questionnaires for the pretest of procedures was carried out over a two-week period in March 1987 by three interviewers. Follow-up interviews were carried out for three months. A Falls Questionnaire was completed for each fall reported during the follow-up.

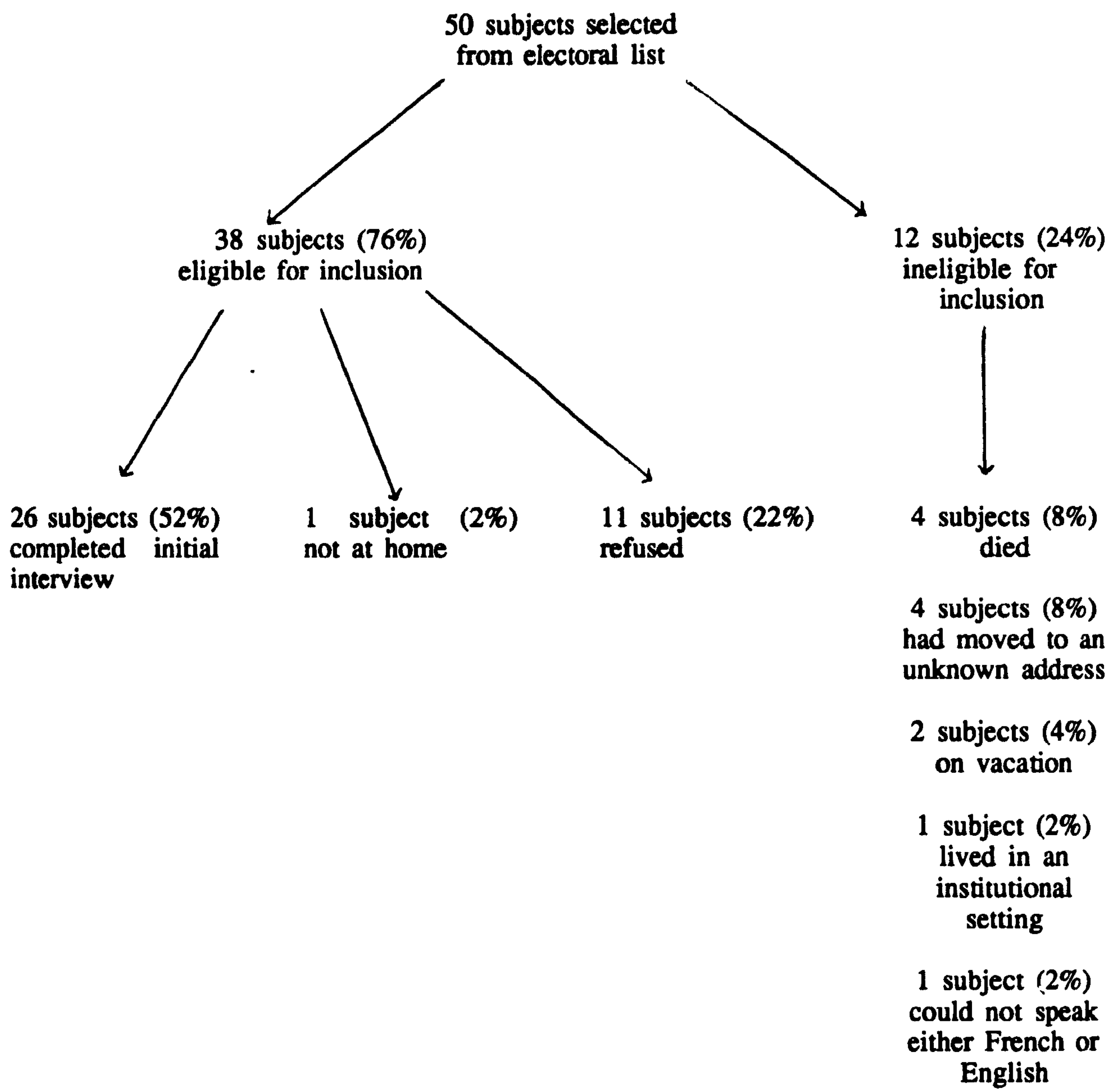
Figure 1 presents results on the pretest response. Of the 50 persons selected from the electoral list, 74 percent were eligible for inclusion in the study, and 24 percent were ineligible for inclusion. Of those who were eligible for inclusion, 68.4 percent agreed to participate, 2.6 percent could not be contacted, and 29 percent refused to participate, either because they were not interested in the study or because they were too ill to participate. Therefore, of the 50 names selected from the electoral list, 52 percent accepted to participate in the study and completed a initial interview. As indicated earlier, these response data were used to revise the number of names to be selected from the electoral list for the main study.

Careful review of the reasons for refusal to participate indicated that modifications to the letter of introduction were required. For example, the first version of the letter did not indicate explicitly that inclusion in the study of persons who had not fallen recently or who had never fallen was just as important as inclusion of those who had fallen. Also, the first version of the letter suggested that the results of the study would be diffused widely, but did not explain that the results on individuals would be strictly confidential. Improvements to the letter of introduction were made on the basis of the review of the reasons for refusal.

As in the pretest of questionnaires and the Memory-Aid Calendar, the difficulties encountered in conducting the interviews and administering the questionnaires were discussed round-table style on an ongoing basis throughout the pretest by the principal investigators, research coordinator, and interviewers.

FIGURE 1

PRETEST RESPONSE



APPENDIX II

INITIAL QUESTIONNAIRE

DOSSIER NUMBER ______

QUESTIONNAIRE NUMBER ______

MONTREAL FALLS STUDY
INTERVIEWER ADMINISTERED QUESTIONNAIRE (QA)

A - ADMINISTRATION

1. Name of subject ______

2. Sex of subject ◯ Male ◯ Female

3. Address ______
   No Street Apt.

4. Postal code [| |] [| |]

5. Record of visits:

Number of visit	Date: Day	Date: Month	Length of interview: Start	Length of interview: Finish	Length of interview: Min.	Comments
1						
2						
3						
4						
5						

6. Interview result
   1 ◯ Interview completed
   2 ◯ Interview incomplete (specify) ______
   3 ◯ Refusal to participate (reason) ______
   4 ◯ No response (specify) ______
   5 ◯ Not eligible (specify) ______

7. Interviewer:
   1 ◯ Suzette Clément
   2 ◯ Patty Dray
   3 ◯ Pauline Lachance
   4 ◯ Martine Le Comte
   5 ◯ Rosemary Williams
   7 ◯ Other ______

8. Type of dwelling:
   1 ◯ Single detached house
   2 ◯ Semi-detached or double (side by side)
   3 ◯ Townhouse or row house
   → Go to Q.10
   4 ◯ Duplex (one above the other)
   5 ◯ Low-rise apartment (less than 5 stories)
   6 ◯ High-rise apartment (5 or more stories)
   → Go to Q.9
   7 ◯ Other (specify) ______

9. On which floor is the residence located?

   [|] floor

B. MEMORY QUESTIONS

Now I would like to begin with a few memory questions. Some people remember recent events better, and others remember events from a long time ago. I have 10 short questions.

	CORRECT RESPONSE	SUBJECT'S RESPONSE	MARK X IF INCORRECT
10. What is your address?	No, street, municipality. Do not include postal code.		
11. What is the name of this city?	Montreal, Montreal West, Westmount		
12. What is your date of birth?	correct if corresponds to age given		
13. How old are you?	correct age verified by another person or from date of birth		
14. What day of the week is it?	correct day		
15. What is the date today?	correct month and year		
16. What was your mother's maiden name?	Cannot verify		
17. Who is the Prime Minister of Canada now?	Brian Mulroney (family name is sufficient)		
18. Who was Prime Minister of Canada just before?	P.E. Trudeau, John Turner		
19. Subtract 3 from 20 and keep subtracting 3 from each new number, all the way down	20, 17, 14, 11, 8, 5, 2		
		TOTAL INCORRECT	☐

NOTE TO INTERVIEWER: Count the numbers of incorrect responses.

- If there are 4 or fewer errors, go to Section D.
- If there are 5 errors, ask:
  "How many years of education do you have?" ☐☐ years
  If less than 8 years, go to Section D.
  If more than 8 years, refer to a proxy.
- If there are 6 or more errors, refer to a proxy.

C. PROXY RESPONSE

20. 1 ◯ Yes ______________________ ______________________
Name of proxy Reason

2 ◯ No ——→ Go to Section D

21. Relationship of proxy to subject

1 ◯ Spouse

2 ◯ Child (son, daughter/son-in-law, daughter-in-law)

3 ◯ Other (specify) ______________________

D. INFORMATION ON HOUSEHOLD MEMBERS

Now I would like to ask about the persons living in this household.

22. How many persons now live in this household?

[|] Number of persons including subject.
If subject lives alone ——→ Go to Section E

23. Please name the other people (excluding subject) who now live here?

Surname	Given name	Age	Sex	Relationship to subject
		[|]	◯ M ◯ F	◯ Spouse ◯ Child ◯ Other ______
		[|]	◯ M ◯ F	◯ Spouse ◯ Child ◯ Other ______
		[|]	◯ M ◯ F	◯ Spouse ◯ Child ◯ Other ______
		[|]	◯ M ◯ F	◯ Spouse ◯ Child ◯ Other ______

E. PERCEIVED HEALTH STATUS

I would now like to ask you a few questions related to your health.

24. How would you describe your state of health, compared to other persons your age, would you say it was ...*

1 ◯ Excellent

2 ◯ Good

3 ◯ Fair

4 ◯ Poor

25. In general, how satisfied are you with your health? Would you say you are ...*

1 ◯ Very satisfied

2 ◯ Somewhat satisfied

3 ◯ Not too satisfied

4 ◯ Not at all satisfied

F. TWO WEEK DISABILITY

26. During the last two weeks, since ________________ did you stay in bed at all because of your health?

1 ◯ Yes

2 ◯ No ⟶ Go to Q.31

27. How many days did you stay in bed for all or most of the day? Include any nights spent as a patient in hospital.

days

28. What was the main health problem which caused you to stay in bed?

____

29. Was this health problem the result of a fall?

1 ◯ Yes

2 ◯ No ⟶ Go to Q.31

30. When did the fall take place?

________ month ________ year

31. (Not counting the bed-days mentioned earlier) Were there any days during those last two weeks that you cut down on things you usually do because of your health?

1 ◯ Yes

2 ◯ No ⟶ Go to Section G

32. How many days did you cut down for all or most of the day?

☐☐ days

33. What was the main health problem which caused you to cut down on things you usually do for all or most of the day?

____

34. Was this health problem the result of a fall?

1 ◯ Yes

2 ◯ No ⟶ Go to Section G

35. When did the fall take place?

☐☐ month ☐☐ year

G. HEALTH CARE SERVICES

The next few questions refer to contacts with health professionals about your health.

36. During the past 12 months how many times did you see or talk to an ophthalmologist, optometrist or optician about your eyes or vision?

☐☐ times If none ⟶ Go to Q.37
Otherwise ⟶ Go to Q.38

37. How long has it been since you saw or talked to an ophthalmologist, optometrist, or optician about your eyes or vision?

☐☐ years

88 ◯ Never

38. During the past 12 months how many times did you see or talk to a medical doctor about your health (exclude visits to the ophthalmologist and health professionals seen during a hospitalization)?

[|] times   If none → Go to Q.39
Otherwise → Go to Q.40

39. How long has it been since you saw or talked to a medical doctor (exclude visits to the ophthalmologist) about your health?

[|] years

88 ◯ Never

40. During the past 12 months, how many times did you see or talk to the following health professionals about your health?*

◯ A nurse (excluding when you saw or talked to the nurse in your doctor's office or during a hospitalization)

[|] times

◯ A pharmacist or druggist for advice (excludes prescriptions)

[|] times

◯ A chiropractor

[|] times

◯ A physiotherapist

[|] times

41. During the past 12 months did you spend any nights as a patient in a hospital, nursing home or convalescent home?

1 ◯ Yes

2 ◯ No → Go to Section H

42. How many nights did you spend as a patient in a hospital, nursing home or convalescent home (in the past 12 months)?

[|] nights

H. HEALTH PROBLEMS

43. How long ago did you last have your blood pressure checked?*

1 ◯ Within last 6 months

2 ◯ 7 to 12 months ago

3 ◯ 13 to 24 months ago

4 ◯ More than 2 years ago

8 ◯ Never → Go to Q.45

9 ◯ Don't know → Go to Q.45

44. Have you ever been told by a doctor or nurse that you have high blood pressure?

1 ◯ Yes

2 ◯ No

9 ◯ Don't know

45. Have you ever had trouble with your heart, such as heart attack, angina, heart failure, rheumatic heart disease or irregular heart beat?

1 ◯ Yes (specify problem) ____________________________

2 ◯ No ——→ Go to Q.47

9 ◯ Don't know ——→ Go to Q.47

46. At what age were you first diagnosed?

☐☐ **age**

88 ◯ Never diagnosed

99 ◯ Don't know

47. Do you have diabetes?

1 ◯ Yes

2 ◯ No ——→ Go to Q.49

9 ◯ Don't know ——→ Go to Q.49

48. At what age were you first diagnosed?

☐☐ **age**

88 ◯ Never diagnosed

99 ◯ Don't know

49. Have you ever been told by a doctor that you have had a stroke?

1 ◯ Yes

2 ◯ No ——→ Go to Q.51

9 ◯ Don't know ——→ Go to Q.51

50. **At what age did you have the (first) stroke?**

[ ][ ] age

88 ○ Never diagnosed

99 ○ Don't know

51. **Have you ever been told by a doctor that you have Parkinson's disease?**

1 ○ Yes

2 ○ No ⟶ Go to Q.53

9 ○ Don't know ⟶ Go to Q.53

52. **At what age were you first diagnosed?**

[ ][ ] age

88 ○ Never diagnosed

99 ○ Don't know

53. **Do you have any of the following long term health problems?** (mark each response if more than one answer)*

Yes	No	
○	○	Asthma
○	○	Emphysema or chronic bronchitis
○	○	Arthritis or rheumatism

54. **Do you have any other long term health problems?**

1 ○ Yes Specify problem: ______________________________

2 ○ No

55. **In the past 14 days since ______________, have you had any of the following:** (mark each response if more than one answer)*

Yes	No	
○	○	Dizziness on standing up quickly
○	○	Any other dizziness, giddiness, vertigo or light headedness
○	○	Palpitations (sensation of heart beating in a rapid or irregular way)
○	○	Loss of consciousness or blackout
○	○	Shortness of breath at rest
○	○	Shortness of breath on exertion

56. Yesterday, or the day before, did you take or use any of the following medications? (mark each response if more than one answer)*

Yes	No	
◯	◯	Medicine for arthritis or rheumatism
◯	◯	Any other pain relievers
◯	◯	Tranquilizers, medicine for the nerves, or medicine to help you sleep
◯	◯	Medicine for your blood pressure
◯	◯	Medicine for your heart
◯	◯	Antibiotics (taken orally)
◯	◯	Laxatives
◯	◯	Stomach remedies or medicines
◯	◯	Cough or cold remedies
◯	◯	Vitamins or minerals
◯	◯	Any other medication (ex. antibiotics applied externally)

____
(specify)

Note to interviewer: Count number of medications taken. If more than one, Go to Q.57, otherwise Go to Q.58.

57. Does your physician (or one of your physicians) know about all the medications you are taking?

1 ◯ Yes

2 ◯ No

58. At the present time, do you smoke cigarettes daily, occasionally or not at all?

1 ◯ Daily

2 ◯ Occasionally ⟶ Go to Section I

8 ◯ Never ⟶ Go to Section I

59. About how many cigarettes do you usually smoke daily?

☐☐ cigarettes

I. LONG TERM DISABILITY

Now I would like to ask some questions about what you can do on an average day (with any aids if you normally use them). <u>Please exclude any temporary difficulties you might be experiencing.</u>

60. Do you have any trouble walking 400 metres without resting, that's about 3 city blocks?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

61. Do you have any trouble walking up and down a flight of stairs?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

62. Do you have any trouble carrying an object like a 12 pound bag of groceries about 30 feet?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

63. Do you have any trouble standing for long periods of time; for example, 20 minutes or more?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

64. Do you have any trouble when standing, bending down to pick up an object from the floor?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

65. Do you have any trouble cutting your toenails?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

66. Do you have any trouble using your fingers to grasp or handle?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

67. Do you have any trouble reaching?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

68. Do you use prescribed eye glasses or contact lenses?

1 ○ Yes

2 ○ No

69. Do you have any trouble seeing (with your glasses (contacts) if you normally wear them)?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

70. Do you have any trouble seeing ordinary newsprint (with your glasses (contacts) if you normally wear them)?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

71. Do you have any trouble recognizing a friend on the other side of the street (with your glasses (contacts) if you normally wear them)?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

72. Do you have any trouble hearing what is said in a normal conversation (with a hearing aid if you normally use one)?

○ Yes - Are you completely unable to do this? 1 ○ yes 2 ○ no

3 ○ No

J. FALLS

Now I want to ask several questions about falls you had in the past year.

73. During the past 12 months, did you fall?

1 ○ Yes

2 ○ No ⟶ Go to Section K

74. **How many times did you fall during the past 12 months?**

________ times

75. **When did the most recent fall occur?**

________ month   ________ year

76. **Did you experience an injury or health problem as a result of a fall during the past 12 months?**

1 ◯ Yes

2 ◯ No ——→ Go to Q.78

77. **Please describe the injury(ies) or health problem(s).**

____

78. **During the past 12 months, did you see or talk to a health professional such as a medical doctor about a fall?**

1 ◯ Yes

2 ◯ No ——→ Go to Section K

79. **Whom did you see or talk to? Was it a:** (mark each response if more than one answer)*

◯ Medical doctor

◯ Chiropractor

◯ Physiotherapist

◯ Pharmacist or druggist

◯ Other (specify) ______________________________

80. **During the past 12 months did you spend any nights as a patient in a hospital, nursing home or convalescent home as a result of the(se) fall(s)?**

1 ◯ Yes

2 ◯ No ——→ Go to Section K

81. **How many nights did you spend as a patient in a hospital, nursing home or convalescent home, in the past 12 months, as a result of the(se) fall(s)?**

________ nights

K. HEIGHT AND WEIGHT

The next few questions concern your physical condition and physical activity.

82. What is your height?

[ ] feet [ ][ ] inch OR [ ][ ][ ] centimetres

9 ◯ Don't know

83. What is your weight?

[ ][ ][ ] lbs OR [ ][ ][ ] kilograms

9 ◯ Don't know

L. PHYSICAL ACTIVITY

84. How would you compare your level of physical activity with other people your age, would you say you are ...*

1 ◯ Much more physically active

2 ◯ Somewhat more active

3 ◯ Same

4 ◯ Somewhat less active

5 ◯ Much less active

9 ◯ Don't know

85. Which of the following best describes the level of physical effort in your work or daily activities?*

1 ◯ Light -- such as driving, sitting ...

2 ◯ Moderate -- such as housework, carpentry, walking ...

3 ◯ Heavy -- such as pushing or carrying heavy objects ...

9 ◯ Don't know

86. **How many times did you participate in the following physical activities in the past week?***

	Times	On the <u>average</u>, about how many minutes did you spend on <u>each</u> occasion?			
		1-15	16-30	31-60	60+
Walking for exercise	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Swimming	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Home exercise	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Exercise classes	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Jogging/Running	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Gardening	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Golf	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Dancing .	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Bowling	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Tennis	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Light housework, light handiwork (washing dishes, ironing, making beds)	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Heavy housework, heavy handiwork (washing or waxing floors, painting)	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
Others (specify)					
____________	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
____________	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯
____________	[ ][ ]	1 ◯	2 ◯	3 ◯	4 ◯

87. **In the past week, have you been:***

1 ◯ More active than usual

2 ◯ As active as usual

3 ◯ Less active than usual

M. ALCOHOL USE

The following questions are about drinking wine, beer or liquor -- all kinds of alcoholic beverages.

88. In the last 12 months have you taken a drink of beer, wine, liquor or other alcoholic beverage?

1 ◯ Yes

2 ◯ No ⟶ Go to Section N

89. In the last 12 months, how often did you take a drink? Was it:*

1 ◯ Every day

2 ◯ At least once a week

3 ◯ One or more times a month

4 ◯ Less often than once a month

9 ◯ Don't know

90. a) Thinking back over the last 7 days, on how many of these days did you have any alcoholic drinks?

1 ☐ ⟶ If 0 go to Section N

b) On how many of these days did you have 2 or more drinks?

2 ☐ ⟶ If 0 go to Section N

c) On how many of these days did you have 4 or more drinks?

3 ☐ ⟶ If 0 go to Section N

d) On how many of these days did you have 8 or more drinks?

4 ☐ ⟶ If 0 go to Section N

e) On how many of these days did you have 12 or more drinks?

5 ☐

B. SUPPORT NETWORK

The next few questions are about your social relationships.

91. **During the past 12 months how often did you participate in a get-together with your family, your friends or aquaintances? Was it: ***

1 ◯ More than once a week

2 ◯ Once a week

3 ◯ At least once a month

4 ◯ Less than once a month

5 ◯ Never

92. **How do you find your social life? Is it: ***

1 ◯ Very satisfying

2 ◯ Rather satisfying

3 ◯ Rather unsatisfying

4 ◯ Really unsatisfying

93. **Is there someone, such as a friend or relative, on whom you could really count if you needed help or had a problem?**

1 ◯ Yes

2 ◯ No

94. **Are you a member or participant in any of the following:** (mark each response if more than one answer)*

1 ◯ A member of a Golden Age Club

2 ◯ In parish activities

7 ◯ Any other association, club, group (ex. NDG Senior Citizens Council, Legion, Shriners, etc...)

(specify) ______________________________

8 ◯ None

95. **Do you receive any community services <u>at home</u> (ex. meals on wheels, home care or health care services, friendly volunteer visits)?**

1 ◯ Yes (specify) ______________________________

2 ◯ No

96. **Do you have a dog or cat?**

1 ◯ Dog

2 ◯ Cat

3 ◯ No

O. ENVIRONMENT

Now I would like to ask a few questions about your home.

97. First, do you rent this dwelling or are you the owner?*

1 ◯ Owner (or family member is the owner)

2 ◯ Owner in a condominium or cooperative

3 ◯ Renting

4 ◯ Boarding/Roomer

98. Not counting time spent sleeping, in which room do you spend most of your time when you are at home? (Note to interviewer: maximum of 2 responses if necessary)

1 ◯ Bedroom

2 ◯ Kitchen

3 ◯ Living room

4 ◯ Dining room

5 ◯ Family room

7 ◯ Other (specify) ______________________________

99. How many stairways do you use, including stairways of a single step, inside your home?

☐☐ If 00 ⟶ Go to Q.105   Note to interviewer: Ask questions 100 - 104 for each stairway inside the home.

(i)	Stairway 1	Stairway 2	Stairway 3	Stairway 4	Stairway 5	Stairway 6
100. Functional description	________ ________	________ ________	________ ________	________ ________	________ ________	________ ________
101. How often do you use the stairway?*	○ Daily _____ (how often) ○ 1-6 times/week ○ 1-3 times/month ○ Less often than once a month	○ Daily _____ (how often) ○ 1-6 times/week ○ 1-3 times/month ○ Less often than once a month	○ Daily _____ (how often) ○ 1-6 times/week ○ 1-3 times/month ○ Less often than once a month	○ Daily _____ (how often) ○ 1-6 times/week ○ 1-3 times/month ○ Less often than once a month	○ Daily _____ (how often) ○ 1-6 times/week ○ 1-3 times/month ○ Less often than once a month	○ Daily _____ (how often) ○ 1-6 times/week ○ 1-3 times/month ○ Less often than once a month
102. When you use the stairway can you see the steps clearly?*	○ Always ○ Most of the time (specify) _____ ○ Not as much as you would like (specify) _____	○ Always ○ Most of the time (specify) _____ ○ Not as much as you would like (specify) _____	○ Always ○ Most of the time (specify) _____ ○ Not as much as you would like (specify) _____	○ Always ○ Most of the time (specify) _____ ○ Not as much as you would like (specify) _____	○ Always ○ Most of the time (specify) _____ ○ Not as much as you would like (specify) _____	○ Always ○ Most of the time (specify) _____ ○ Not as much as you would like (specify) _____
103. When you use the stairway do you use the handrail?*	○ Always ○ Most of the time ○ Sometimes ○ Never ○ No handrail	○ Always ○ Most of the time ○ Sometimes ○ Never ○ No handrail	○ Always ○ Most of the time ○ Sometimes ○ Never ○ No handrail	○ Always ○ Most of the time ○ Sometimes ○ Never ○ No handrail	○ Always ○ Most of the time ○ Sometimes ○ Never ○ No handrail	○ Always ○ Most of the time ○ Sometimes ○ Never ○ No handrail
104. Do you have difficulty using the stairway?	○ Yes, Why? _____ _____ ○ No	○ Yes, Why? _____ _____ ○ No	○ Yes, Why? _____ _____ ○ No	○ Yes, Why? _____ _____ ○ No	○ Yes, Why? _____ _____ ○ No	○ Yes, Why? _____ _____ ○ No

105. How many stairways do you use, including stairways of a single step, outside of your home but inside the building (for example, to go to the basement, or to the garage)?

[ ][ ] If 00, Go to Q.112   Note to interviewer   Ask questions 106 - 111 for each stairway.

A	Stairway 1	Stairway 2	Stairway 3	Stairway 4	Stairway 5	Stairway 6
106. Functional description						
107. How often do you use the stairway?*	() Daily ___ (how often) () 1-6 times/week () 1-3 times/month () Less often than once a month	() Daily ___ (how often) () 1-6 times/week () 1-3 times/month () Less often than once a month	() Daily ___ (how often) () 1-6 times/week () 1-3 times/month () Less often than once a month	() Daily ___ (how often) () 1-6 times/week () 1-3 times/month () Less often than once a month	() Daily ___ (how often) () 1-6 times/week () 1-3 times/month () Less often than once a month	() Daily ___ (how often) () 1-6 times/week () 1-3 times/month () Less often than once a month
108. When you use the stairway can you see the steps clearly?*	() Always () Most of the time (specify) () Not as much as you would like (specify)	() Always () Most of the time (specify) () Not as much as you would like (specify)	() Always () Most of the time (specify) () Not as much as you would like (specify)	() Always () Most of the time (specify) () Not as much as you would like (specify)	() Always () Most of the time (specify) () Not as much as you would like (specify)	() Always () Most of the time (specify) () Not as much as you would like(specify)
109. When you use the stairway do you use the handrail?*	() Always () Most of the time () Sometimes () Never () No handrail	() Always () Most of the time () Sometimes () Never () No handrail	() Always () Most of the time () Sometimes () Never () No handrail	() Always () Most of the time () Sometimes () Never () No handrail	() Always () Most of the time () Sometimes () Never () No handrail	() Always () Most of the time () Sometimes () Never () No handrail
110. Do you have difficulty using the stairway?	() Yes, Why? () No	() Yes, Why? () No	() Yes, Why? () No	() Yes, Why? () No	() Yes, Why? () No	() Yes, Why? () No
111. During the winter, do you use the stairway?*	() More than now () The same as now () Less than now () Never () N/A	() More than now () The same as now () Less than now () Never () N/A	() More than now () The same as now () Less than now () Never () N/A	() More than now () The same as now () Less than now () Never () N/A	() More than now () The same as now () Less than now () Never () N/A	() More than now () The same as now () Less than now () Never () N/A

112. How many stairways do you use, including stairways of a single step, outside the building?

[|] If 00→ Go to Q.121   Note to interviewer. Ask questions 113 - 120 for each stairway outside the building

	Stairway 1	Stairway 2	Stairway 3	Stairway 4	Stairway 5	Stairway 6
113. Functional description						
114. How often do you use the stairway?*	( ) Daily (how often) ( ) 1-6 times/week ( ) 1-3 times/month ( ) less often than once a month	( ) Daily (how often) ( ) 1-6 times/week ( ) 1-3 times/month ( ) less often than once a month	( ) Daily (how often) ( ) 1-6 times/week ( ) 1-3 times/month ( ) less often than once a month	( ) Daily (how often) ( ) 1-6 times/week ( ) 1-3 times/month ( ) less often than once a month	( ) Daily (how often) ( ) 1-6 times/week ( ) 1-3 times/month ( ) less often than once a month	( ) Daily (how often) ( ) 1-6 times/week ( ) 1-3 times/month ( ) less often than once a month
115. When you use the stairway can you see the steps clearly?*	( ) Always ( ) Most of the time (specify) ( ) Not as much as you would like (specify)	( ) Always ( ) Most of the time (specify) ( ) Not as much as you would like (specify)	( ) Always ( ) Most of the time (specify) ( ) Not as much as you would like (specify)	( ) Always ( ) Most of the time (specify) ( ) Not as much as you would like (specify)	( ) Always ( ) Most of the time (specify) ( ) Not as much as you would like (specify)	( ) Always ( ) Most of the time (specify) ( ) Not as much as you would like (specify)
116. When you use the stairway do you use the handrail?*	( ) Always ( ) Most of the time ( ) Sometimes ( ) Never ( ) No handrail	( ) Always ( ) Most of the time ( ) Sometimes ( ) Never ( ) No handrail	( ) Always ( ) Most of the time ( ) Sometimes ( ) Never ( ) No handrail	( ) Always ( ) Most of the time ( ) Sometimes ( ) Never ( ) No handrail	( ) Always ( ) Most of the time ( ) Sometimes ( ) Never ( ) No handrail	( ) Always ( ) Most of the time ( ) Sometimes ( ) Never ( ) No handrail
117. Do you have difficulty using the stairway?	( ) Yes, Why? ( ) No	( ) Yes, Why? ( ) No	( ) Yes, Why? ( ) No	( ) Yes, Why? ( ) No	( ) Yes, Why? ( ) No	( ) Yes, Why? ( ) No

( )	Stairway 1	Stairway 2	Stairway 3	Stairway 4	Stairway 5	Stairway 6
118. During the winter, do you use the stairway?*	More than now The same as now Less than now Never	More than now The same as now Less than now Never	More than now The same as now Less than now Never	More than now The same as now Less than now Never	More than now The same as now Less than now Never	More than now The same as now Less than now Never
119. During the winter, are the stairs clear of snow when you wish to go out?*	Always Most of the time Sometimes Never N/A	Always Most of the time Sometimes Never N/A	Always Most of the time Sometimes Never N/A	Always Most of the time Sometimes Never N/A	Always Most of the time Sometimes Never N/A	Always Most of the time Sometimes Never N/A
120. Who shovels the snow from the stairway in the winter?*	You Family or household member Janitor/ Superintendant Neighbor/Friend Snow removal Co. Other (specify) __________ No one N/A	You Family or household member Janitor/ Superintendant Neighbor/Friend Snow removal Co. Other (specify) __________ No one N/A	You Family or household member Janitor/ Superintendant Neighbor/Friend Snow removal Co. Other (specify) __________ No one N/A	You Family or household member Janitor/ Superintendant Neighbor/Friend Snow removal Co. Other (specify) __________ No one N/A	You Family or household member Janitor/ Superintendant Neighbor/Friend Snow removal Co. Other (specify) __________ No one N/A	You Family or household member Janitor/ Superintendant Neighbor/Friend Snow removal Co. Other (specify) __________ No one N/A

Now, I would like to ask a few questions about your bathroom.

121. Do you usually take a bath or do you usually take a shower?

1 ◯ Bath

2 ◯ Shower

3 ◯ Both bath and shower

8 ◯ No bath; no shower (specify)

_______________________________ ⟶ Go to Q.125

122. Do you usually use a grab bar to help you get in and out of the shower or bath?

1 ◯ Yes

2 ◯ No (i.e. there is a grab bar, but subjects do not use it)

8 ◯ No grab bar

123. Do you usually use a rubber mat inside the bathtub when you take a bath/shower?

1 ◯ Yes

2 ◯ No

124. Do you have any difficulties using the bath/shower, for example: difficulty in getting into or out of the bath; difficulty reaching for the soap or shampoo in the bath or shower, difficulty reaching for the hot and cold water tap?

1 ◯ Yes Please describe the difficulty _______________________________

____

2 ◯ No

125. Do you usually get up during the night to go to the bathroom?

1 ◯ Yes

2 ◯ No ⟶ Go to Q.127

126. Do you usually turn on a light, or have a night-light on when you get up during the night to go to the bathroom?

1 ◯ Yes

2 ◯ No

127. Finally, what type of footwear do you usually wear inside your home (apartment)? Do you usually wear:*

1 ◯ Wool slippers or socks only

2 ◯ Other types of slippers

3 ◯ High heeled shoes (approx. 2 inches or more)

4 ◯ Low heeled shoes

5 ◯ Sandals - open-heel, no back strap

7 ◯ Other (specify) ____________________

P. BACKGROUND CHARACTERISTICS

128. Finally, I'd like to ask you for some background information. How many years of elementary or secondary education have you completed?

1 2 3 4 5 6 7 8 9 10 11 12 13

88 ◯ No schooling ——→ Go to Q.131

99 ◯ Don't know ——→ Go to Q.131

129. Have you graduated from secondary school?

1 ◯ Yes

2 ◯ No

130. Have you had any further schooling beyond high school?

1 ◯ Yes --------- **What is the highest level?**

3 ◯ Community college, CEGEP, nursing school, secretarial school (partial or completed)

4 ◯ Bachelor's degree or University studies (partial or completed)

2 ◯ No

131. What language do you speak at home now? (If more than one language, which is spoken most often).

1 ◯ English

2 ◯ French

3 ◯ Italian

4 ◯ Greek

5 ◯ Chinese

7 ◯ Other (specify) ____________________

132. **During the past 12 months, were you working for an income?**

1 ◯ Yes, full-time

2 ◯ Yes, part-time

3 ◯ No

133. **What is your current marital status?**

1 ◯ Married (including common-law)

2 ◯ Single (never married)

3 ◯ Widowed

4 ◯ Separated/Divorced

134. **What is your best estimate of the total income of all household members from all sources during the last 12 months? Was the total household income ...***

- 10 ◯ Less than 20 000 $
  - 11 ◯ Less than 10 000 $
    - 13 ◯ Less than 5 000 $
    - 14 ◯ 5 000 $ and more
  - 12 ◯ 10 000 $ and more
    - 15 ◯ Less than 15 000 $
    - 16 ◯ 15 000 $ and more
- 20 ◯ 20 000 $ and more
  - 21 ◯ Less than 40 000 $
    - 23 ◯ Less than 30 000 $
    - 24 ◯ 30 000 $ and more
  - 22 ◯ 40 000 $ and more
    - 25 ◯ Less than 60 000 $
    - 26 ◯ 60 000 $ and more

77 ◯ Refused to answer

88 ◯ None

99 ◯ Don't know

Q. TELEPHONE FOLLOWUP

Now I want to ask a few last questions to make sure that I can contact you next month.

135. **What is your home telephone number?**

				-				

telephone number

136. Will I be able to contact you at your home telephone number next month?

1 ◯ Yes ——→ Go to Q.140

2 ◯ No

137. Are you planning to move or be on vacation next month?

1 ◯ Moving ——→ Go to Q.138

2 ◯ On vacation ——→ Go to Q.139

7 ◯ Other (specify why) ____________________

138. What is the new address and new telephone number of the place where you will be next month?

____

No Street Apt.

____

City Province

Postal Code

			-				
			-				

Telephone Number

Now Go to Q.140

139. What is the telephone number where you could be reached next month?

Area code

			-				
			-				

Telephone number

None

Dates (approximate) of departure ____________________

and return ____________________

140. In the event that we are unable to reach you is there a friend or relative we may contact?

a) Name ____________________

Relationship to subject ____________________

Telephone number: | | | | - | | | | |

b) Name ____________________

Relationship to subject ____________________

Telephone number: | | | | - | | | | |

141. Before leaving, may I look at the stairway(s) and at the bathroom(s)?

1 ◯ Yes

2 ◯ No

142. This is the end of the interview. I would like to thank you very much for your patience and your time. I will contact you in one month at the telephone number you have given me.

INTERVIEWER OBSERVATION

I - **BATHROOM** Complete questions 1 to 6 for the bathroom, used the most frequently by the study subject to wash themselves (if there is more than one bathroom).

1. Is the shower in the bath?

1 ◯ Yes

2 ◯ No

3 ◯ N/A

4 ◯ No bath, no shower ⟶ Go to Q.5

2. Is there a grab bar present in the bath/shower area?

1 ◯ Yes

2 ◯ No ⟶ Go to Q.4

3. Does the grab bar go along the entire length of the bath/shower area?

1 ◯ Yes

2 ◯ No

4. Is there an antislip surface in the bath/shower area?

1 ◯ Yes

2 ◯ No

3 ◯ Cannot be observed ______________________________
(specify)

5. Is there a grab bar near the toilet?

1 ◯ Yes

2 ◯ No

6. Is the toilet seat elevated?

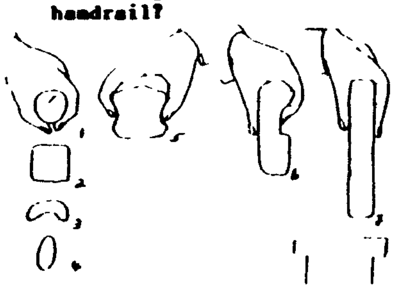
1 ◯ Yes

2 ◯ No

II - STAIRWAYS INSIDE THE HOME Q.7 to Q.17

(1)	Stairway 1	Stairway 2	Stairway 3	Stairway 4	Stairway 5	Stairway 6
7. Functional description	______	______	______	______	______	
8. Is the stairway?	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight
9. Number of landings	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
10. Total number of stairs	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]
11. What is the depth of the stairs?	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A
12. Surface of the stairs	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)
13. Is the surface of the bottom step the same as the other stairs?	( ) Yes ( ) No (specify)	( ) Yes ( ) No (specify)	( ) Yes ( ) No (specify)	( ) Yes ( ) No (specify)	( ) Yes ( ) No (specify)	( ) Yes ( ) No (specify)

(I)	Stairway 1	Stairway 2	Stairway 3	Stairway 4	Stairway 5	Stairway 6
14. Presence of handrail	○ 1 complete handrail	○ 1 complete handrail	○ 1 complete handrail	○ 1 complete handrail	○ 1 complete handrail	○ 1 complete handrail
	○ 2 complete handrails	○ 2 complete handrails	○ 2 complete handrails	○ 2 complete handrails	○ 2 complete handrails	○ 2 complete handrails
	○ 1 handrail incomplete	○ 1 handrail incomplete	○ 1 handrail incomplete	○ 1 handrail incomplete	○ 1 handrail incomplete	○ 1 handrail incomplete
	○ 1 complete and 1 incomplete	○ 1 complete and 1 incomplete	○ 1 complete and 1 incomplete	○ 1 complete and 1 incomplete	○ 1 complete and 1 incomplete	○ 1 complete and 1 incomplete
	○ 2 incomplete	○ 2 incomplete	○ 2 incomplete	○ 2 incomplete	○ 2 incomplete	○ 2 incomplete
	○ Don't know	○ Don't know	○ Don't know	○ Don't know	○ Don't know	○ Don't know
	○ N/A	○ N/A	○ N/A	○ N/A	○ N/A	○ N/A
15. What is the height of each handrail?						
Side A	○ Height ______	○ Height ______	○ Height ______	○ Height ______	○ Height ______	○ Height ______
	○ Variable height	○ Variable height	○ Variable height	○ Variable height	○ Variable height	○ Variable height
	○ No handrail	○ No handrail	○ No handrail	○ No handrail	○ No handrail	○ No handrail
Side B	○ Height ______	○ Height ______	○ Height ______	○ Height ______	○ Height ______	○ Height ______
	○ Variable height	○ Variable height	○ Variable height	○ Variable height	○ Variable height	○ Variable height
	○ No handrail	○ No handrail	○ No handrail	○ No handrail	○ No handrail	○ No handrail
16. What is the distance between your thumb and your index finger when you encircle the handrail?						
Side A	○ Distance ______	○ Distance ______	○ Distance ______	○ Distance ______	○ Distance ______	○ Distance ______
	○ Variable distance	○ Variable distance	○ Variable distance	○ Variable distance	○ Variable distance	○ Variable distance
	○ No handrail	○ No handrail	○ No handrail	○ No handrail	○ No handrail	○ No handrail
Side B	○ Distance ______	○ Distance ______	○ Distance ______	○ Distance ______	○ Distance ______	○ Distance ______
	○ Variable distance	○ Variable distance	○ Variable distance	○ Variable distance	○ Variable distance	○ Variable distance
	○ No handrail	○ No handrail	○ No handrail	○ No handrail	○ No handrail	○ No handrail
17. What is the design that best describes the design of handrail?	○ Other: drawing	○ Other: drawing	○ Other: drawing	○ Other: drawing	○ Other: drawing	○ Other: drawing

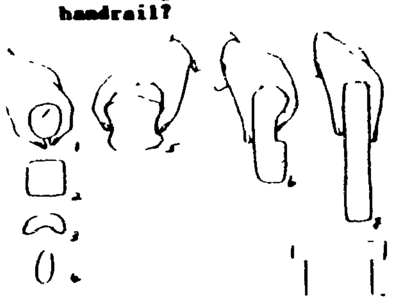


III - STAIRWAYS OUTSIDE THE HOME BUT INSIDE THE BUILDING

Q.18 to Q.28

A.	Stairway 1	Stairway 2	Stairway 3	Stairway 4	Stairway 5	Stairway 6
18. Functional description						
19. Is the stairway?	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight
20. Number of landings						
21. Total number of stairs						
22. What is the depth of the stairs?	( ) < 280mm (11 in.) ( ) > 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) > 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) > 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) > 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) > 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) > 280mm (11 in.) ( ) Variable ( ) N/A
23. Surface of the stairs	( ) Continuous carpet ( ) Non continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)	( ) Continuous carpet ( ) Non continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)	( ) Continuous carpet ( ) Non continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify)
24. Is the surface of the bottom step the same as the other stairs?	( ) Yes ( ) No (specify)	( ) Yes ( ) No (specify)	( ) Yes ( ) No (specify)	( ) Yes ( ) No (specify)	( ) Yes ( ) No (specify)	( ) Yes ( ) No (specify)

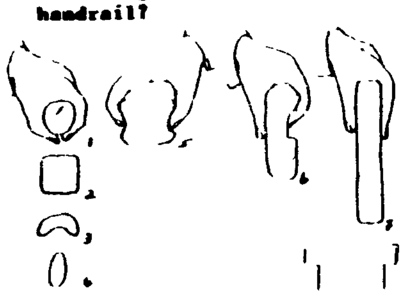
(A)	Stairway 1	Stairway 2	Stairway 3	Stairway 4	Stairway 5	Stairway 6
25. Presence of handrail	○ 1 complete handrail ○ 2 complete handrails ○ 1 handrail incomplete ○ 1 complete and 1 incomplete ○ 2 incomplete ○ Don't know ○ N/A	○ 1 complete handrail ○ 2 complete handrails ○ 1 handrail incomplete ○ 1 complete and 1 incomplete ○ 2 incomplete ○ Don't know ○ N/A	○ 1 complete handrail ○ 2 complete handrails ○ 1 handrail incomplete ○ 1 complete and 1 incomplete ○ 2 incomplete ○ Don't know ○ N/A	○ 1 complete handrail ○ 2 complete handrails ○ 1 handrail incomplete ○ 1 complete and 1 incomplete ○ 2 incomplete ○ Don't know ○ N/A	○ 1 complete handrail ○ 2 complete handrails ○ 1 handrail incomplete ○ 1 complete and 1 incomplete ○ 2 incomplete ○ Don't know ○ N/A	○ 1 complete handrail ○ 2 complete handrails ○ 1 handrail incomplete ○ 1 complete and 1 incomplete ○ 2 incomplete ○ Don't know ○ N/A
26. What is the height of each handrail?						
Side A	○ Height ______ ○ Variable height ○ No handrail	○ Height ______ ○ Variable height ○ No handrail	○ Height ______ ○ Variable height ○ No handrail	○ Height ______ ○ Variable height ○ No handrail	○ Height ______ ○ Variable height ○ No handrail	○ Height ______ ○ Variable height ○ No handrail
Side B	○ Height ______ ○ Variable height ○ No handrail	○ Height ______ ○ Variable height ○ No handrail	○ Height ______ ○ Variable height ○ No handrail	○ Height ______ ○ Variable height ○ No handrail	○ Height ______ ○ Variable height ○ No handrail	○ Height ______ ○ Variable height ○ No handrail
27. What is the distance between your thumb and your index finger when you encircle the handrail?						
Side A	○ Distance ______ ○ Variable distance ○ No handrail	○ Distance ______ ○ Variable distance ○ No handrail	○ Distance ______ ○ Variable distance ○ No handrail	○ Distance ______ ○ Variable distance ○ No handrail	○ Distance ______ ○ Variable distance ○ No handrail	○ Distance ______ ○ Variable distance ○ No handrail
Side B	○ Distance ______ ○ Variable distance ○ No handrail	○ Distance ______ ○ Variable distance ○ No handrail	○ Distance ______ ○ Variable distance ○ No handrail	○ Distance ______ ○ Variable distance ○ No handrail	○ Distance ______ ○ Variable distance ○ No handrail	○ Distance ______ ○ Variable distance ○ No handrail
28. What is the design that best describes the design of handrail?	○ ○ Other: drawing	○ ○ Other: drawing	○ ○ Other: drawing	○ ○ Other: drawing	○ ○ Other: drawing	○ ○ Other: drawing



IV – STAIRWAYS OUTSIDE THE BUILDING Q.29 to Q.39

(..)	Stairway 1	Stairway 2	Stairway 3	Stairway 4	Stairway 5	Stairway 6
29. Functional description	______	______	______	______	______	______
30. Is the stairway?	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight	( ) Straight ( ) Not straight
31. Number of landings	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
32. Total number of stairs	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]
33. What is the depth of the stairs?	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A	( ) < 280mm (11 in.) ( ) ≥ 280mm (11 in.) ( ) Variable ( ) N/A
34. Surface of the stairs	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify) ______	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify) ______	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify) ______	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify) ______	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify) ______	( ) Continuous carpet ( ) Non-continous carpet, rubber, vinyl ( ) Wood ( ) Metal ( ) Cement/Terrazo ( ) Other (specify) ______
35. Is the surface of the bottom step the same as the other stairs?	( ) Yes ( ) No (specify) ______	( ) Yes ( ) No (specify) ______	( ) Yes ( ) No (specify) ______	( ) Yes ( ) No (specify) ______	( ) Yes ( ) No (specify) ______	( ) Yes ( ) No (specify) ______

(.)	Stairway 1	Stairway 2	Stairway 3	Stairway 4	Stairway 5	Stairway 6
36. Presence of handrail	○1 complete handrail	○1 complete handrail	○1 complete handrail	○1 complete handrail	○1 complete handrail	○1 complete handrail
	○2 complete handrails	○2 complete handrails	○2 complete handrails	○2 complete handrails	○2 complete handrails	○2 complete handrails
	○1 handrail incomplete	○1 handrail incomplete	○1 handrail incomplete	○1 handrail incomplete	○1 handrail incomplete	○1 handrail incomplete
	○1 complete and 1 incomplete	○1 complete and 1 incomplete	○1 complete and 1 incomplete	○1 complete and 1 incomplete	○1 complete and 1 incomplete	○1 complete and 1 incomplete
	○2 incomplete	○2 incomplete	○2 incomplete	○2 incomplete	○2 incomplete	○2 incomplete
	○Don't know	○Don't know	○Don't know	○Don't know	○Don't know	○Don't know
	○N/A	○N/A	○N/A	○N/A	○N/A	○N/A
37. What is the height of each handrail?						
Side A	○Height ______	○Height ______	○Height ______	○Height ______	○Height ______	○Height
	○Variable height	○Variable height	○Variable height	○Variable height	○Variable height	○Variable height
	○No handrail	○No handrail	○No handrail	○No handrail	○No handrail	○No handrail
Side B	○Height ______	○Height ______	○Height ______	○Height ______	○Height ______	○Height
	○Variable height	○Variable height	○Variable height	○Variable height	○Variable height	○Variable height
	○No handrail	○No handrail	○No handrail	○No handrail	○No handrail	○No handrail
38. What is the distance between your thumb and your index finger when you encircle the handrail?						
Side A	○Distance ______	○Distance ______	○Distance ______	○Distance ______	○Distance ______	○Distance
	○Variable distance	○Variable distance	○Variable distance	○Variable distance	○Variable distance	○Variable distance
	○No handrail	○No handrail	○No handrail	○No handrail	○No handrail	○No handrail
Side B	○Distance ______	○Distance ______	○Distance ______	○Distance ______	○Distance ______	○Distance
	○Variable distance	○Variable distance	○Variable distance	○Variable distance	○Variable distance	○Variable distance
	○No handrail	○No handrail	○No handrail	○No handrail	○No handrail	○No handrail
39. What is the design that best describes the design of handrail?	○	○	○	○	○	○
	○Other: drawing	○Other: drawing	○Other: drawing	○Other: drawing	○Other: drawing	○Other: drawing



40. **Is there an access ramp on the exterior or the interior of this building?**

1 ◯ Yes (specify) ______________________

2 ◯ No

INTERVIEWER'S COMMENT

1 - 1 ◯ Entrevue facile (l'information est valable)

2 ◯ Entrevue difficile (l'information est valable)

____

(spécifiez)

2 - 1 ◯ La validité n'est pas mise en doute

2 ◯ La validité peut être mise en doute

Précisez les sections: ______________________

3 - Le suivi téléphonique sera avec:

1 ◯ Sujet

2 ◯ Répondant intermédiaire

4 - Observation des escaliers:

1 ◯ Etat normal

2 ◯ Aspect détérioré (spécifiez) ______________________

3 ◯ Très grand risque apparent (spécifiez) ______________________

____

5 - Observation de la salle de bain:

1 ◯ Etat normal

2 ◯ Aspect détérioré (spécifiez) ______________________

3 ◯ Très grand risque apparent (spécifiez) ______________________

____

APPENDIX III

FOLLOW-UP QUESTIONNAIRE

DOSSIER NUMBER

FALLS AND THE ELDERLY
Department of Community Health
The Montreal General Hospital

FOLLOWUP TELEPHONE QUESTIONNAIRE (QB)

A - ADMINISTRATION

(Note to interviewer Please review subject's file. Please complete questions 1 - 7, blank spaces in "Introduction to Subject", Q.19, 27 and 28 before phonecall).

1. Name of subject ____________________

2. Questionnaire number

3. Target date for QB
Day Month Year

4. Date and occasion of last contact with subject (at-home interview or telephone contact)

Date | Name of interviewer

○ QA Day Month Year ____________________

○ QB Day Month Year ____________________

○ QC* Day Month Year ____________________

* (Subject called DSC)

5. Proxy respondent?

1 ○ Yes ____________________ ____________________
Name of proxy Reason for proxy

2 ○ No ⟶ Go to Q.7

6. Relationship of proxy to the subject:

○ Spouse

○ Daughter/son (daughter in law/son in law)

○ Other (specify) ____________________

7. Telephone number -

○ No Telephone ⟶ Go to Q.9

8. Record of phonecalls

Number of phone-call	Date		Time of phonecall			Comments
	Day	Month	Start	Finish	Total Min.	
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

9. Questionnaire completed at subject's home?

◯ No ⟶ Go to Q.11

◯ Yes, why?

◯ No telephone (QA)

◯ Other, specify why ______________________

10. Record of visits:

Number of visits	Date		Time of visit			Comments
	Day	Month	Start	Finish	Total Min.	
1						
2						
3						

11. Interview result:

1 ◯ Interview completed by telephone

2 ◯ Interview completed at home of subject

3 ◯ Interview incomplete (specify why) ______________________

4 ◯ Refusal to participate (specify why) ______________________

5 ◯ No interview (specify why) ______________________

12. Interviewer:

1 ◯ Patty Dray

2 ◯ Martine LeComte

3 ◯ Tracey Moore

4 ◯ Other (specify) ______________________

INTRODUCTION TO SUBJECT

Hel o, this is ______________ of the study "Falls and the Elderly" for the Montreal General Hospital's Community Health Department. This is the monthly telephone follow-up call and I would like to ask a few questions about your health since we last spoke with you:

____
(Date and occasion, see Q.4)

This call will take approximately 10 minutes. You could refer to the calendar, which we gave to you on our first visit, to assist you in recalling the dates.

B - TWO WEEK DISABILITY

13. During the last two weeks, since ______________ did you stay in bed at all because of your health? Please refer to your Falls Calendar.

1 ◯ Yes

2 ◯ No ——→ Go to 16

14. How many days did you stay in bed for all or most of the day? Include any nights spent as a patient in hospital

☐☐ days

15. What was the main health problem which caused you to stay in bed?

____

16. During those two weeks, were there any days (not counting the bed-days mentioned earlier) that you cut down on things you normally do, because of your health?

1 ◯ Yes

2 ◯ No ——→ Go to Section C

17. How many days did you cut down for all or most of the day?

☐☐ days

18. What was the main health problem which caused you to cut down on things on these days?

____

C - **HEALTH CARE SERVICES**

19. **Since ______________, our last monthly follow-up with you, did you spend any nights as a patient in a hospital, nursing home or convalescent home?** (Note to interviewer: refer to date of last QB).

1 ◯ Yes

2 ◯ No ——→ Go to Section D

20. **How many nights did you spend as a patient in a hospital, nursing home or convalescent home?**

☐☐ nights

21. **What was the main health problem which caused you to be hospitalized?**

____

D - **HEALTH PROBLEMS**

22. **In the past 2 weeks since ______________, have you had any of the following:** (mark each response if more than one answer)*

Yes	No	
◯	◯	Dizziness on standing up quickly
◯	◯	Any other dizziness, giddiness, vertigo or light headedness
◯	◯	Palpitations (sensation of heart beating in a rapid or irregular way)
◯	◯	Loss of consciousness or blackout
◯	◯	Shortness of breath at rest
◯	◯	Shortness of breath on exertion

23. **Yesterday, or the day before, did you take or use any of the following medications? (mark each response if more than one answer)***

Yes	No	
◯	◯	Medicine for arthritis or rheumatism
◯	◯	Any other pain relievers
◯	◯	Tranquilizers, medicine for the nerves, or medicine to help you sleep
◯	◯	Medicine for your blood pressure
◯	◯	Medicine for your heart
◯	◯	Antibiotics (taken orally)
◯	◯	Laxatives
◯	◯	Stomach remedies or medicines
◯	◯	Cough or cold remedies
◯	◯	Vitamins or minerals
◯	◯	Any other medication ______________ (specify) (ex: antibiotics applied externally)

E - PHYSICAL ACTIVITY

24. How many times did you participate in the following physical activities in the past week?*

	Times	On the *average*, about how many minutes did you spend on *each* occasion?			
		1-15	16-30	31-60	60+
Walking for exercise	☐☐	1 ○	2 ○	3 ○	4 ○
Swimming	☐☐	1 ○	2 ○	3 ○	4 ○
Home exercise	☐☐	1 ○	2 ○	3 ○	4 ○
Exercise classes	☐☐	1 ○	2 ○	3 ○	4 ○
Jogging/Running	☐☐	1 ○	2 ○	3 ○	4 ○
Gardening	☐☐	1 ○	2 ○	3 ○	4 ○
Golf	☐☐	1 ○	2 ○	3 ○	4 ○
Dancing	☐☐	1 ○	2 ○	3 ○	4 ○
Bowling	☐☐	1 ○	2 ○	3 ○	4 ○
Tennis	☐☐	1 ○	2 ○	3 ○	4 ○
Light housework, light handiwork (washing dishes, ironing, making beds)	☐☐	1 ○	2 ○	3 ○	4 ○
Heavy housework, heavy handiwork (washing or waxing floors, painting)	☐☐	1 ○	2 ○	3 ○	4 ○
Others (specify)					
______________	☐☐	1 ○	2 ○	3 ○	4 ○
______________	☐☐	1 ○	2 ○	3 ○	4 ○
______________	☐☐	1 ○	2 ○	3 ○	4 ○

25. In the past week, have you been:*

1 ○ More active than usual

2 ○ As active as usual

3 ○ Less active than usual

F - ALCOHOL USE

The following questions are about drinking wine, beer or liquor -- all kinds of alcoholic beverages.

26. a) **Thinking back over the last 7 days, on how many of these days did you have any alcoholic drinks?**

1 ☐ If 0 go to Section G

b) **On how many of these days did you have 2 or more drinks?**

2 ☐ If 0 go to Section G

c) **On how many of these days did you have 4 or more drinks?**

3 ☐ If 0 go to Section G

d) **On how many of these days did you have 8 or more drinks?**

4 ☐ If 0 go to Section G

e) **On how many of these days did you have 12 or more drinks?**

5 ☐ If 0 go to Section G

G - ENVIRONMENT

27. **Since ____________ our last monthly follow-up with you, have there been any renovations in your home? For example, renovations to your bathroom, renovations to one of your stairways or any other important renovations.** (Note to interviewer: refer to date of last QB).

○ Yes (specify)________________________________

○ No

H - FALLS

28. **Did you fall since we spoke with you on ________________?** (Note to interviewer: refer to Q.4). **Please refer to your Falls Calendar.**

1 ○ Yes

2 ○ No → Go to Section I

29. **How many times did you fall since we spoke with you on ____________?**

☐☐ times

30. When did the fall(s) take place?

day	month	year
day	month	year
day	month	year

"I would like to ask you a few short questions about your fall(s)".

(Note to interviewer: Please complete a QC for each fall if it has not been reported already. Then continue to Section I of this questionnaire.)

I - TELEPHONE FOLLOWUP

To complete this interview I would like to ask a few questions to make sure that we can contact you next month.

31. Will I be able to contact you at your home telephone number next month?

1 ◯ Yes ⟶ End of Interview Q.34

2 ◯ No

32. Are you planning to move or be on vacation next month?

1 ◯ Moving

2 ◯ On vacation

3 ◯ Other (specify) ____________________

33. What is the address and telephone number of the place where you will be next month?

____
No Street Apt.

____
City Province

Postal Code Telephone Number

34. End of Interview:

That is all for now. Thank you very much once again for your participation. I will contact you again in one month. Please let us know at any time if you should require any more stickers for your calendar.

APPENDIX IV

FALLS QUESTIONNAIRES

DOSSIER NUMBER [ ][ ]

FALLS AND THE ELDERLY

FALL QUESTIONNAIRE (QC)
(To be completed for each fall experienced by study subjects)

A. ADMINISTRATION

1. Name of subject ______________________________

2. Questionnaire number [ ][ ][ ]

3. Number of fall in the study [ ][ ][ ]

4. Date of interview [ ][ ] day [ ][ ] month [ ][ ] year

5. Interviewer
   - 1 ◯ Patty Dray
   - 2 ◯ Martine Le Comte
   - 3 ◯ Tracey Moore
   - ◯ Other ______________________________

6. Proxy respondent?
   - 1 ◯ Yes ____________ Name of proxy ____________ Reason
   - 2 ◯ No → Go to Q.8

7. Relationship of proxy to the subject:
   - 1 ◯ Spouse
   - 2 ◯ Daughter/son, daughter-in-law/son-in-law
   - ◯ Other (specify) ______________________________

8. Fall reported from:
   - 1 ◯ Monthly telephone followup - QB
   - 2 ◯ Telephone call from the subject to the DSC
   - ◯ Other ______________________________

B. TIME OF FALL

First, I would like to ask a few questions about when the fall occurred.

9. On what date did you fall? Please refer to your Falls Calendar.

day month year

10. What time of day or night did you fall? (Use 24 hour clock)

		:		

Note to interviewer: Do not continue interview if fall has already been reported.

C. PLACE OF FALL

Now, I would like to ask a few q tions about where the fall occurred.

11. Did you fall inside a building?

1 ◯ Yes

2 ◯ No ⟶ Go to Q.14

12. In what building did you fall? Did you fall:*

1 ◯ In your own home

2 ◯ In someone else's home

3 ◯ In a public place or building (i.e. church, shopping center, metro, office) specify ______________________

◯ Other (specify) ______________________

13. In which room or area did you fall?

1 ◯ Bathroom

2 ◯ Bedroom

3 ◯ Kitchen

4 ◯ Living room

5 ◯ Dining room

6 ◯ Hallway

7 ◯ Stairs

8 ◯ Escalators

◯ Other (specify) ______________________

Now go to Q.16.

14. **Where did you fall?** (Note to interviewer: write the subject's exact response, ex: on the road, on the sidewalk, crossing the street, in the park, etc.).

____

____

15. **What were the weather conditions at the time of the fall?** (Mark each response if more than one answer)*

1 ◯ Rain

2 ◯ Snow

3 ◯ Wind

4 ◯ Very sunny

5 ◯ Freezing rain, hail, sleet

6 ◯ Nothing special

8 ◯ N/A (example: falls in a bus)

9 ◯ Don't remember

16. **Was the place where you fell familiar to you?**

1 ◯ Yes

2 ◯ No

17. **Was the place where you fell:***

1 ◯ Well lit

2 ◯ Poorly lit

3 ◯ Did not note anything in particular

9 ◯ Do not remember

D. CIRCUMSTANCES AROUND THE FALL

Next, I woulk like to ask several questions about the circumstances surrounding the fall.

18. What were you doing at the time of the fall? (Note to interviewer: write the subject's exact response, ex: walking, running, climbing stairs, going downstairs, etc.)

____

____

____

19. Were you in a hurry?

1 ○ Yes

2 ○ No

20. Did you know you were going to fall?

1 ○ Yes

2 ○ No

21. Why did you fall? (Note to interviewer: write the subject's exact response).

____

____

____

22. Was the fall a result of:

Yes	No	
○	○	A surprise event
○	○	Tripping (specify on what) ____________________
○	○	Slipping (specify on what) ____________________
○	○	Getting up too quickly
○	○	Turning head quickly

23. **Did you have any of the following symptoms just before you fell?** (Mark each response if more than one answer)*

Yes	No	
◯	◯	Vertigo (spinning head)
◯	◯	Light headedness
◯	◯	Palpitations
◯	◯	Shortness of breath
◯	◯	Weakness or strange sensation in one side of your body
◯	◯	Sudden weakness in the legs
◯	◯	Coughing
◯	◯	Difficulty speaking, speech
◯	◯	Smell strange odor
◯	◯	Flashing lights
◯	◯	Other symptoms just before you fell? (specify) ______________________

E. THE FALL

Now, I will ask several questions about the fall itself.

24. **First, did someone else see you fall?**

1 ◯ Yes

2 ◯ No ⟶ Go to Q.26

9 ◯ Don't know ⟶ Go to Q.26

25. **Who saw you fall?** (Relationship to subject)

1 ◯ Spouse

2 ◯ Daughter/son, Daughter-in-law/son-in-law

3 ◯ Friend/neighbor

4 ◯ Stranger

◯ Other (specify) ______________________

26. **Did you fall:***

1 ◯ Forward

2 ◯ Backward

3 ◯ To the side

◯ Other (specify) ______________________

9 ◯ Don't know

27. **What part or parts of your body received the <u>most</u> impact** (Mark each response if more than one answer)*

○ Head

○ Face

○ Backside

○ Hands

○ Arms

○ Knees

○ Other (specify) ____________________

9 ○ Don't know

28. **Did you fall a distance the same as, greater than or less than your own height?**

1 ○ The same as your height

2 ○ Greater than your height

3 ○ Less than your height

9 ○ Don't know

29. **If you fell on the stairs, how many stairs did you fall up or down?**

[ ][ ] stairs

30. **Did you hit or knock against something as you fell?**

1 ○ Yes

2 ○ No ——→ Go to Q.32

9 ○ Don't know ——→ Go to Q.32

31. **What did you hit or knock against?**

Specify: ____________________

32. **What kind of surface did you land on when you fell. Was it:***

1 ○ Hard (such as cement, terrazo, asphalt, ice)

2 ○ Soft (such as rug, linoleum, wood, grass, snow)

3 ○ Other (specify) ____________________

9 ○ Don't remember

33. How long did you remain on the ground?

[ ][ ][ ] minutes

9 ◯ Don't know

34. Did you get up?*

1 ◯ Alone

2 ◯ With some help

3 ◯ Someone else picked you up

◯ Other (specify) ______________________

F. CONSEQUENCES OF THE FALL

35. Did you injure yourself because of the fall?

1 ◯ Yes

2 ◯ No → Go to Q.40

36. Please describe the injury caused by the fall.

____

____

37. Did you spend any nights in a hospital, nursing home or convalescent home because of the fall?

1 ◯ Yes

2 ◯ No → Go to Q.40

38. On what date did you enter the hospital?

[ ][ ] Day [ ][ ] Month [ ][ ] Year

39. How many nights did you stay in the hospital, nursing home or convalescent home?

[ ][ ][ ] nights

40. Did you (or someone else) consult any health professional because of the fall (excluding consultations during hospitalization(s)?

1 ◯ Yes

2 ◯ No ⟶ Go to Q.47 - End of interview

(Note to interviewer: repeat Q.41 to 46 for each consultation in the 8 days following the fall. The day of the fall is counted as day 1).

	FIRST	SECOND	THIRD
41. Which health professional was consulted first? Was it a*	1 ◯ Doctor 2 ◯ Nurse 3 ◯ Chiropractor 4 ◯ Physiotherapist 5 ◯ Pharmacist or druggist ◯ Other (specify) ________	1 ◯ Doctor 2 ◯ Nurse 3 ◯ Chiropractor 4 ◯ Physiotherapist 5 ◯ Pharmacist or druggist ◯ Other (specify) ________	1 ◯ Doctor 2 ◯ Nurse 3 ◯ Chiropractor 4 ◯ Physiotherapist 5 ◯ Pharmacist or druggist ◯ Other (specify) ________
42. How long after the fall did the consultation take place?	☐☐ hours OR ☐ days	☐☐ hours OR ☐ days	☐☐ hours OR ☐ days
43. Did the consultation take place over the telephone only? (i.e. no subsequent visit)	1 ◯ Yes 2 ◯ No	1 ◯ Yes 2 ◯ No	1 ◯ Yes 2 ◯ No
44. Where did the consultation take place?	1 ◯ Urgences Santé 911 2 ◯ Hospital emergency 3 ◯ Community clinic 4 ◯ At home 5 ◯ Private office ◯ Other (specify) ________	1 ◯ Urgences Santé 911 2 ◯ Hospital emergency 3 ◯ Community clinic 4 ◯ At home 5 ◯ Private office ◯ Other (specify) ________	1 ◯ Urgences Santé 911 2 ◯ Hospital emergency 3 ◯ Community clinic 4 ◯ At home 5 ◯ Private office ◯ Other (specify) ________

	FIRST	SECOND	THIRD
45. Did you receive treatment for the fall?	1 ◯ Yes 2 ◯ No	1 ◯ Yes 2 ◯ No	1 ◯ Yes 2 ◯ No
46. Please describe the treatment that you received	__________	__________	__________

47. This concludes our questionnaire. I would like to thank you very much for your time and your having accepted to answer our questions.

G. TO BE COMPLETED BY INTERVIEWER

48. 1 ◯ Interview easy

    2 ◯ Interview difficult (specify why) ____________________

49. Doubts as to validity of responses?

    1 ◯ Yes (specify sections) ____________________

    2 ◯ No

50. Comments

____

____

____

____

Note to interviewer: If this QC was completed less than 8 days after the fall, the subject must be telephoned again and Q.40 to Q.46 must be repeated in order to verify if other consultations occurred during this period.

51. Questionnaire completed more than 8 days after the fall?

    1 ◯ Yes

    2 ◯ No ⟶ Go to Q.52

52. Subject (or proxy) must be telephoned ________________(date) (9 days after the fall) to complete Section F - CONSEQUENCES OF THE FALL.

APPENDIX V

RANGE OF RESPONSES OBSERVED AND/OR CODED CATEGORIES FOR VARIABLES IN THE INITIAL, FOLLOW-UP, AND FALLS QUESTIONNAIRES

APPENDIX V

TABLE 1

RANGE OF RESPONSES OBSERVED AND/OR CODED CATEGORIES FOR VARIABLES IN THE INITIAL QUESTIONNAIRE

Question number	Variable	Range of responses observed and/or coded categories
Sociodemographic Data		
2.	Sex	1. Male 2. Female
12.	Age	65-92 years
128.	Years of elementary or secondary school	0-14 years 88. Don't know 99. No answer
131.	Language spoken at home	1. English 2. French 3. Other 8. Don't know 9. No answer
132.	Paid employment in the 12 months preceding the interview	1. Full time 2. Part time 3. No 8. Don't know 9. No answer
133.	Marital status	1. Married 2. Single 3. Widowed 4. Divorced, separated 8. Don't know 9. No answer
134.	Annual household income	1. <$10,000 2. $10,000 - $20,000 3. >$20,000 - $40,000 4. >$40,000 8. Don't know 9. No answer
Proxy Response		
20.	Proxy respondent	1. Yes 2. No

Question number	Variable	Range of responses observed and/or coded categories
Household Occupants		
22.	Number of persons living in household	1-6 persons 7. More than six persons 8. Don't know 9. No answer
Self-Reported Health		
24.	Self-perceived health status	1. Excellent 2. Good 3. Average 4. Poor 8. Don't know 9. No answer
25.	Satisfaction with health	1. Very satisfied 2. Somewhat satisfied 3. Not too satisfied 4. Not at all satisfied 8. Don't know 9. No answer
Two-Week Disability		
27.	Bed-days	1. Yes 2. No 8. Don't know 9. No answer
32.	Activity-limitation days	1. Yes 2. No 8. Don't know 9. No answer
Use of Health Services		
36.	Number of consultations with an ophthalmologist, optometrist, or optician in the 12 months preceding the interview	0-50 consultations 88. Don't know 99. No answer
38.	Number of consultations with a physician in the 12 months preceding the interview	0-72 consultations 88. Don't know 99. No answer
40.	Number of consultations in the 12 months preceding the interview with a:	
	Nurse	0-52 consultations
	Pharmacist	0-12 consultations
	Chiropractor	0-20 consultations
	Physiotherapist	0-87 consultations 88. Don't know 99. No answer

Question number	Variable	Range of responses observed and/or coded categories
42.	Number of nights spent as a patient in a hospital, nursing home, or convalescent home in the 12 months preceding the interview	0-150 nights 888. Not applicable 999. No answer
95.	Receives at-home community services	1. Yes 2. No 8. Don't know 9. No answer
Chronic Health Problems		
44.	High blood pressure	1. Yes 2. No 8. Don't know 9. No answer
45.	Heart trouble	1. Yes 2. No 8. Don't know 9. No answer
47.	Diabetes	1. Yes 2. No 8. Don't know 9. No answer
49.	Stroke	1. Yes 2. No 8. Don't know 9. No answer
51.	Parkinson's disease	1. Yes 2. No 8. Don't know 9. No answer
53.	. Asthma . Emphysema, bronchitis . Arthritis, rheumatism	1. Yes 2. No 8. Don't know 9. No answer
54.	Other chronic health problem(s)	Laval Classification 888. Not applicable 999. Don't know
Symptoms		
55.	Symptoms in the 14 days preceding the interview: Dizziness on standing Other dizziness Palpitations Short of breath at rest Short of breath on exertion	1. Yes 2. No 8. Don't know 9. No answer

Question number	Variable	Range of responses observed and/or coded categories
Use of medication		
56.	Medication in the two days preceding the interview:	1. Yes 2. No 8. Don't know 9. No answer
	Medicine for arthritis or rheumatism Other pain relievers Tranquilizers, medicine for the nerves, medicine to help you sleep Medicine for blood pressure Medicine for the heart Antibiotics (taken orally) Laxatives Stomach remedies Cough or cold remedies Vitamins or minerals Anticoagulants Medicine for diabetes Medicine for respiratory disease Miscellaneous major medications Miscellaneous minor medications	
Smoking		
58.	Smokes cigarettes	1. Yes 2. No 8. Don't know 9. No answer
Long-Term Disability		
	Experiences trouble:	
60.	Walking 400 meters	1. Completely unable
61.	Walking up and down stairs	2. Has difficulty
62.	Carrying a 12-pound object	3. No difficulty
63.	Standing for long periods	8. Don't know
64.	Bending down	9. No answer
65.	Cutting toenails	
66.	Using fingers to grasp	
67.	Reaching	
69.	Seeing (with glasses)	
70.	Reading newsprint	
71.	Recognizing a friend on the street	
72.	Hearing	
Falls		
74.	Number of falls in the past 12 months	0-12 falls 88. Don't know 99. No answer

Question number	Variable	Range of responses observed and/or coded categories
79.	Health professional consulted as a result of a fall in the past 12 months: Medical doctor Chiropractor Physiotherapist Pharmacist Nurse	1. Yes 2. No 7. Not applicable 8. Don't know 9. No answer
Height and weight		
82.	Height	142-193 centimetres 888. Don't know 999. No answer
83.	Weight	34-136 kilograms 888. Don't know 999. No answer
Physical Activity		
84.	Physical activity compared to peers	1. Much more active 2. Somewhat more active 3. Same 4. Somewhat less active 5. Much less active 8. Don't know 9. No answer
85.	Physical effort in daily activities	1. Light 2. Moderate 3. Heavy 8. Don't know 9. No answer
86.	Recent physical activity (in the week preceding the interview): Walking for exercise Swimming Home exercise Exercise classes Jogging/running Gardening Golf Dancing Bowling Tennis Light housework/handiwork Heavy housework/handiwork Other	Number of times 0-42 times 88. Don't know 99. No answer

Question number	Variable	Range of responses observed and/or coded categories
Use of Alcohol		
89.	Usual frequency of drinking alcoholic beverages in the 12 months preceding the interview	1. Every day 2. At least once a week 3. One or more times a month 4. Less than once a month 5. Don't drink 8. Don't know 9. No answer
90.	Number of alcoholic drinks in the week preceding the interview	0-70 drinks 77. Not applicable 88. Don't know 99. No answer
Social Life		
91.	Frequency of social gatherings in the 12 months preceding the interview	1. More than once a week 2. Once a week 3. At least once a month 4. Less than once a month 5. Never 8. Don't know 9. No answer
92.	Satisfaction with social life	1. Very satisfying 2. Rather satisfying 3. Rather unsatisfying 4. Really unsatisfying 8. Don't know 9. No answer
94.	Member of a social group	1. Yes 2. No 8. Don't know 9. No answer
96.	Owns cat or dog	1. Yes 2. No 8. Don't know 9. No answer

TABLE 2

RANGE OF RESPONSES OBSERVED AND/OR CODED CATEGORIES FOR VARIABLES IN THE FOLLOW-UP QUESTIONNAIRE

Question number	Variable	Range of responses observed and/or coded categories
Proxy Response		
5.	Proxy respondent	1. Yes 2. No
Two-week Disability		
14.	Bed-days	1. Yes 2. No 8. Don't know 9. No answer
17.	Activity-limitation days	1. Yes 2. No 8. Don't know 9. No answer
Use of Health Services		
20.	Number of nights spent as a patient in hospital, nursing home, or convalescent home since the last follow-up interview	0 - 31 nights 88. Don't know 99. No answer
21.	Main health problem(s) associated with hospitalization	Laval Classification 777. Not applicable 888. Don't know 999. No answer
Symptoms		
22.	Symptoms in the two weeks preceding the interview: Dizziness on standing Other dizziness Palpitations Short of breath at rest Short of breath on exertion	1. Yes 2. No 8. Don't know 9. No answer
Use of medication		
23.	Medication in the two days preceding the interview: Medicine for arthritis or rheumatism Other pain relievers Tranquilizers, medicine for the nerves, medicine to help you sleep Medicine for blood pressure Medicine for the heart Antibiotics (taken orally) Laxatives Stomach remedies Cough or cold remedies	1. Yes 2. No 8. Don't know 9. No answer

Question number	Variable	Range of responses observed and/or coded categories
	Vitamins or minerals Anticoagulants Medicine for diabetes Medications for respiratory disease Miscellaneous major medications Miscellaneous minor medications	
Physical Activity		
24.	Activities in the week preceding the interview: Walking for exercise Swimming Home exercise Exercise classes Jogging / running Gardening Golf Dancing Bowling Tennis Light housework/handiwork Heavy housework/handiwork Other	Number of times: 0 - 76 77. Not applicable 88. Don't know 99. No answer
25.	Activity level in the week preceding the interview	1. More active than usual 2. As active as usual 3. Less active than usual 8. Don't know 9. No answer
Use of Alcohol		
26.	Number of alcoholic drinks in the week preceding the interview	0 - 70 drinks 7. Not applicable 8. Don't know 9. No answer
Falls		
28.	Number of falls since the last follow-up interview	0 - 5 falls 6. Six or more falls 7. Not applicable 8. Don't know 9. No answer

TABLE 3

RANGE OF RESPONSES OBSERVED OR CODED CATEGORIES FOR VARIABLES IN THE FALLS QUESTIONNAIRE

Question number	Variable	Range of responses observed and/or coded categories
6.	Proxy respondent	1. Yes 2. No
Time of Fall		
9.	Date	Day/Month/Year 88. Don't know 99. No answer
10.	Time of day	24-hour clock 8888. Don't know 9999. No answer
Place of Fall		
11.	Inside a building	1. Yes 2. No 8. Don't know 9. No answer
12.	Subject fell in own home	1. Yes 2. No 7. Not applicable 8. Don't know 9. No answer
13.	Room or area where inside fall occurred	1. Bathroom 2. Bedroom 3. Kitchen 4. Living room 5. Hallway 6. Stairs 7. Other 77. Not applicable 88. Don't know 99. No answer
14.	Location of exterior fall	1. Stairs 2. Sidewalk, street, parking lot 3. Other 7. Not applicable 8. Don't know 9. No answer
15.	Weather conditions at time of exterior fall	1. Snow 2. Very sunny 3. Other 4. Nothing memorable 7. Not applicable 8. Don't know 9. No answer

Question number	Variable	Range of responses observed and/or coded categories
16.	Place where subject fell familiar	1. Yes 2. No 8. Don't know 9. No answer
17.	Lighting in place where subject fell	1. Well lit 2. Poorly lit 3. Lighting not noticed 8. Don't know 9. No answer
Circumstances of Fall		
18.	Activity at time of fall	1. Stair-related 2. Walking 3. Getting up 4. Other 8. Don't know 9. No answer
19.	Subject in a hurry	1. Yes 2. No 8. Don't know 9. No answer
20.	Subject anticipated fall	1. Yes 2. No 8. Don't know 9. No answer
21.	Reason subject fell	1. Health-related 2. Environment-related 3. Both health- and environment-related 8. Don't know 9. No answer
22.	Fall result of:	
	Surprise event Tripping Slipping Getting up too quickly Turning head quickly	1. Yes 2. No 8. Don't know 9. No answer
23.	Symptoms before fall:	
	Vertigo Light-headed Palpitations Short of breath Weakness Sudden weakness in legs Coughing Difficulty speaking Smell strange odor Flashing lights Other symptoms	1. Yes 2. No 8. Don't know 9. No answer

Question number	Variable	Range of responses observed and/or coded categories
The Fall		
25.	Witness	1. Yes 2. No 8. Don't know 9. No answer
26.	Direction of fall	1. Forward 2. Backward 3. To the side 4. Other 8. Don't know 9. No answer
27.	Part of body which received most impact	1. Buttocks 2. Knees 3. Upper extremeties 4. Other 8. Don't know 9. No answer
28.	Height of fall	1. Same as subject's height 2. Greater than subject's height 3. Less than subject's height 8. Don't know 9. No answer
30.	Subject hit something as he/she fell	1. Yes 2. No 8. Don't know 9. No answer
31.	Surface on which subject fell	1. Hard (cement, terrazo, macadam, ice) 2. Soft (carpet, linoleum, wood, grass, snow) 3. Other 8. Don't know 9. No answer
32.	Number of minutes subject remained on the ground	0-60 minutes 88. Don't know 99. No answer
33.	Subject got up:	1. Alone 2. With help 8. Don't know 9. No answer
Consequences of the Fall		
35.	Subject injured	1. Yes 2. No 8. Don't know 9. No answer

Question number	Variable	Range of responses observed and/or coded categories
	Severity of injury	1. Fracture 2. Laceration with suture 3. Minor soft tissue injury 7. Not applicable 8. Don't know 9. No answer
39.	Hospitalized because of fall	1. Yes 2. No 7. Not applicable 8. Don't know 9. No answer
40.	Physician consulted because of fall	1. Yes 2. No 7. Not applicable 8. Don't know 9. No answer
42.	Length of time after fall that consultation took place	Less than 1 day 1-14 days 77. Not applicable 88. Don't know 99. No answer
44.	Where consultation took place	1. Private office 2. Hospital emergency 3. Other 7. Not applicable 8. Don't know 9. No answer
45.	Received treatment	1. Yes 2. No 7. Not applicable 8. Don't know 9. No answer

APPENDIX VI

VARIABILITY IN EXPOSURE TO POTENTIAL RISK FACTORS OVER TIME

APPENDIX VI

VARIABILITY IN EXPOSURE TO POTENTIAL RISK FACTORS OVER TIME

INTRODUCTION

Several potential risk factors for falls were expected to fluctuate substantially over time. These "time dependent exposure variables" were measured in the initial and in each follow-up interview. Other potential risk factors were not expected to fluctuate and therefore were not measured repeatedly in the follow-up interviews. The data for these "stable exposure variables" were collected in the initial at-home interview, and these results were used in the multivariate analyses to identify risk factors for falls and fall-related injury. However, in order to verify whether or not changes in the stable exposure variables occurred in individual subjects during the follow-up, some variables including member of a social group, self-perceived health status, satisfaction with health, chronic health problems, number of disabilities, number of ophthalmologist consultations, number of physician consultations, consulted other health professionals and received homecare, were measured a second time in the last follow-up interview. The objective of this appendix is to study variability in the time dependent exposure variables and the stable exposure variables over time.

METHOD

To study variability in exposure to the time dependent exposure variables over time, exposure to each time dependent variable was described by month of interview. To study variability in the stable exposure variables, correlation coefficients were computed between measures obtained in the initial at-home interview and the last follow-up interview. Only the 383 subjects who completed both interviews were included in the analysis. For the purpose of comparison, the same analysis was undertaken for the time dependent exposure variables (i.e. correlation coefficients were computed between the measures of the time dependent exposure variables obtained in the initial at-home interview and the last follow-up interview for the 383 subjects who completed both interviews).

RESULTS

Tables 1 to 5 (Figures 1-7) describe exposure to the time dependent exposure variables by month of interview. The data suggest that for some time dependent exposure variables, there was marked variability in the study group as a whole over time. For example, use of alcohol increased during the summer months of May and June, while remaining relatively constant the rest of the year. Disability-days and, in particular, activity-limitation days, fluctuated considerably with fewer subjects reporting disability-days during the summer months. Several symptoms including short of breath on exertion, other dizziness, and dizzy on standing were reported more frequently during the summer months. Palpitations and short of breath at rest remained relatively constant over time. In general, with the exceptions of other major medications and other minor medication, the use of specific medications remained relatively constant over time. Finally, both number of different activities and number of total activities suggested that there was little variability in level of physical activity over time in the group as a whole.

With the exception of number of ophthalmologist visits and consulted other health professional, the correlation coefficients for the stable exposure variables were all 0.50 or above (Table 6). Variables with high correlation coefficients included high blood pressure, respiratory disorder, diabetes, number of chronic health problems and number of disabilities. For these variables, subjects remained quite consistent in their responses over time. Subjects were less consistent in their responses to member of a social group, vision problem, hearing

TABLE 1

LEVEL OF PHYSICAL ACTIVITY BY MONTH OF INTERVIEW

MONTH	Person-months n	Number of different activities $\bar{x} \pm SD$	Total number of activities $\bar{x} \pm SD$
Total	**4,854[1]**	**2.5±1.1**	**17.5±9.2**
January	432	2.4±1.0	16.6±9.1
February	391	2.5±1.0	16.9±8.5
March	410	2.5±1.1	17.5±8.8
April	374	2.6±1.1	18.2±8.6
May	414	2.7±1.3	17.1±8.7
June	403	2.6±1.2	16.3±8.8
July	431	2.5±1.3	18.0±10.1
August	413	2.5±1.2	18.7±10.4
September	412	2.6±1.1	18.9±9.8
October	401	2.5±1.1	18.0±9.4
November	405	2.5±1.1	17.5±8.8
December	368	2.5±1.1	16.5±8.9

Note: [1] Includes 409 initial at-home interviews and 4,445 completed follow-up interviews.

TABLE 2

ALCOHOL CONSUMPTION BY MONTH OF INTERVIEW

MONTH	Person-months n	Number of alcoholic drinks per week $\bar{x} \pm SD$
Total	**4,854[1]**	**3.2±8.1**
January	432	3.3±8.6
February	391	3.1±9.2
March	410	3.0±7.8
April	374	3.2±8.0
May	414	4.3±9.1
June	403	5.0±8.8
July	431	3.5±7.1
August	413	3.5±8.3
September	412	3.5±8.8
October	401	3.1±7.3
November	405	2.8±7.3
December	368	3.3±8.1

Note: [1] Includes 409 initial at-home interviews and 4,445 completed follow-up interviews.

TABLE 3

PROPORTION OF SUBJECTS REPORTING DISABILITY-DAYS IN THE PAST TWO WEEKS BY MONTH OF INTERVIEW

MONTH	Person-months n	Bed-days %	Activity-limitation days %
Total	**4,854[1]**	**5.2**	**13.8**
January	432	5.8	17.1
February	391	8.5	17.2
March	410	3.9	16.6
April	374	3.5	14.2
May	414	4.6	16.4
June	403	4.7	12.0
July	431	4.2	12.7
August	413	3.9	8.5
September	412	5.6	11.4
October	401	6.7	11.7
November	405	6.7	15.6
December	368	4.6	14.1

Note: (1) Includes 409 initial at-home interviews and 4,445 completed follow-up interviews.

TABLE 4

PROPORTION OF SUBJECTS REPORTING NONSPECIFIC SYMPTOMS BY MONTH OF INTERVIEW

MONTH	Person-months n	Dizziness on standing %	Other dizziness %	Palpitations %	Short of breath at rest %	Short of breath on exertion %	Number of symptoms $\bar{x} \pm SD$
Total	**4,854[1]**	**6.2**	**10.7**	**8.4**	**7.8**	**20.9**	**0.5±0.9**
January	432	3.2	9.5	9.3	7.6	17.1	0.5±0.9
February	391	2.8	8.2	7.2	7.7	19.3	0.5±0.8
March	410	4.4	10.5	7.8	7.3	21.5	0.5±0.9
April	374	4.6	10.8	9.1	7.8	22.9	0.6±0.9
May	414	7.5	12.3	10.1	8.5	26.6	0.7±1.0
June	403	13.8	16.8	9.5	7.3	27.0	0.7±1.1
July	431	9.4	12.4	8.2	7.0	17.3	0.5±1.1
August	413	8.6	10.8	8.4	6.9	18.2	0.5±0.9
September	412	6.1	8.3	8.3	9.3	18.5	0.5±0.9
October	401	4.5	11.0	9.5	9.0	20.8	0.6±0.9
November	405	5.2	9.4	4.5	7.2	20.3	0.5±0.9
December	368	4.1	8.5	8.2	7.7	21.6	0.5±0.9

Note: [1] Includes 409 initial at-home interviews and 4,445 completed follow-up interviews.

TABLE 5

PROPORTION OF SUBJECTS REPORTING USE OF MEDICATION BY SPECIFIC MEDICATION AND MONTH OF INTERVIEW

MONTH	Person-months n	Medicine for arthritis	Other pain relievers	Tranquilizers	Blood pressure medication	Medicine for the heart	Antibiotics	Laxatives	Stomach remedies	Cough or cold remedies	Vitamins or minerals	Anticoagulants	Medicine for diabetes	Asthma or COPD[1] medicine	Other major medications	Other minor medications	Number of medications x̄ ± SD
Total	**4,854[2]**	**15.7**	**9.1**	**18.0**	**35.8**	**18.6**	**2.1**	**11.9**	**9.6**	**3.4**	**32.3**	**8.3**	**7.3**	**5.3**	**11.3**	**6.1**	**1.9±1.5**
January	432	14.1	8.1	17.4	37.5	20.1	1.2	13.0	9.3	4.4	33.6	8.1	7.6	6.7	11.6	7.0	2.0±1.5
February	391	15.4	8.7	16.7	36.9	18.2	0.8	12.6	9.2	4.6	33.9	8.2	7.4	5.7	12.3	6.7	2.0±1.5
March	410	17.7	8.1	15.7	34.8	17.9	1.7	11.5	9.1	3.4	34.1	8.6	7.4	6.4	13.5	6.4	2.0±1.4
April	374	18.5	9.6	16.6	37.4	17.9	2.1	12.3	11.5	3.2	34.5	9.4	7.5	5.9	13.6	7.2	2.1±1.5
May	414	18.6	11.1	18.8	37.4	19.8	2.4	13.8	11.8	3.1	34.8	9.2	7.5	5.3	9.7	8.5	2.1±1.5
June	403	16.3	12.5	19.8	35.3	20.3	2.8	12.5	10.5	2.3	29.1	5.8	6.0	4.0	8.3	6.8	1.9±1.5
July	431	14.5	9.3	19.4	31.2	18.2	1.6	12.4	9.6	3.0	28.0	6.6	7.5	4.2	10.1	4.9	1.8±1.5
August	413	13.7	11.3	17.9	35.2	18.8	2.7	10.8	8.6	2.5	32.1	8.4	7.4	4.7	11.1	4.0	1.9±1.4
September	412	15.1	8.1	17.8	34.9	17.6	2.7	11.7	8.1	2.7	30.7	9.1	7.6	4.9	11.0	4.9	1.9±1.4
October	401	14.7	6.5	17.0	36.7	18.5	1.3	10.7	9.5	4.2	31.4	8.5	7.5	5.2	11.7	4.5	1.9±1.4
November	405	16.1	8.9	19.6	36.4	17.6	2.7	9.9	9.9	4.0	32.7	8.9	6.9	5.5	12.1	5.9	2.0±1.5
December	368	14.2	7.4	18.9	36.3	17.8	3.0	12.0	8.5	3.3	32.8	8.8	7.1	5.5	11.2	6.3	1.9±1.5

Notes: (1) Chronic obstructive pulmonary disease.
(2) Includes 409 initial at-home interviews and 4,445 completed follow-up interviews.

FIGURE 1.
LEVEL OF PHYSICAL ACTIVITY BY MONTH

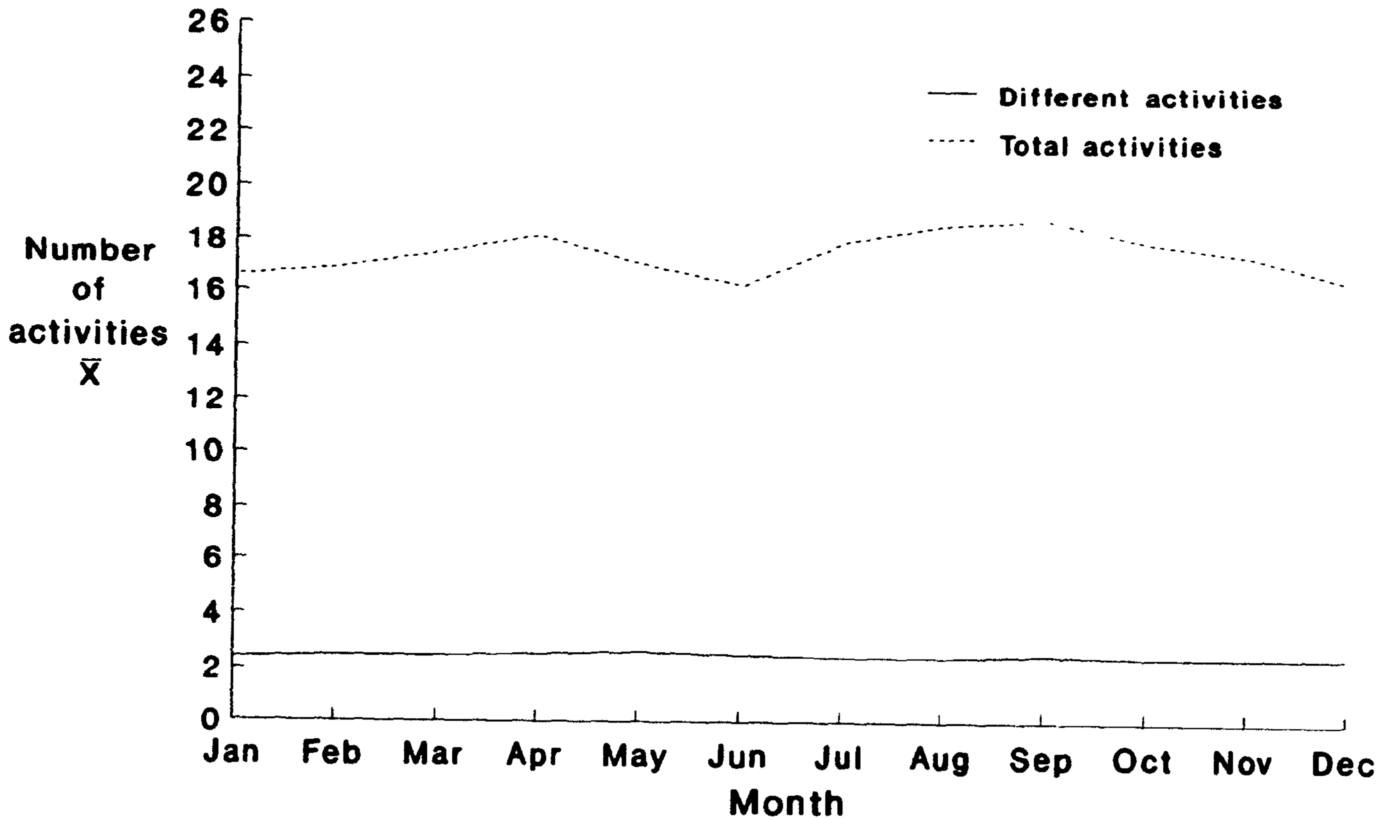


FIGURE 2.
ALCOHOL CONSUMPTION BY MONTH

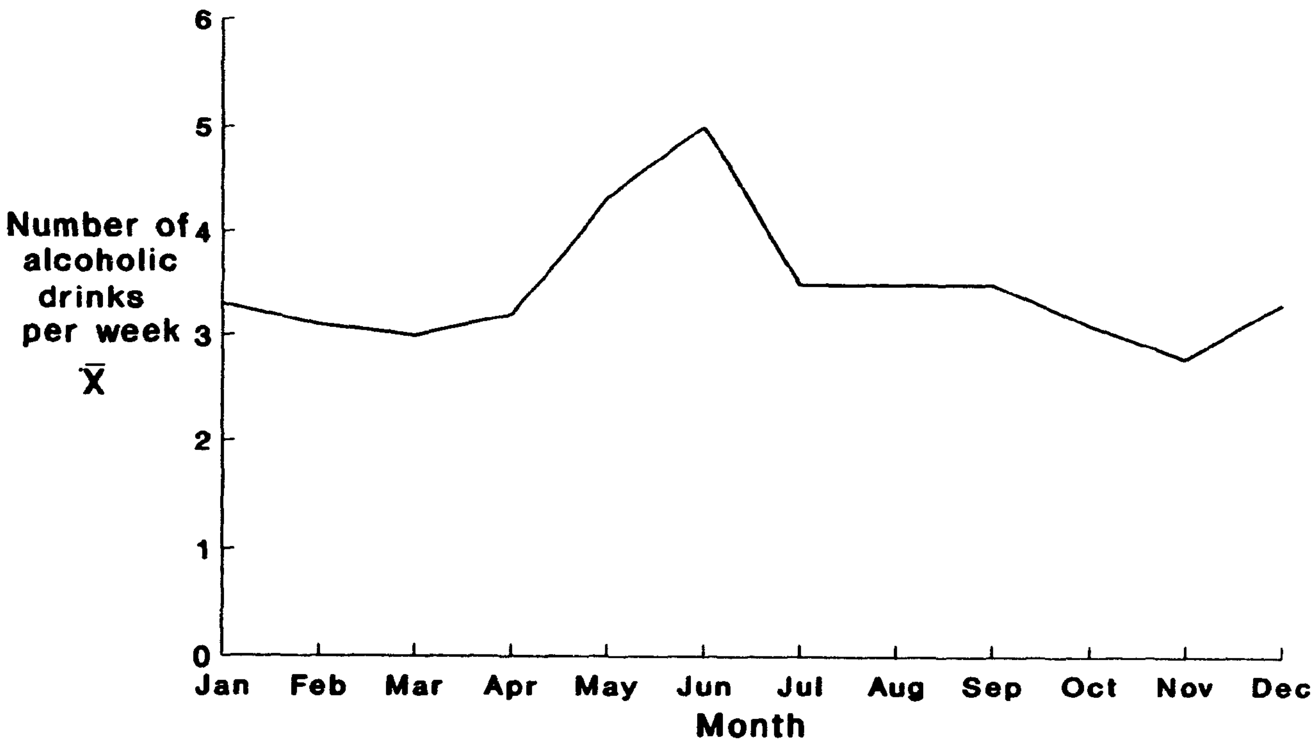


FIGURE 3.
PROPORTION OF SUBJECTS REPORTING DISABILITY-DAYS BY MONTH

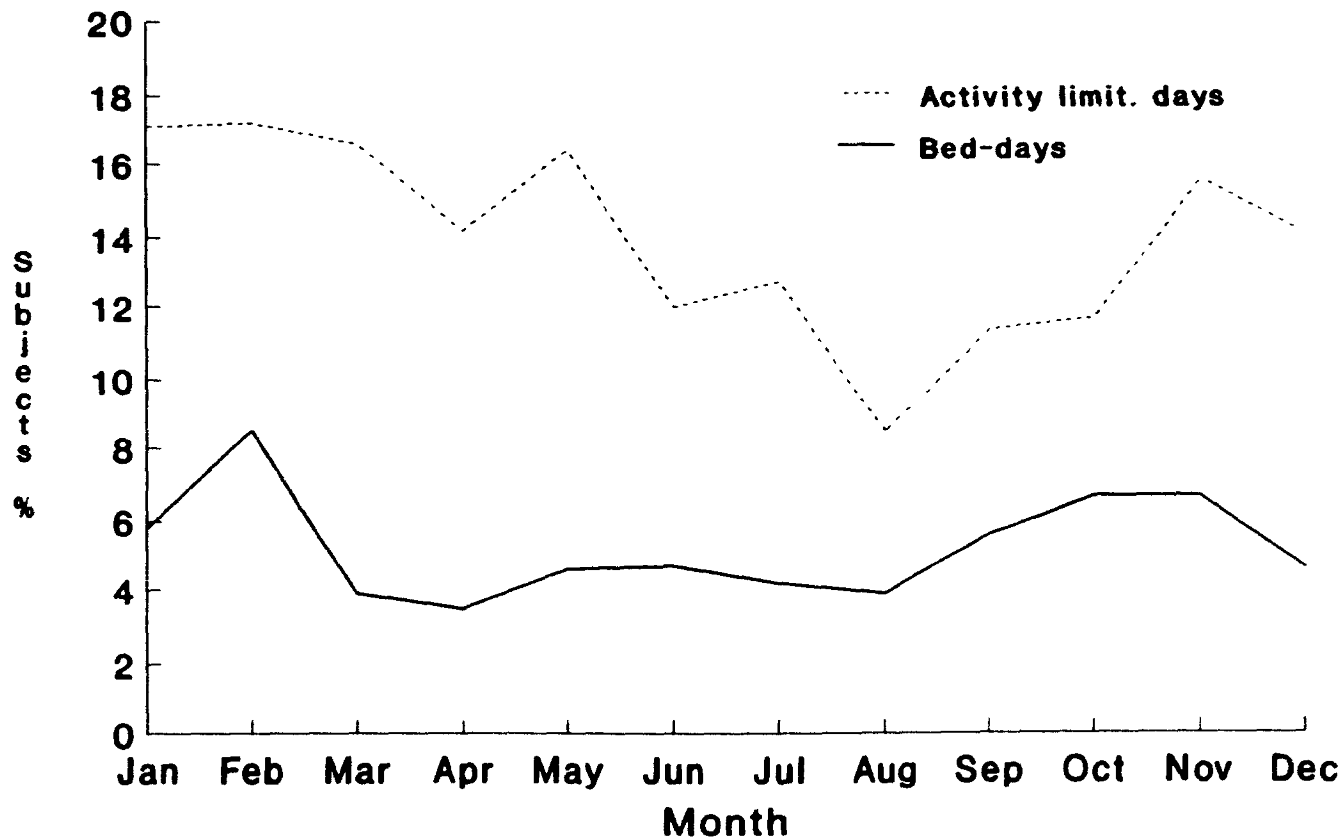


FIGURE 4.
PROPORTION OF SUBJECTS REPORTING
SYMPTOMS BY MONTH

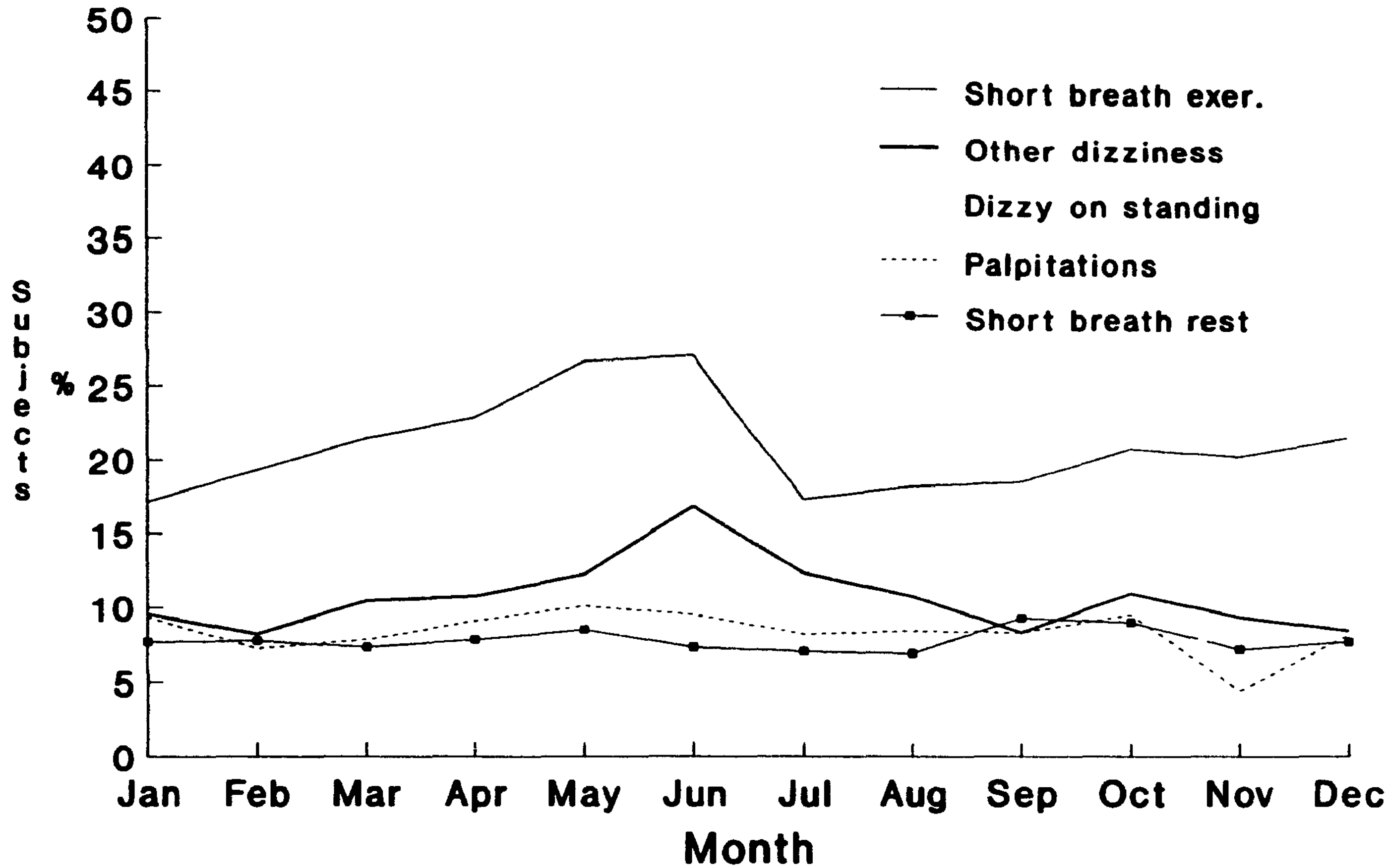


FIGURE 5.
PROPORTION OF SUBJECTS REPORTING USE OF MEDICATION BY MONTH

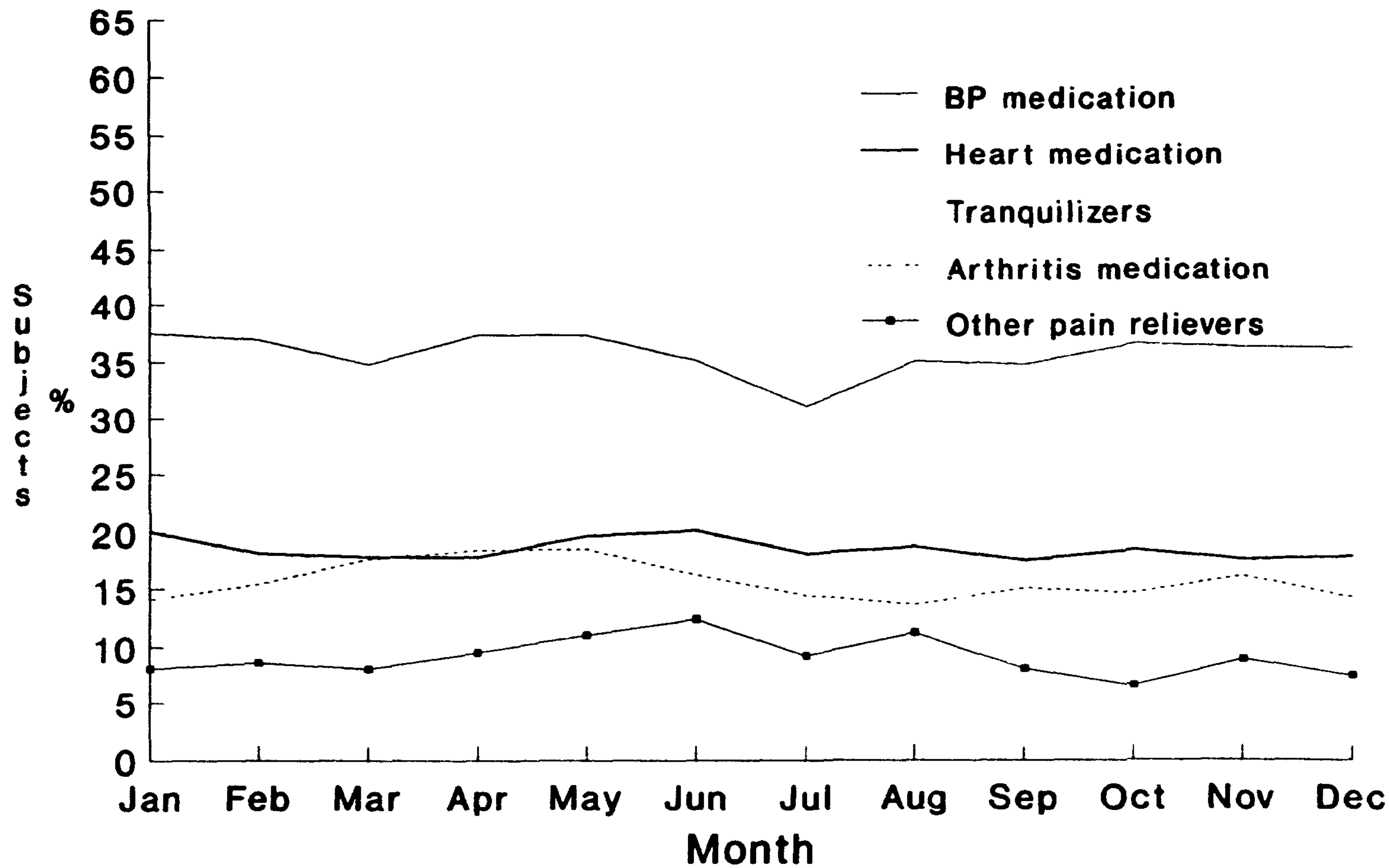


FIGURE 6.
PROPORTION OF SUBJECTS REPORTING USE OF MEDICATION BY MONTH

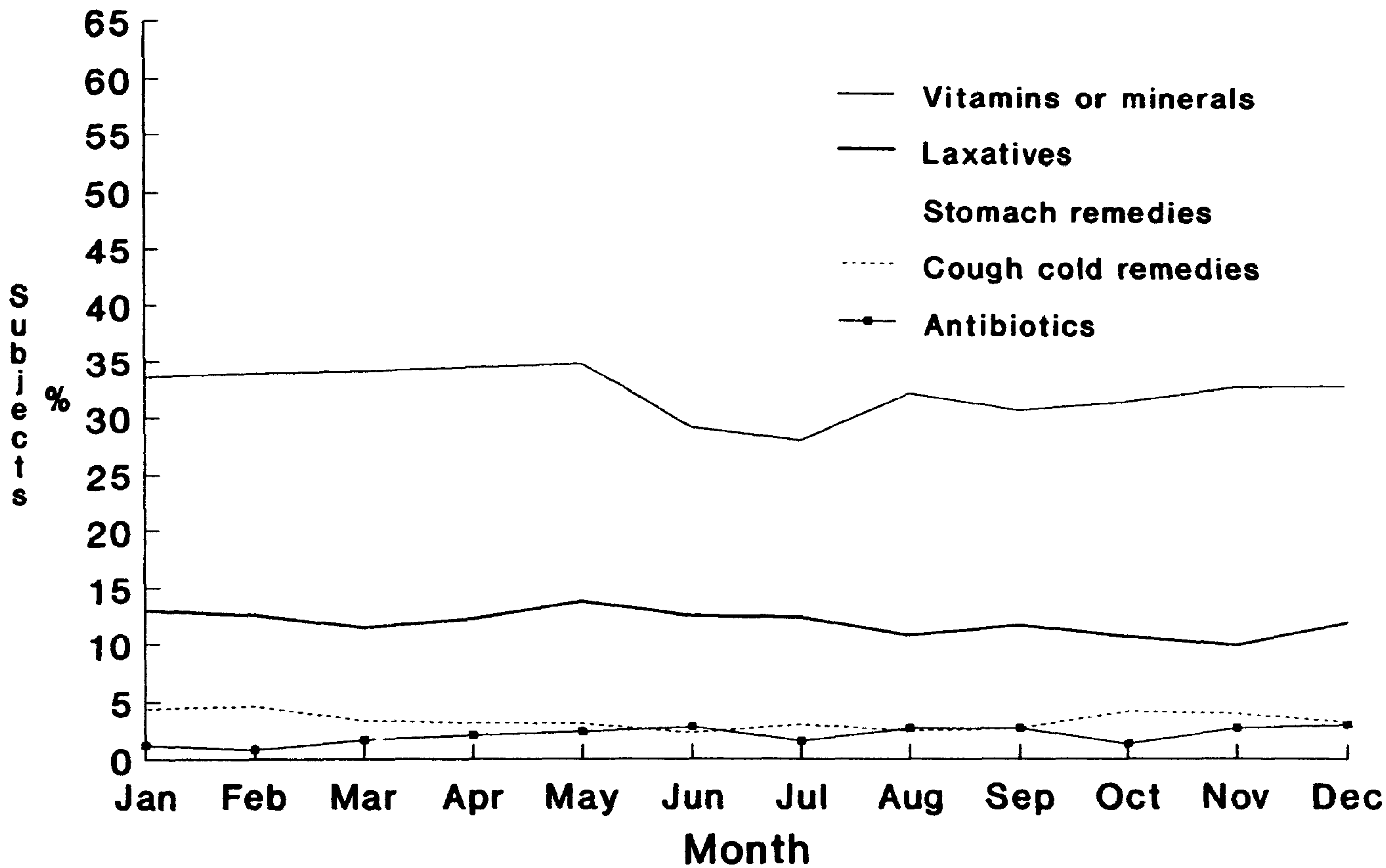


FIGURE 7.
PROPORTION OF SUBJECTS REPORTING USE OF MEDICATION BY MONTH

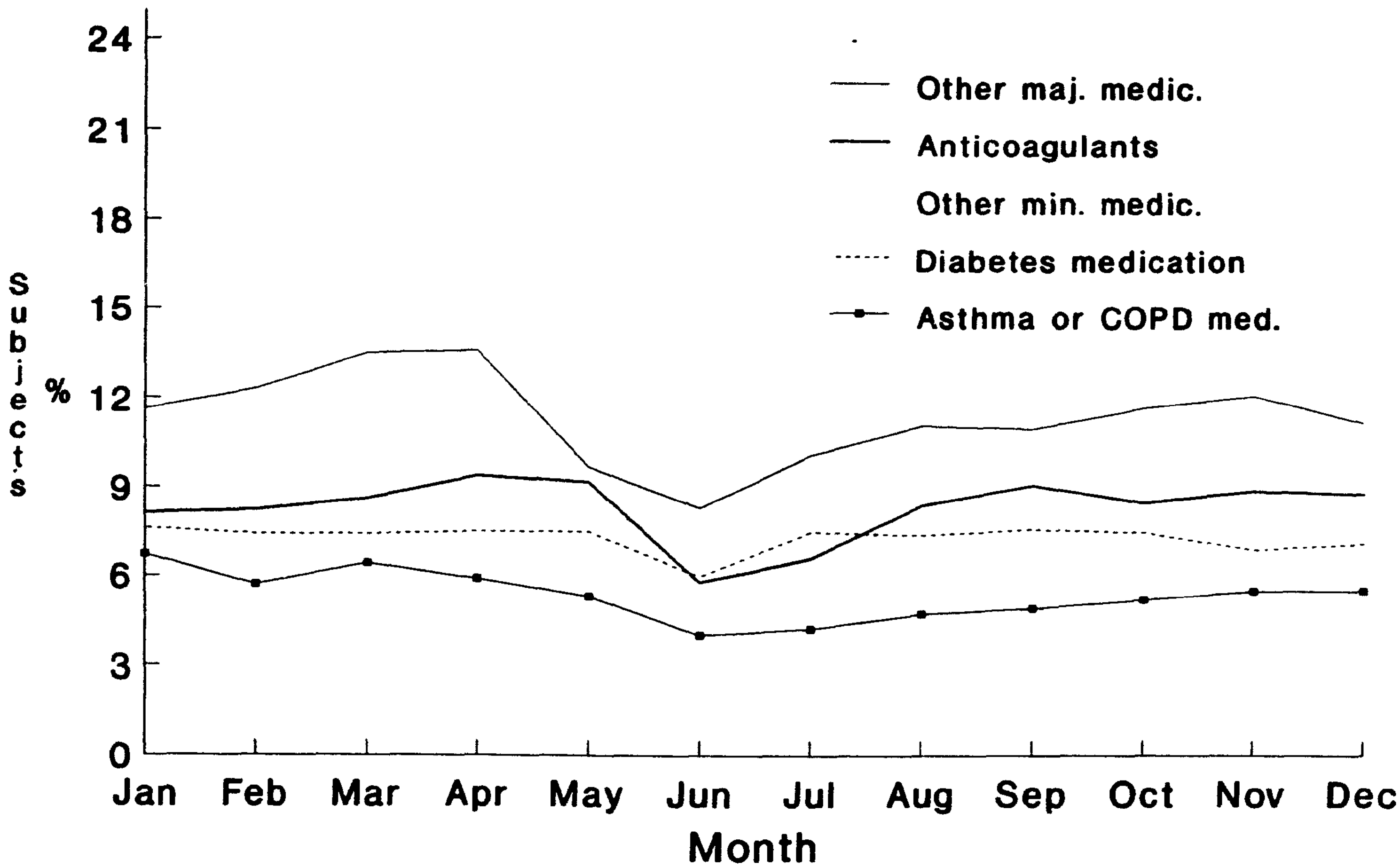


TABLE 6

CORRELATION COEFFICIENTS BETWEEN "STABLE EXPOSURE VARIABLES" MEASURED IN THE INITIAL INTERVIEW AND AGAIN IN THE TWELFTH FOLLOW-UP INTERVIEW (n=383)[1]

	Correlation coefficient[2]	Standard error
Lifestyle habits		
Member of a social group	0.56	0.04
Health status indicators		
Self-perceived health status	0.56	0.04
Satisfaction with health	0.56	0.04
Chronic health problems		
Arthritis or rheumatism	0.64	0.04
High blood pressure	0.77	0.03
Heart trouble	0.65	0.05
Diabetes	0.86	0.04
Vision problem	0.50	0.05
Hearing problem	0.55	0.05
Respiratory disorder	0.69	0.05
Other	0.56	0.04
Number of chronic health problems	0.71	0.03
Number of disabilities	0.79	0.03
Use of health services		
Number of physician consultations	0.52	0.05
Number of ophthalmologist consultations	0.39	0.06
Consulted other health professional	0.37	0.05
Received homecare	0.62	0.06

Notes: (1) Only the 383 subjects who completed both the initial at-home interview and the twelfth follow-up interview were included in the analysis.

(2) Pearson product moment correlation coefficients were calculated for continuous variables. Spearman rank correlation coefficients were calculated for categorical variables.

problem and other chronic health problems. Table 7 compares the distribution of responses for each of the variables measured in the initial interview and again in the last follow-up interview. With the exception of member of a social group, these were no statistically significant differences in the distribution of responses.

The correlation coefficients for the time dependent exposure variables ranged between 0.09 and 0.83 (Table 8). Fifteen of the 27 coefficients reported were below 0.50, and 12 were above 0.50. Variables for which there was little or no correlation between measures obtained in the initial and twelfth follow-up interviews included bed-days, activity-limitation days, dizziness on standing, other dizziness, use of antibiotics and use of cough or cold remedies. Variables for which responses were quite consistent included number of alcoholic drinks, use of medication for arthritis, tranquilizers, medicine for blood pressure, medicine for the heart, vitamins or minerals, medicine for diabetes, medicine for asthma or chronic obstructive pulmonary disease, and number of medications.

DISCUSSION

The data on the time dependent exposure variables suggest that with some notable exceptions there was little variation over time in the proportion of subjects exposed (for categorical variables) or in the mean level of exposure (for the continuous variables). However in the correlation analysis which examined variability in individuals rather than in the group as a whole, there was considerably less consistency in responses for many variables. For example, as could well be expected, variables which measured episodes of acute illness such as disability-days, use of antibiotics and use of cough or cold remedies, had very low correlation coefficients. However, correlations coefficients were much higher than expected for some time dependent exposure variables such as number of alcoholic drinks, medicine for blood pressure, medicine for the heart, and medicine for diabetes.

Although, in general, the measures of the stable exposure variables obtained in the initial and twelfth follow-up interview were quite consistent, it is somewhat surprising that the observed correlation coefficients were not higher, especially since the distribution of responses for most variables was quite similar in the first and last interviews. Possible explanations for the lower than expected correlation coefficients include changes in the respondent's exposure status over time, different measurement methods in the first and last interviews (i.e. in-person versus telephone interviews), and inaccurate reporting by the subject due to memory difficulties or to lack of understanding of the question.

This analysis suggests then, that in prospective follow-up studies which identify risk factors for an outcome of interest, careful consideration should be given to the extent to which a given exposure can be expected to fluctuate over time, and to how these fluctuations might affect the accurate identification of risk factors. Decisions on the frequency with which data on certain exposures should be collected should be based on sound hypotheses regarding the degree to which exposure might fluctuate and how that fluctuation affects the outcome.

TABLE 7
COMPARISON OF THE DISTRIBUTION OF STABLE EXPOSURE VARIABLES MEASURED IN THE INITIAL INTERVIEW AND AGAIN IN THE 12th FOLLOW-UP INTERVIEW (n=383)[1]

	Initial at-home interview %	Twelfth follow-up interview %	p
Lifestyle habits			
Member of a social group	51.7	43.7	0.03
Health status indicators			
Self-perceived health status			
Excellent	31.5	33.2	0.19
Good	41.2	44.2	
Average	22.0	19.1	
Poor	5.2	2.9	
Satisfaction with health			
Very satisfied	40.9	38.6	0.26
Somewhat satisfied	38.8	44.5	
Not too satisfied	15.5	12.6	
Not at all satisfied	4.7	3.1	
Chronic health problems			
Arthritis or rheumatism	55.1	55.2	0.52
High blood pressure	40.9	43.9	0.36
Heart trouble	29.4	25.6	0.30
Vision problem	28.6	23.3	0.11
Hearing problem	22.8	23.0	0.89
Respiratory disorder	15.2	14.7	0.91
Diabetes	9.2	9.4	0.98
Number of chronic health problems			
0	14.7	14.1	0.09
1	26.8	31.4	
2	28.6	32.2	
≥3	29.9	22.3	
Number of disabilities			
0	37.3	34.0	0.08
1-2	30.5	32.2	
3-5	19.4	25.1	
6-8	12.9	8.6	
Use of health services			
Number of physician consultations			
0-1	26.5	27.2	0.78
2-3	27.0	29.6	
4-5	20.5	19.8	
≥6	26.0	23.4	
Number of ophthalmologist consultations			
0	37.0	43.3	0.22
1	43.8	36.7	
2	10.2	10.8	
3-50	8.9	9.2	
Consulted other health professional	28.3	23.8	0.18
Received homecare	13.1	16.5	0.85

Note: (1) Only the 383 subjects who completed both the initial at-home and twelfth follow-up interviews were included in the analysis.

TABLE 8
CORRELATION COEFFICIENTS BETWEEN TIME DEPENDENT EXPOSURE VARIABLES AS MEASURED IN THE INITIAL INTERVIEW AND IN THE TWELFTH FOLLOW-UP INTERVIEWS

	Correlation coefficient[2] r	Standard error
LIFESTYLE HABITS		
Number of different activities	0.53	0.04
Number of activities	0.51	0.05
Number of alcoholic drinks	0.72	0.07
HEALTH STATUS		
Two-week disability		
Bed-days	0.09	0.08
Activity-limitation days	0.09	0.06
Symptoms		
Dizziness on standing	0.13	0.07
Other dizziness	0.18	0.06
Palpitations	0.37	0.08
Short of breath at rest	0.32	0.08
Short of breath on exertion	0.40	0.05
Number of symptoms	0.45	0.05
USE OF MEDICATION		
Medicine for arthritis	0.69	0.05
Other pain relievers	0.21	0.07
Tranquilizers	0.61	0.05
Medicine for blood pressure	0.74	0.04
Medicine for the heart	0.75	0.04
Antibiotics	0.10	0.11
Laxatives	0.36	0.07
Stomach remedies	0.41	0.07
Cough or cold remedies	0.19	0.10
Vitamins or minerals	0.67	0.04
Anticoagulants	0.36	0.08
Medicine for diabetes	0.83	0.05
Medicine for asthma or COPD[3]	0.72	0.09
Other major medication	0.53	0.08
Other minor medication	0.44	0.09
Number of medications	0.69	0.03

Notes:
(1) Only the 383 subjects who completed both the initial at-home interview and the twelfth follow-up interview were included in the analysis.
(2) Pearson product moment correlation coefficients were calculated for continuous variables. Spearman rank correlation coefficients were calculated for categorical variables.
(3) Chronic obstructive pulmonary disease.

APPENDIX VII

UNIVARIATE ASSOCIATIONS BETWEEN POTENTIAL RISK FACTORS AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD. COMPARISONS BY SEX AND AGE GROUP

TABLE 1

ASSOCIATIONS BETWEEN SOCIODEMOGRAPHIC CHARACTERISTICS AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD. COMPARISON BY SEX

SOCIODEMOGRAPHIC CHARACTERISTIC	Person-months[1]		Incidence density[2]		Incidence density ratio	
	Male n	Female n	Male n	Female n	Male	Female
Total	1,767[3]	2,996[3]	35.7	44.7	-	-
Age group (years)						
65-69	522	729	24.9	53.5	1.0	1.0
70-74	527	768	28.5	26.0	1.1	0.5
75-79	463	625	45.4	43.2	1.8	0.8
80-92	255	874	54.9	54.9	2.2	1.0
Marital Status						
Married (incl common law)	1,279	813	29.7	38.1	1.0	1.0
Single (never married)	157	606	19.1	49.5	0.6	1.3
Widowed	247	1,433	81.0	47.5	2.7	1.2
Divorced, Separated	84	144	35.7	27.8	1.2	0.7
Language						
English	954	1,607	35.6	51.0	1.0	1.0
French	561	1,161	32.1	35.3	0.9	0.7
Other	252	228	47.6	43.9	1.3	0.9
Paid employment						
No	1,347	2,818	40.8	42.9	1.0	1.0
Yes	420	178	21.4	67.4	0.5	1.6
Income						
<$10,000	157	756	25.5	52.9	1.0	1.0
$10,000 - $20,000	509	683	66.8	42.5	2.6	0.8
>$20,000 - $40,000	333	580	30.0	51.7	1.2	1.0
>$40,000	551	216	25.4	50.9	1.0	1.0
No answer	217	761	9.2	30.2	0.4	0.6
Number of persons in household						
One	298	1,559	57.0	51.3	1.0	1.0
Two	1,227	1,078	32.6	38.0	0.6	0.7
Three or more	242	359	28.9	33.4	0.5	0.7
Years of schooling						
0-7	391	858	35.8	31.5	1.0	1.0
8-10	323	786	21.7	50.9	0.6	1.6
11	466	678	49.3	47.2	1.4	1.5
12 or more	551	566	32.7	51.2	0.9	1.6

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Totals for each variable may differ because of missing data.

TABLE 2

ASSOCIATIONS BETWEEN LIFESTYLE HABITS AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD. COMPARISON BY SEX

LIFESTYLE HABIT	Person-months[1]		Incidence density[2]		Incidence density ratio	
	Male n	Female n	Male n	Female n	Male	Female
TOTAL	**1,767[3]**	**2,996[3]**	**35.7**	**44.7**	-	-
Physical activity						
Physical activity compared to peers						
Much more active	536	983	37.3	44.8	1.0	1.0
Somewhat more active	452	660	19.9	51.5	0.5	1.1
Same	321	716	28.0	33.5	0.8	0.7
Somewhat less active	192	293	36.5	55.7	1.0	1.2
Much less active	194	305	97.9	45.9	2.6	1.0
Physical effort in daily activities						
Light	649	625	38.5	49.6	1.0	1.0
Moderate	1,024	2,287	33.2	43.3	0.9	0.9
Heavy	60	84	0.0	35.7	-	0.7
Number of different activities						
Short-term						
0-1	311	383	38.6	39.2	1.0	1.0
2	616	1,194	42.2	47.7	1.1	1.2
3	489	939	24.5	45.8	0.6	1.2
4-7	351	480	39.9	37.5	1.0	1.0
Average						
0 -1.9	452	548	59.7	56.6	1.0	1.0
2.0-2.4	426	948	23.5	38.0	0.4	0.7
2.5-3.1	393	806	25.4	43.4	0.4	0.8
3.2-6.0	496	694	34.3	44.7	0.6	0.8
Number of activities						
Short-term						
0-10	407	643	49.1	35.8	1.0	1.0
11-15	396	796	27.8	41.5	0.6	1.2
16-20	231	441	34.6	49.9	0.7	1.4
21-25	365	633	32.9	52.1	0.7	1.5
≥26	368	483	35.3	45.5	0.7	1.3
Average						
0 -12.7	471	727	55.2	46.8	1.0	1.0
12.8-17.2	369	808	27.1	38.4	0.5	0.8
17.3-22.2	430	767	32.6	36.5	0.6	0.8
22.3-54.0	497	694	28.2	57.6	0.5	1.2
Social life						
Frequency of social gatherings						
More than once a week	721	1,442	38.8	42.3	1.0	1.0
Once a week	483	704	37.3	48.3	1.0	1.1
At least once a month	349	395	25.8	35.4	0.7	0.8
Less than once a month	214	455	42.1	52.7	1.1	1.2
Social life						
Very satisfying	609	1,238	24.6	27.5	1.0	1.0
Rather satisfying	908	1,193	30.8	46.9	1.3	1.7
Unsatisfying	250	565	84.0	76.1	3.4	2.8
Member of social group						
No	815	1,513	30.7	36.4	1.0	1.0
Yes	952	1,483	41.0	52.6	1.3	1.4

TABLE 2 (continued)

LIFESTYLE HABIT	Person-months[1] Male n	Female n	Incidence density[2] Male n	Female n	Incidence density ratio Male	Female
Own cat or dog						
No	1,582	2,558	36.7	45.0	1.0	1.0
Yes	185	438	32.4	41.1	0.9	0.9
Smokes cigarettes						
No	1,350	2,427	31.9	47.0	1.0	1.0
Yes	417	569	50.4	33.4	1.6	0.7
Use of alcohol						
Frequency of alcohol consumption						
Don't drink	417	1,192	46.5	44.5	1.0	1.0
Less than once a month	242	675	41.3	43.0	0.9	1.0
One or more times a month	156	395	76.9	55.7	1.7	1.3
At least once a week	486	458	35.0	41.5	0.8	0.9
Every day	466	264	12.9	37.9	0.3	0.9
Number of alcoholic drinks						
Short-term						
0	852	2,170	38.7	47.9	1.0	1.0
1-3	306	492	45.8	36.6	1.2	0.8
4-10	286	243	42.0	16.5	1.1	0.3
11-70	323	91	15.5	76.9	0.4	1.6
Average						
0	508	1,422	43.3	42.2	1.0	1.0
0.1-0.3	100	385	20.0	57.1	0.5	1.4
0.4-2.8	399	757	57.6	43.6	1.3	1.0
2.9-70.0	760	432	22.4	41.7	0.5	1.0

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Totals for each variable may differ because of missing data.

TABLE 3

ASSOCIATIONS BETWEEN HEALTH STATUS
AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD.
COMPARISON BY SEX

HEALTH STATUS	Person-months[1] Male n	Person-months[1] Female n	Incidence density[2] Male n	Incidence density[2] Female n	Incidence density ratio Male	Incidence density ratio Female
TOTAL	**1,767[3]**	**2,996[3]**	**35.7**	**44.7**	.	.
Self-reported health						
Self-perceived health status						
Excellent	606	905	29.7	43.1	1.0	1.0
Good	704	1,216	27.0	46.9	0.9	1.1
Average	357	728	39.2	33.0	1.3	0.8
Poor	100	147	130.0	88.4	4.4	2.1
Satisfaction with health						
Very satisfied	729	1,214	27.4	44.5	1.0	1.0
Somewhat satisfied	713	1,118	18.2	38.5	0.7	0.9
Not too satisfied	241	522	74.7	42.1	2.7	0.9
Not at all satisfied	84	142	154.8	98.6	5.6	2.2
Two-week disability						
Bed-days						
Short-term						
No	1,698	2,804	35.9	46.0	1.0	1.0
Yes	69	192	43.5	20.8	1.2	0.5
Average						
None	1,499	2,327	33.3	45.6	1.0	1.0
Less than half	237	558	25.3	41.2	0.8	0.9
Half or more	31	111	258.0	36.0	7.7	0.8
Activity-limitation days						
Short-term						
No	1,587	2,530	30.2	39.1	1.0	1.0
Yes	180	465	88.9	73.1	2.9	1.9
Average						
None	1,144	1,644	25.3	36.5	1.0	1.0
Less than half	529	1,071	43.5	45.8	1.7	1.3
Half or more	94	281	127.7	85.4	5.0	2.3
Symptoms						
Dizziness on standing						
Short-term						
No	1,683	2,755	35.1	43.2	1.0	1.0
Yes	68	232	73.5	60.3	2.1	1.4
Average						
None	1,393	2,125	32.3	42.8	1.0	1.0
Less than half	309	589	51.8	44.1	1.6	1.0
Half or more	65	282	46.2	56.7	1.4	1.3
Other dizziness						
Short-term						
No	1,640	2,609	31.7	39.5	1.0	1.0
Yes	111	378	108.1	79.4	3.4	2.0
Average						
None	1,270	1,839	26.0	29.4	1.0	1.0
Less than half	379	794	66.0	52.9	2.5	1.8
Half or more	118	363	50.8	101.9	2.0	3.5

TABLE 3 (continued)

HEALTH STATUS	Person-months[1] Male n	Person-months[1] Female n	Incidence density[2] Male n	Incidence density[2] Female n	Incidence density ratio Male	Incidence density ratio Female
Palpitations						
Short-term						
No	1,681	2,667	36.3	45.0	1.0	1.0
Yes	70	320	42.9	40 6	1 2	0.9
Average						
None	1,521	2,098	30.9	41.9	1 0	1.0
Less than half	199	573	75 4	50.6	2.4	1.2
Half or more	47	325	42.6	49 2	1.4	1.2
Short of breath at rest						
Short-term						
No	1,642	2,740	34.7	44.2	1 0	1.0
Yes	109	247	64.2	48.6	1.9	1 1
Average						
None	1,475	2,271	34 6	43.6	1.0	1.0
Less than half	219	508	32.0	49.2	0.9	1 1
Half or more	73	217	82.2	41.5	2.4	1 0
Short of breath on exertion						
Short-term						
No	1,454	2,331	33.0	42.9	1.0	1.0
Yes	296	656	54.1	50.3	1.6	1.2
Average						
None	996	1,406	27.1	41.3	1.0	1.0
Less than half	444	911	47 3	41.7	1.7	1.0
Half or more	327	679	48.9	54.5	1.8	1.3
Number of symptoms						
Short-term						
0	1,336	1,892	28 4	41.8	1.0	1.0
1	256	610	58 6	37.7	2.1	0.9
2	135	307	44.4	55.4	1.6	1.3
3-5	40	187	125.0	74.9	4.4	1.8
Average						
0	710	804	22.5	32.3	1.0	1 0
0.1-0.3	316	469	31.6	55 4	1.4	1.7
0.4-0.9	406	691	34 5	27.5	1 5	0.9
1.0-5.0	335	1,032	65 7	53.3	2.9	1 7
Chronic health problems						
High blood pressure						
No	1,247	1,547	31.3	43.3	1.0	1.0
Yes	496	1,425	50.4	46.3	1.6	1.1
Heart Trouble						
No	1,136	2,145	40.5	43.4	1.0	1.0
Yes	583	814	30.9	47.9	0.8	1.1
Diabetes						
No	1,568	2,707	35 0	44.7	1.0	1.0
Yes	175	277	51.4	43.3	1.5	1.0
Respiratory disorder						
No	1,492	2,546	31.5	40.8	1.0	1.0
Yes	275	450	61.8	64.4	2.0	1.6
Arthritis or rheumatism						
No	1,039	1,098	36.6	41.0	1 0	1.0
Yes	728	1,898	35.7	46.4	1.0	1.1

TABLE 3 (continued)

HEALTH STATUS	Person-months[1] Male n	Person-months[1] Female n	Incidence density[2] Male n	Incidence density[2] Female n	Incidence density ratio Male	Incidence density ratio Female
Vision problem						
No	1,326	2,053	29.4	40.9	1.0	1.0
Yes	441	943	56.7	52.0	1.9	1.3
Hearing problem						
No	1,350	2,317	37.8	44.0	1.0	1.0
Yes	417	679	31.2	45.7	0.8	1.0
Stroke						
No	1,552	2,839	34.8	44.4	1.0	1.0
Yes	203	133	49.3	52.6	1.4	1.2
Other long-term problem						
No	1,120	1,897	34.8	38.5	1.0	1.0
Yes	647	1,099	38.6	54.6	1.1	1.4
Number of chronic health problems						
0	301	407	26.6	41.8	1.0	1.0
1	563	696	28.4	50.3	1.1	1.2
2	475	882	31.6	30.6	1.2	0.7
3	273	589	76.9	42.4	2.9	1.0
4	107	255	18.7	43.1	0.7	1.0
5-7	48	167	41.7	107.8	1.6	2.6
Long-term disability						
Experiences trouble;						
Walking 400 meters						
No	1,388	2,233	26.7	37.2	1.0	1.0
Yes	379	763	71.2	65.5	2.7	1.8
Walking up and down stairs						
No	1,270	1,871	26.0	42.2	1.0	1.0
Yes	497	1,125	62.4	48.0	2.4	1.1
Carrying a 12-pound object						
No	1,376	1,802	27.6	39.4	1.0	1.0
Yes	391	1,194	66.5	51.9	2.4	1.3
Standing for long periods						
No	1,375	1,938	24.7	39.7	1.0	1.0
Yes	392	1,058	76.5	52.9	3.1	1.3
Bending down						
No	1,223	2,147	28.6	34.0	1.0	1.0
Yes	544	849	53.3	70.7	1.9	2.1
Cutting toenails						
No	1,163	1,936	25.8	34.6	1.0	1.0
Yes	604	1,048	56.3	63.0	2.2	1.8
Using fingers to grasp						
No	1,553	2,466	26.4	37.7	1.0	1.0
Yes	214	530	107.4	75.5	4.1	2.0
Reaching						
No	1,681	2,499	32.7	35.6	1.0	1.0
Yes	86	497	104.7	88.5	3.2	2.5
Number of disabilities						
0	801	939	16.2	28.8	1.0	1.0
1-2	469	943	40.5	41.4	2.5	1.4
3-5	286	654	52.4	44.3	3.2	1.5
6-8	211	460	80.6	82.6	5.0	2.9
Fell in year preceding initial interview						
No	1,363	2,224	35.2	35.1	1.0	1.0
Yes	404	772	39.6	71.2	1.1	2.0

TABLE 3 (continued)

HEALTH STATUS	Person-months(1) Male n	Person-months(1) Female n	Incidence density(2) Male n	Incidence density(2) Female n	Incidence density ratio Male	Incidence density ratio Female
Follow-up fall						
Short-term						
No	1,682	2,810	31 5	41 6	1 0	1 0
Yes	84	186	131 0	86 0	4 2	2 1
Average						
None	1,221	1,909	22.1	31 4	1 0	1 0
Less than half	462	901	71 4	61 0	3 2	1 9
Half or more	84	186	47 6	96.8	2.2	3 1
Quetelet Index						
14.19-21 33	267	876	41 2	45 7	1 0	1 0
21 36-23 529	473	751	23.3	50 6	0.6	1 1
23.5-25 965	428	653	28 0	42.9	0 7	0 9
25 97-41.51	563	588	53 3	32.3	1 3	0.7
Missing	36	128	-	62.5	-	1.4

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Totals for each variable may differ because of missing data.

TABLE 4

ASSOCIATIONS BETWEEN USE OF MEDICATION AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD. COMPARISON BY SEX

MEDICATION	Person-months[1] Male n	Person-months[1] Female n	Incidence density[2] Male n	Incidence density[2] Female n	Incidence density ratio Male	Incidence density ratio Female
Total	**1,767**[3]	**2,996**[3]	**35.6**	**44.7**	-	-
Medicine for arthritis						
Short-term						
No	1,555	2,481	37.9	40.7	1.0	1.0
Yes	198	510	25.3	62.7	0.7	1.5
Average						
None	1,448	2,167	35.9	41.5	1.0	1.0
Less than half	111	328	45.0	42.7	1.3	1.0
Half or more	208	501	33.7	57.9	0.9	1.4
Other pain relievers						
Short-term						
No	1,649	2,660	30.9	43.2	1.0	1.0
Yes	103	331	126.2	54.4	4.1	1.3
Average						
None	1,427	2,125	26.6	41.4	1.0	1.0
Less than half	232	533	47.4	50.7	1.8	1.2
Half or more	108	338	138.8	53.3	5.2	1.3
Tranquilizers						
Short-term						
No	1,563	2,332	33.9	45.9	1.0	1.0
Yes	189	659	58.2	39.5	1.7	0.9
Average						
None	1,416	2,018	25.4	46.6	1.0	1.0
Less than half	163	262	36.8	45.8	1.4	1.0
Half or more	188	716	117.0	37.7	4.6	0.8
Medicine for blood pressure						
Short-term						
No	1,212	1,855	37.1	43.7	1.0	1.0
Yes	540	1,136	35.2	45.8	0.9	1.0
Average						
None	1,149	1,695	36.6	42.5	1.0	1.0
Less than half	61	165	49.2	42.4	1.3	1.0
Half or more	557	1,136	34.1	47.5	0.9	1.1
Medicine for the heart						
Short-term						
No	1,360	2,493	37.5	46.1	1.0	1.0
Yes	392	498	33.2	36.1	0.9	0.8
Average						
None	1,272	2,329	30.7	45.9	1.0	1.0
Less than half	95	171	115.8	52.6	3.8	1.1
Half or more	400	496	35.0	34.3	1.1	0.7
Antibiotics						
Short-term						
No	1,721	2,926	32.5	44.4	1.0	1.0
Yes	31	65	258.1	46.2	7.9	1.0
Average						
None	1,625	2,801	31.4	44.6	1.0	1.0
Less than half	114	153	43.9	39.2	1.4	0.9
Half or more	28	42	285.7	47.6	9.1	1.1

TABLE 4 (continued)

MEDICATION	Person-months[1] Male n	Person-months[1] Female n	Incidence density[2] Male n	Incidence density[2] Female n	Incidence density ratio Male	Incidence density ratio Female
Laxatives						
Short-term						
No	1,615	2,584	35 2	42 2	1 0	1 0
Yes	137	407	51 0	59 0	1 4	1 4
Average						
None	1,471	2,276	36 7	42 6	1 0	1 0
Less than half	165	285	42 4	38 6	1 2	0 9
Half or more	131	435	22 9	57 5	0 6	1 3
Stomach remedies						
Short-term						
No	1,581	2,712	38.0	43 5	1 0	1 0
Yes	171	279	23.4	53 8	0 6	1 2
Average						
None	1,378	2,472	38.5	44.5	1 0	1 0
Less than half	228	227	30.7	39 6	0.8	0 9
Half or more	161	297	24.8	47 1	0.6	1 1
Cough or cold remedies						
Short-term						
No	1,699	2,886	35.9	43.3	1.0	1 0
Yes	53	105	56 6	76 2	1 6	1 8
Average						
None	1,559	2,590	35 9	42.1	1 0	1 0
Less than half	159	350	25 2	54.3	0.7	1.3
Half or more	49	56	81 6	89 3	2 3	2 1
Vitamins or minerals						
Short-term						
No	1,360	1,872	30.9	42.2	1 0	1 0
Yes	392	1,119	56.1	48.3	1.8	1 1
Average						
None	1,250	1,548	28.8	40.7	1 0	1 0
Less than half	114	356	17.5	39.3	0.6	1 0
Half or more	403	1,092	64.5	51 3	2.2	1 3
Anticoagulants						
Short-term						
No	1,609	2,759	34.8	45.3	1 0	1 0
Yes	141	231	56.7	34.6	1.6	0.8
Average						
None	1,577	2,707	33.0	44 7	1.0	1 0
Less than half	42	78	95.2	25.6	2 9	0.6
Half or more	148	211	54.1	47.4	1 6	1 1
Medicine for diabetes						
Short-term						
No	1,611	2,782	35.4	45.7	1 0	1 0
Yes	139	208	50.4	28.8	1.4	0 6
Average						
None	1,605	2,777	34.3	45.7	1.0	1.0
Less than half	16	10	62.5	-	1.8	-
Half or more	146	209	54.8	28.7	1 6	0 6
Medicine for asthma or COPD[4]						
Short-term						
No	1,644	2,848	37.1	43.5	1 0	1.0
Yes	106	142	28.3	63.4	0.8	1 5
Average						
None	1,627	2,824	35.6	43.6	1.0	1.0
Less than half	51	40	78.4	25.0	2.2	0 6
Half or more	89	132	22.5	68.2	0 6	1 6

TABLE 4 (continued)

MEDICATION	Person-months[1] Male n	Person-months[1] Female n	Incidence density[2] Male n	Incidence density[2] Female n	Incidence density ratio Male	Incidence density ratio Female
Other major medication						
Short-term						
No	1,605	2,625	34 8	47 2	1 0	1 0
Yes	145	365	55 2	24 7	1 6	0 5
Average						
None	1,536	2,513	36 5	46.2	1.0	1 0
Less than half	95	143	0.0	90.9	-	2.0
Half or more	136	340	58.8	11.8	1.6	0.3
Other minor medication						
Short-term						
No	1,681	2,776	36 3	43.6	1.0	1.0
Yes	68	214	44 1	56.1	1 2	1 3
Average						
None	1,600	2,647	35.6	43.8	1.0	1 0
Less than half	101	158	29 7	38.0	0 8	0.9
Half or more	66	191	60 6	57.6	1.7	1.3
Number of medications						
Short-term						
0	423	413	14.2	33 9	1.0	1 0
1	466	745	34.3	49 7	2.4	1 5
2	501	823	43.9	36 5	3 1	1 1
3	233	478	38.6	56.5	2.7	1.7
4	100	341	80.0	44 0	5 6	1 3
5-8	44	196	68.2	51.0	4.8	1 5
Average						
0 -0.9	527	565	15.2	47.8	1.0	1.0
1.0-1.8	502	808	23.9	38 4	1.6	0 8
1.9-2.7	425	745	49.4	43.0	3.3	0.9
2.8-8.5	313	878	73 5	49.0	4 8	1.0

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Totals for each variable may differ because of missing data.
(4) Chronic obstructive pulmonary disease.

TABLE 5

ASSOCIATIONS BETWEEN THE USE OF HEALTH SERVICES AND FALL SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD. COMPARISON BY SEX

USE OF HEALTH SERVICES	Person-months[1] Male n	Person-months[1] Female n	Incidence density[2] Male n	Incidence density[2] Female n	Incidence density ratio Male	Incidence density ratio Female
TOTAL	**1,767[3]**	**2,996[3]**	**35.7**	**44.7**	-	-
Number of ophthalmologist consultations						
0	734	1,055	23.2	39 8	1 0	1 0
1	776	1,286	39 9	51 3	1.7	1 3
2	150	345	73 3	20.3	3 2	0 5
3	35	84	28 6	47 6	1 2	1 2
4-50	72	226	55 6	61 9	2 4	1 6
Number of physician consultations						
0-1	493	743	18 3	44 4	1 0	1 0
2-3	493	821	32.5	34 1	1 8	0 8
4-5	289	684	55.4	26.3	3 0	0 6
6-10	302	484	23.2	53 7	1 3	1 2
12-72	190	264	84 2	106 1	4 6	2.4
Consultated other health professionals						
No	1,308	2,115	36 7	32.2	1 0	1 0
Yes	459	881	34 9	73.8	1 0	2 3
Hospitalized in 12 months preceding initial interview						
No	1,274	2,500	36.1	39 6	1.0	1 0
Yes	493	496	36.5	68.5	1 0	1 7
Received homecare						
No	1,609	2,538	32.6	40.2	1 0	1 0
Yes	158	458	63.3	67.7	1.9	1.7

Notes: (1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Totals for each variable may differ because of missing data.

TABLE 6

ASSOCIATIONS BETWEEN SOCIODEMOGRAPHIC CHARACTERISTICS AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD. COMPARISON BY AGE GROUP

SOCIODEMOGRAPHIC CHARACTERISTIC	Person-months[1]		Incidence density[2]		Incidence density ratio	
	65-74 years n	≥75 years n	65-74 years n	≥75 years n	65-74 years	≥75 years
Total	**2,546[3]**	**2,217[3]**	**34.2**	**49.6**	-	-
Sex						
Female	1,497	1,499	38 1	50 7	1.0	1 0
Male	1,049	718	26.7	49 1	0.7	1 0
Marital Status						
Married (incl. common law)	1,301	791	26.1	44 2	1 0	1 0
Single (never married)	456	307	41.7	45 6	1 6	1 0
Widowed	621	1,059	40 3	59.5	1 5	1 3
Divorced, Separated	168	60	41.7	0 0	1.6	-
Language						
English	1,279	1,282	36 0	54 6	1.0	1 0
French	991	731	29.3	41.0	0.8	0 8
Other	276	204	36.2	58.8	1.0	1 1
Paid employment						
No	2,126	2,039	34.3	50.5	1.0	1.0
Yes	420	178	28.6	50.6	0.8	1.0
Income						
<$10,000	371	542	40.4	53 5	1 0	1 0
$10,000 - $20,000	702	490	37.0	75.5	0 9	1.4
>$20,000 - $40,000	598	315	38 5	54.0	1 0	1.0
>$40,000	432	335	30.1	35.8	0.7	0.7
No answer	443	535	18.1	31 8	0 4	0.6
Number of persons in household						
One	826	1,031	41.2	61.1	1.0	1.0
Two	1,397	908	32.9	38.5	0.8	0.6
Three or more	323	278	15.5	50.4	0.4	0.8
Years of schooling						
0-7	662	587	31 7	34 1	1 0	1.0
8-10	602	507	38.2	47.3	1.2	1.4
11	611	533	32.7	65.7	1.0	1 9
12 or more	599	518	28.4	57 9	0.9	1 7

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months.
(3) Totals for each variable may differ because of missing data.

TABLE 7

ASSOCIATIONS BETWEEN LIFESTYLE HABITS AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD. COMPARISON BY AGE GROUP

LIFESTYLE HABIT	Person-months[1] 65-74 years n	Person-months[1] ≥75 years n	Incidence density[2] 65-74 years n	Incidence density[2] ≥75 years n	Incidence density ratio 65-74 years	Incidence density ratio ≥75 years
TOTAL	2,546[3]	2,217[3]	34.2	49.6	-	-
Physical activity						
Physical activity compared to peers						
Much more active	816	703	34.3	51.2	1.0	1.0
Somewhat more active	551	561	25.4	51.7	0.7	1.0
Same	579	458	29.4	34.9	0.9	0.7
Somewhat less active	288	197	34.7	71.1	1.0	1.4
Much less active	252	247	63.5	68.8	1.9	1.3
Physical effort in daily activities						
Light	628	646	41.4	46.4	1.0	1.0
Moderate	1,800	1,511	28.9	53.6	0.7	1.2
Heavy	96	48	20.8	20.8	0.5	1.4
Number of different activities						
Short-term						
0-1	298	396	43.6	35.4	1.0	1.0
2	931	879	33.3	59.2	0.8	1.7
3	790	638	30.4	48.6	0.7	1.4
4-7	527	304	32.3	49.3	0.7	1.4
Average						
0 -1.9	399	601	55.1	59.9	1.0	1.0
2.0-2.4	716	658	26.5	41.0	0.5	0.7
2.5-3.1	681	506	25.0	55.3	0.5	0.9
3.2-6.0	750	452	36.0	46.5	0.7	0.8
Number of activities						
Short-term						
0-10	465	585	38.7	42.7	1.0	1.0
11-15	659	533	28.8	46.9	0.7	1.1
16-20	349	323	31.5	58.8	0.8	1.4
21-25	575	423	43.5	47.3	1.1	1.1
≥26	498	353	24.1	65.2	0.6	1.5
Average						
0 -12.7	514	687	52.5	48.0	1.0	1.0
12.8-17.2	675	501	25.2	47.9	0.5	1.0
17.3-22.2	662	537	21.1	52.1	0.4	1.1
22.3-54.0	695	492	38.8	54.9	0.7	1.1
Social life						
Frequency of social gatherings						
More than once a week	1,152	1,011	34.7	48.5	1.0	1.0
Once a week	665	522	16.5	78.5	0.5	1.6
At least once a month	419	325	38.2	21.5	1.1	0.4
Less than once a month	310	359	58.1	41.8	1.7	0.9
Social life						
Very satisfying	1,036	811	23.2	30.8	1.0	1.0
Rather satisfying	1,166	935	30.9	51.3	1.3	1.7
Unsatisfying	344	471	72.7	82.8	3.1	2.7
Member of social group						
No	1,314	1,014	28.9	41.4	1.0	1.0
Yes	1,232	1,203	38.1	58.2	1.3	1.4

TABLE 7 (continued)

LIFESTYLE HABIT	Person-months[1] 65-74 years n	Person-months[1] ≥75 years n	Incidence density[2] 65-74 years n	Incidence density[2] ≥75 years n	Incidence density ratio 65-74 years	Incidence density ratio ≥75 years
Own cat or dog						
No	2,104	2,036	33.7	50.1	1.0	1.0
Yes	442	181	31.7	55.2	0.9	1.1
Smokes cigarettes						
No	1,920	1,857	32.8	50.6	1.0	1.0
Yes	626	360	35.1	50.0	1.1	1.0
Use of alcohol						
Frequency of alcohol consumption						
Don't drink	700	909	37.1	50.6	1.0	1.0
Less than once a month	499	418	32.1	55.0	0.9	1.1
One or more times a month	323	228	40.2	92.1	1.1	1.8
At least once a week	616	328	34.1	45.7	0.9	0.9
Every day	408	322	22.1	21.7	0.6	0.4
Number of alcoholic drinks						
Short-term						
0	1,509	1,513	36.4	54.2	1.0	1.0
1-3	447	351	26.8	57.0	0.7	1.1
4-10	348	181	28.7	33.1	0.8	0.6
11-70	242	172	33.1	23.3	0.9	0.4
Average						
0	913	1,017	39.4	45.2	1.0	1.0
0.1-0.3	259	233	23.2	77.3	0.6	1.7
0.4-2.8	632	514	38.0	62.3	1.0	1.4
2.9-70.0	742	453	25.6	35.3	0.6	0.8

Notes:
(1) A person-month of follow-up was equivalent to four weeks
(2) Number of falls per 1,000 person-months
(3) Totals for each variable may differ because of missing data.

TABLE 8

ASSOCIATIONS BETWEEN HEALTH STATUS AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD. COMPARISON BY AGE GROUP

HEALTH STATUS	Person-months[1] 65-74 years n	≥75 years n	Incidence density[2] 65-74 years n	≥75 years n	Incidence density ratio 65-74 years	≥75 years
TOTAL	2,546[3]	2,217[3]	34.2	49.6	.	.
Self-reported health						
Self-perceived health status						
Excellent	846	665	33 1	43 6	1 0	1 0
Good	1,041	879	27 9	53 5	0 8	1 2
Average	551	534	36 3	33 7	1 1	0 8
Poor	108	139	74 1	129 5	2 2	3 0
Satisfaction with health						
Very satisfied	1,084	859	33.2	44 2	1 0	1 0
Somewhat satisfied	1,034	797	20 3	43 9	0.6	1 0
Not too satisfied	334	429	56 9	49 0	1 7	1 1
Not at all satisfied	94	132	95.7	136 4	2 9	3 1
Two-week disability						
Bed-days						
Short-term						
No	2,414	2,088	34 0	51 7	1 0	1 0
Yes	132	129	22.7	31 0	0.7	0 6
Average						
None	2,044	1,782	33 8	48 8	1 0	1 0
Less than half	429	366	25 6	49 2	0 8	1 0
Half or more	73	69	68.5	101 4	2 0	2 1
Activity-limitation days						
Short-term						
No	2,210	1,907	29 4	43 0	1 0	1 0
Yes	335	310	59 7	96.8	2.0	2 3
Average						
None	1,514	1,274	30 4	33.8	1 0	1 0
Less than half	854	746	31.6	60.3	1 0	1 8
Half or more	178	197	67.4	121 8	2 2	3 6
Symptoms						
Dizziness on standing						
Short-term						
No	2,390	2,048	32 6	49 3	1 0	1 0
Yes	150	150	53.3	73 3	1 6	1 5
Average						
None	1,906	1,612	31 0	47 8	1 0	1 0
Less than half	458	440	39 3	54 5	1 3	1 1
Half or more	182	165	44 0	66.7	1 4	1 4
Other dizziness						
Short-term						
No	2,326	1,923	28 4	46 3	1 0	1 0
Yes	214	275	88.8	83.6	3 1	1 8
Average						
None	1,825	1,284	24.1	33 5	1 0	1 0
Less than half	525	648	41 9	69 4	1.7	2 1
Half or more	196	285	96.9	84 2	4 0	2.5

TABLE 8 (continued)

HEALTH STATUS	Person-months[1] 65-74 years n	≥75 years n	Incidence density[2] 65-74 years n	≥75 years n	Incidence density ratio 65-74 years	≥75 years
Palpitations						
Short-term						
No	2,370	1,978	32.5	52 6	1 0	1 0
Yes	170	220	47.1	36 4	1 4	0 7
Average						
None	2,045	1,574	30 8	45 7	1 0	1 0
Less than half	349	423	37 2	73 3	1 2	1 6
Half or more	152	220	59 2	40 9	1 9	0 9
Short of breath at rest						
Short-term						
No	2,337	2,045	31 2	51 3	1 0	1 0
Yes	203	153	59 1	45 8	1 9	0 9
Average						
None	2,015	1,731	31 3	50.3	1 0	1 0
Less than half	363	364	24.8	63 2	0 8	1 3
Half or more	168	122	77.4	16.4	2.5	0.3
Short of breath on exertion						
Short-term						
No	2,009	1,776	29 4	50 1	1 0	1 0
Yes	530	422	49.1	54.5	1 7	1.1
Average						
None	1,333	1,069	30 8	41.2	1 0	1 0
Less than half	644	711	26.4	59.1	0 9	1 4
Half or more	569	437	47.5	59 5	1 5	1 4
Number of symptoms						
Short-term						
0	1,750	1,478	27.4	46 7	1 0	1.0
1	460	406	32.6	56.7	1 2	1.2
2	232	210	56.0	47 6	2.0	1.0
3-5	104	123	86.5	81 3	3 2	1.7
Average						
0	856	658	23 4	33.4	1.0	1 0
0 1-0.3	433	352	43.9	48.3	1 9	1.4
0.4-0.9	552	518	16.3	46.3	0.7	1 4
1 0-5.0	705	689	45.4	65 3	1.9	2 0
Chronic health problems						
High blood pressure						
No	1,565	1,229	30.7	47.2	1 0	1 0
Yes	969	952	38.2	56 7	1 2	1.2
Heart Trouble						
No	1,861	1,420	37.1	50.0	1.0	1 0
Yes	624	773	25 6	53.0	0.7	1.1
Diabetes						
No	2,333	1,942	33.0	51.0	1 0	1 0
Yes	201	251	39 8	51.8	1.2	1.0
Respiratory disorder						
No	2,174	1,864	29.0	47.2	1.0	1 0
Yes	372	353	59.1	68.0	2.0	1.4
Arthritis or rheumatism						
No	1,209	928	32.3	47.4	1.0	1.0
Yes	1,337	1,289	34.4	52.8	1.1	1.1

TABLE 8 (continued)

HEALTH STATUS	Person-months[1] 65-74 years n	Person-months[1] ≥75 years n	Incidence density[2] 65-74 years n	Incidence density[2] ≥75 years n	Incidence density ratio 65-74 years	Incidence density ratio ≥75 years
Vision problem						
No	1,938	1,441	25.3	51.4	1.0	1.0
Yes	608	776	59.2	49.0	2.3	1.0
Hearing problem						
No	2,122	1,545	33.5	53.1	1.0	1.0
Yes	424	672	33.0	44.6	1.0	0.8
Stroke						
No	2,386	2,041	32.7	50.0	1.0	1.0
Yes	160	176	43.8	56.8	1.3	1.1
Other long-term problem						
No	1,568	1,449	36.4	38.0	1.0	1.0
Yes	978	768	28.6	74.2	0.8	2.0
Number of chronic health problems						
0	419	289	38.2	31.1	1.0	1.0
1	685	574	32.1	50.5	0.8	1.6
2	787	570	29.2	33.3	0.8	1.1
3	352	510	36.9	66.7	1.0	2.1
4	219	143	27.4	49.0	0.7	1.6
5-7	84	131	71.4	106.9	1.9	3.4
Long-term disability						
Experiences trouble:						
Walking 400 meters						
No	2,063	1,558	28.6	39.2	1.0	1.0
Yes	483	659	53.8	77.4	1.9	2.0
Walking up and down stairs						
No	1,728	1,413	27.2	46.0	1.0	1.0
Yes	818	804	46.5	58.5	1.7	1.3
Carrying a 12-pound object						
No	1,910	1,268	30.4	40.2	1.0	1.0
Yes	636	949	42.5	64.3	1.4	1.6
Standing for long periods						
No	1,923	1,390	26.5	43.2	1.0	1.0
Yes	623	827	54.6	62.9	2.1	1.5
Bending down						
No	1,959	1,411	27.6	38.3	1.0	1.0
Yes	587	806	52.8	72.0	1.9	1.9
Cutting toenails						
No	1,871	1,228	31.5	30.9	1.0	1.0
Yes	663	989	39.2	74.8	1.2	2.4
Using fingers to grasp						
No	2,178	1,841	26.6	41.3	1.0	1.0
Yes	368	376	73.4	95.7	2.8	2.3
Reaching						
No	2,320	1,860	31.5	38.2	1.0	1.0
Yes	226	357	53.1	114.8	1.7	3.0
Number of disabilities						
0	1,068	672	26.2	17.9	1.0	1.0
1-2	815	597	30.7	55.3	1.2	3.1
3-5	399	541	30.1	59.1	1.1	3.3
6-8	264	407	75.8	86.0	2.9	4.8
Fell in year preceding initial interview						
No	1,910	1,677	31.4	39.4	1.0	1.0
Yes	636	540	39.3	85.2	1.3	2.2

TABLE 8 (continued)

HEALTH STATUS	Person-months[1] 65-74 years n	≥75 years n	Incidence density[2] 65-74 years n	≥75 years n	Incidence density ratio 65-74 years	≥75 years
Follow-up fall						
Short-term						
No	2,418	2,075	31 0	45 8	1 0	1 0
Yes	128	142	78 1	120 0	2 5	2 6
Average						
None	1,663	1,467	26 5	29 3	1 0	1 0
Less than half	751	612	49 3	83.3	1 9	2 8
Half or more	132	138	30 3	130.4	1 1	4 6
Quetelet Index						
14 19-21 33	551	592	30 9	57 4	1 0	1 0
21.36-23.529	611	613	37 6	42.4	1 2	0 7
23.5-25 965	539	542	16 7	57 2	0 5	1 0
25.97-41 51	797	354	38 9	50.8	1 3	0 9
Missing	48	116	104.2	25.9	3 4	0 5

Notes: (1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months
(3) Totals for each variable may differ because of missing data.

TABLE 9

ASSOCIATIONS BETWEEN USE OF MEDICATION AND FALLS SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD COMPARISON BY AGE GROUP

MEDICATION	Person-months[1] 65-74 years n	Person-months[1] ≥75 years n	Incidence density[2] 65-74 years n	Incidence density[2] ≥75 years n	Incidence density ratio 65-74 years	Incidence density ratio ≥75 years
Total	2,546[3]	2,217[3]	34.2	49.6	-	-
Medicine for arthritis						
Short-term						
No	2,225	1,818	30.6	50.6	1.0	1.0
Yes	317	391	54.1	51.2	1.8	1.0
Average						
None	2,007	1,608	29.9	51.0	1.0	1.0
Less than half	236	203	50.8	34.5	1.8	0.7
Half or more	303	406	42.9	56.7	1.4	1.1
Other pain relievers						
Short-term						
No	2,306	2,010	30.8	47.3	1.0	1.0
Yes	236	198	59.3	85.9	1.9	1.8
Average						
None	1,949	1,603	25.7	47.4	1.0	1.0
Less than half	379	386	52.8	46.6	2.1	1.0
Half or more	218	228	68.8	78.9	2.7	1.7
Tranquilizers						
Short-term						
No	2,118	1,784	32.1	51.6	1.0	1.0
Yes	424	424	40.1	47.2	1.2	0.9
Average						
None	1,906	1,528	29.4	48.4	1.0	1.0
Less than half	186	239	53.8	33.5	1.8	0.7
Half or more	454	450	41.9	66.7	1.4	1.4
Medicine for blood pressure						
Short-term						
No	1,782	1,292	33.1	51.9	1.0	1.0
Yes	760	916	34.2	48.6	1.0	0.9
Average						
None	1,710	1,134	33.3	50.3	1.0	1.0
Less than half	69	157	29.0	51.0	0.9	1.0
Half or more	767	926	33.9	50.8	1.0	1.0
Medicine for the heart						
Short-term						
No	2,208	1,652	35.3	53.3	1.0	1.0
Yes	334	556	21.0	43.2	0.6	0.8
Average						
None	2,115	1,486	34.0	49.8	1.0	1.0
Less than half	97	169	72.2	76.9	2.1	1.5
Half or more	334	562	18.0	44.5	0.5	0.9
Antibiotics						
Short-term						
No	2,499	2,155	34.0	46.9	1.0	1.0
Yes	43	53	0.0	207.5	-	4.4
Average						
None	2,340	2,086	32.9	47.5	1.0	1.0
Less than half	181	86	44.2	34.9	1.3	0.7
Half or more	25	45	0.0	222.2	-	4.7

TABLE 9 (continued)

MEDICATION	Person-months[2] 65-74 years n	≥75 years n	Incidence density[3] 65-74 years n	≥75 years n	Incidence density ratio 65-74 years	≥75 years
Laxatives						
Short-term						
No	2,293	1,913	32 3	48 1	1 0	1 0
Yes	249	295	44 2	67 8	1 4	1 4
Average						
None	2,030	1,717	32 0	50 1	1 0	1 0
Less than half	238	212	37 8	42 5	1 2	0 8
Half or more	278	288	39 6	59 0	1 2	1 2
Stomach remedies						
Short-term						
No	2,340	1,960	32 9	51 5	1.0	1 0
Yes	202	248	39 6	44 4	1 2	0 9
Average						
None	2,097	1,753	33 9	52 5	1 0	1 0
Less than half	230	225	30 4	40 0	1 0	0 8
Half or more	219	239	32 0	46.0	0.9	0 9
Cough or cold remedies						
Short-term						
No	2,440	2,152	32 4	49.7	1 0	1 0
Yes	102	56	58.8	89 3	1 8	1 8
Average						
None	2,163	1,986	34.2	45 8	1 0	1 0
Less than half	305	204	26 2	73 5	0 8	1 6
Half or more	78	27	38.5	222 2	1 1	4 9
Vitamins or minerals						
Short-term						
No	1,834	1,405	30 0	47 0	1 0	1 0
Yes	709	803	42.3	57.3	1.4	1 2
Average						
None	1,597	1,201	30.7	41 6	1 0	1.0
Less than half	250	220	20.0	50 0	0 7	1 2
Half or more	699	796	44.3	64.1	1.4	1.5
Anticoagulants						
Short-term						
No	2,391	1,986	33.9	50.4	1 0	1.0
Yes	150	222	26.7	54.1	0 8	1 1
Average						
None	2,371	1,913	33.7	48.6	1.0	1 0
Less than half	33	87	30.3	57 5	0.9	1.2
Half or more	142	217	28.2	64.5	0.8	1.3
Medicine for diabetes						
Short-term						
No	2,359	2,043	33 5	51.4	1 0	1 0
Yes	182	165	33.0	42.4	1 0	0.8
Average						
None	2,353	2,029	33 6	50.8	1 0	1.0
Less than half	11	15	0.0	66.7	-	1.3
Half or more	182	173	33 0	46.2	1 0	0.9
Medicine for asthma or COPD[4]						
Short-term						
No	2,405	2,096	32.4	51.0	1.0	1.0
Yes	136	112	51 5	44.6	1.6	0.9
Average						
None	2,379	2,072	31.9	50.7	1.0	1.0
Less than half	48	43	62.5	46.5	2.0	0 9
Half or more	119	102	50.4	68.6	1 6	1.4

TABLE 9 (continued)

MEDICATION	Person-months[1] 65-74 years n	Person-months[1] ≥75 years n	Incidence density[2] 65-74 years n	Incidence density[2] ≥75 years n	Incidence density ratio 65-74 years	Incidence density ratio ≥75 years
Other major medication						
Short-term						
No	2,264	1,975	34.0	52.2	1.0	1.0
Yes	277	233	28.9	38.6	0.9	0.7
Average						
None	2,174	1,875	34.0	52.3	1.0	1.0
Less than half	108	130	46.3	61.5	1.4	1.2
Half or more	264	212	22.7	28.3	0.7	0.5
Other minor medication						
Short-term						
No	2,376	2,090	30.7	52.2	1.0	1.0
Yes	165	117	72.7	25.6	2.4	0.9
Average						
None	2,267	1,980	30.9	52.0	1.0	1.0
Less than half	135	124	14.8	56.5	0.5	1.1
Half or more	144	113	90.3	17.7	2.9	0.3
Number of medications						
Short-term						
0	512	324	19.5	30.9	1.0	1.0
1	757	454	30.4	66.1	1.6	2.1
2	702	622	37.0	41.8	1.9	1.4
3	316	395	50.6	50.6	2.6	1.6
4	172	269	23.3	70.6	1.2	2.3
5-8	87	153	69.9	45.8	3.6	1.5
Average						
0 -0.9	696	396	24.4	45.5	1.0	1.0
1.0-1.8	768	542	31.3	35.1	1.3	0.8
1.9-2.7	621	559	40.3	50.1	1.7	1.1
2.8-8.5	461	720	41.2	65.3	1.7	1.4

Notes:
(1) A person-month of follow-up was equivalent to four weeks.
(2) Number of falls per 1,000 person-months
(3) Totals for each variable may differ because of missing data.
(4) Chronic obstructive pulmonary disease

TABLE 10

ASSOCIATIONS BETWEEN THE USE OF HEALTH SERVICES AND FALL SUSTAINED DURING THE 48-WEEK FOLLOW-UP PERIOD. COMPARISON BY AGE GROUP

USE OF HEALTH SERVICES	Person-months[1] 65-74 years n	Person-months[1] ≥75 years n	Incidence density[2] 65-74 years n	Incidence density[2] ≥75 years n	Incidence density ratio 65-74 years	Incidence density ratio ≥75 years
TOTAL	**2,546[3]**	**2,217[3]**	**34.2**	**49.6**	.	.
Number of ophthalmologist consultations						
0	1,014	775	26.6	41 3	1.0	1 0
1	1,128	934	32 8	64 2	1.2	1 6
2	226	269	48.7	26.0	1.8	0.6
3	36	83	27.8	48.2	1.0	1.2
4-50	142	156	63 3	57.7	2.4	1 4
Number of physician consultations						
0-1	731	505	27.4	43.6	1.0	1.0
2-3	762	552	39.4	25.4	1.4	0.6
4-5	492	481	18.3	52.0	0.7	1.2
6-10	359	427	27.9	53.9	1.0	1 2
12-72	202	252	79.2	111.1	2.9	2.5
Consultated other health professionals						
No	1,874	1,549	28.8	40.0	1.0	1.0
Yes	672	668	46.1	74.9	1.6	1.9
Hospitalized in 12 months preceding initial interview						
No	2,054	1,720	31.6	46.5	1.0	1 0
Yes	492	497	40.7	64.4	1.3	1.4
Received homecare						
No	2,390	1,757	31.0	46.7	1.0	1.0
Yes	156	460	70.5	65.2	2.3	1.4

Notes: [1] A person-month of follow-up was equivalent to four weeks.
[2] Number of falls per 1,000 person-months.
[3] Totals for each variable may differ because of missing data.

APPENDIX VIII

DESCRIPTION OF FALL PREVENTION INTERVENTIONS

APPENDIX VIII

DESCRIPTION OF FALL PREVENTION INTERVENTIONS

	DESCRIPTION OF INTERVENTION	EVALUATION
Community-Based Interventions		
Obonyo (1984)	The intervention included (i) an informal home safety audit and encouragement to modify specific hazards; and either of (ii) an intensive "long" (up to 12 visits) course of home-based physical therapy including a range of exercises to improve posture, balance and performance of activities of daily living; or (iii) a "short" (no more than 3 visits) course of exercise.	100 elderly persons seen in community medical practices in Birmingham, England who had fallen in the previous four weeks were randomly assigned to two treatment groups. Both groups received component (i) of the intervention. One group received the more intensive exercise program and the other received the less intensive program. After four months, there was no difference in outcome between the two groups.
Alkalay et al. (1984)	A falls prevention program was carried out in a small middle class rural community in central Israel. Seventy-four persons in the community were over the age of 65. The program included group sessions about the causes and prevention of falls (lectures, slides, discussion). Also the family physician and nurse explained to each patient the importance of reducing their intake of nonessential drugs (tranquillizers and sleeping pills).	The incidence of falls in the six months after the program dropped by 72% (from 18 falls to 5). There was a 46% reduction in the use of tranquillizers and hypnotics, and repairs and alterations to prevent accidents were made in several homes.
McCabe (1985)	Community nurses in Coventry, England, attempted to prevent falls and "long-lies" after falls in 110 housebound elderly referred by their general practitioners as being at high risk of falls. They assessed general health and functional disability, safety of the home environment, use of medication, dizziness, and blood pressure. They provided advice and counselling on how to rise after a fall, on alarm and alerting devices, and on the development of a social support system. In addition they provided practical help as required, and referred to health or social service professionals when necessary.	There was no evaluation of the impact of the program on the frequency of falls. However, the nurse noted that the intervention was welcomed if it was confined to medical advice on nutrition or use of medication. Advice on home modifications was not well received for a variety of reasons (the client did not view home alteration as a nurse's role, hazards identified were actually well-negotiated by the client because of their familiarity with the hazards clients did not want to accept or view themselves as being at risk). Interventions suggested to prevent "long lies" were not useful because everything acceptable to client had already been done. The investigator recommended that preventive interventions be preceded by counselling, and that they be offered by a trusted individual known to clients.

	DESCRIPTION OF INTERVENTION	EVALUATION
Hornbrook (1986) in Nevitt (1987)	A multiple risk factor intevention program included (i) a home safety assessment and a home safety publication; (ii) an assessment of risk factors for falls including performance measures of balance and strength; (iii) encouragement and assistance in completing safety repairs and modifications identified in the home audit; (iv) a series of four falls prevention workshops covering exercises to improve strength, balance, flexibility, posture and conditioning, drug safety and calcium intake; development of social support skills and an environment for group reinforcement; and falls risk awareness and risk control; and (v) guidelines for preventive health care, and screening and follow-up care for vision and hearing problems.	2,500 elderly households from the Portland, Oregon Kaiser Permanente Medicare population were randomized to intervention or control group. Both groups received components (i) and (ii) of the intervention and the experimental group received in addition the other three components (iii, iv, v). Both groups were followed for 24 months to ascertain falls, injury, and fall-related medical care utilization. Preliminary results indicate that no consistent differences between groups have emerged in the incidence and prevalence of falls and fall-related injuries.
Olson & Malloy (1988)	Twenty-one home health aides working in a federally funded program administered by a senior citizens center in a southern US city, were provided with in-service training to raise awareness of fall potential in their homebound patients, to teach them how to assess the home environment for hazards, and to instruct them about reporting pertinent information to appropriate health care professionals.	-
Clinic-Based Interventions		
Wolf-Klein et al. (1988)	A "Falls Clinic" was established at the Jewish Institute for Geriatric Care in Long Island, New York. Thirty-six patients received intensive and coordinated medical management from a geriatrician, neurologist, cardiologist, and physiatrist to identify and treat potential etiologic factors for falls such as medication, cardiac arrythmias, hypotension, and visual impairment. In addition, treatment included home visits by a trained occupational therapist to assess and adapt the home environment and to educate patients, families and caregivers regarding appropriate equipment and precautions.	A before-after comparison of the number of patients who fell showed that 23% of patients fell during the 12 months post intervention follow-up, compared to 100% before the intervention. The investigators suggested that falls are a multidisciplinary issue, and recommended a team approach for successful management.
Institution-Based Interventions		
Feist (1978)	A fall prevention nursing intervention was implemented for institutionalized elderly. The components included (i) increased staff during high risk evening shifts and a floor aid to respond to calls for help; (ii) attempts to reduce dose and frequency of tranquillizer use; (iii) floor length garments and flimsy footwear eliminated for ambulatory patients; and (iv) staff were instructed to provide assistance promptly.	-

	DESCRIPTION OF INTERVENTION	EVALUATION
Blumenthal & Davie (1980)	Several steps were taken to reduce the risk of aggravating dizziness and falling in a geriatric psychiatric clinic. These included (i) thorough medical examination before treatment; (ii) reducing drug regimes to a minimum before beginning psychotropic medication; (iii) initiating psychotropic drugs at low doses and increasing dosage slowly; and (iv) evaluating each patient for orthostatic hypotension at every clinic visit.	-
Innes & Turman (1983)	A fall prevention nursing program for institutionalized elderly was tested at St. Francis Memorial Hospital in 1982. The components included (i) a special nursing care plan for identifying and "flagging" patients at high risk of falling (colour stickers on patient's door, call button and patient record); (ii) education and ongoing reminders to patient and family of the risk of falls; (iii) preparing and maintaining a safe environment (side rails up, bed in low position, unnecessary furniture removed, call light within easy reach, night light working, closing door to reduce noise level); and (iv) assessing pharmacologic effects. The nursing department conducted an in-service program to educate staff about the fall prevention program. Because the fall rate had risen by 1985, the program was reintroduced and in addition to the other component, included a new safety alarm device a battery-operated alarm on the patient's leg which alerted staff that the patient was getting out of bed.	A before-after comparison showed that there were 50% fewer falls recorded after the program than in the same month one year before. Innes (1985) reported that by 1985, the fall rate had risen again because the nursing care plan was not used routinely (it was too complex), because the "flagging" system was not working, and because new or "per diem" nurses were not kept informed of the preventive program. A before-after comparison of a reintroduction of the program in 1985 showed that during the first quarter of 1985 (after reintroduction) there was a 44% decrease in the number of falls compared to the first quarter of 1984.
Krishna & Cleave (1983)	A falls education program was delivered to the staff in a geriatric hospital. The program included two one-hour lectures on the causes and prevention of falls, a video film on patient falls, and informed discussion of falls in all monthly and weekly patient-oriented conferences and seminars.	A before-after comparison showed the incidence of falls decreased from 32 falls per 1,000 patient-days to 20 falls per 1,000 patient-days six months after the education program. In addition, the program led to elimination of bedtime hypnotics, proper use of neuroleptics and antihypertensives, and a decrease in the number of drugs per patient from 7 to 4.
Gray-Vickrey (1984)	A one-hour educational program on safety was integrated into discharge planning for the hospitalized elderly. The program focused on identification of hazards in the home which could precipitate a fall, and on how to improve safety of the home.	Eleven patients were tested before and after receiving the program. There was a 34% mean improvement in patient's knowledge of fall hazards. In addition the program also increased socialization because participants shared their fears, problems, and solutions with nurses and on another. Refresher classes may be necessary to ensure long-term memory.

	DESCRIPTION OF INTERVENTION	EVALUATION
Fife et al. (1984)	An individualized fall prevention nursing intervention "Code Orange for Success" was implemented in a community hospital in Cleveland, Ohio. An individualized program was developed for patients at high risk of falling, based on an informal risk analysis. (Patients identified as being at high risk had an orange symbol placed on the nursing care plan.)	The program was implemented in two of four units that were comparable in census and age of patients. At the end of 12 weeks, there was no difference in the number of falls reported in the experimental and control units.
Rainville (1984)	Patients in an experimental unit of St.Mary's Hospital in Streator, Illinois were assessed for fall risk upon admission and a "standard care plan" was implemented for those at high risk. The program components included (i) patient and family education on fall hazards in the hospital; (ii) increased staff awareness of the high risk patient; and (iii) a special care protocol focusing on transfer to and from bed.	A before-after comparison showed a 10% decrease in falls, indicating that the fall prevention program had positive results.
Hernandez & Miller (1986)	A fall prevention program was instituted at a geriatric psychiatric unit. It included the development of simple fall precaution guidelines to rate patients by the degree of observation they would need to prevent falls (preventive, modified, and strict). The first key to successful use of the plan was familiarization with the risk factors for falls by staff, as well as each patient's history and current condition. The second key was specific, frequent and thorough communication among nursing staff members, and the third was frequent reassessment of the patient's required degree of observation.	A before-after comparison showed that falls were reduced over 82% during a two-year period.
Hill et al. (1988)	Based on an analysis of the characteristics of fallers in 1986, nurses at the Veterans Administration Medical Center of Fort Wayne Indiana, instituted a fall prevention intervention. Patients at high risk of falling were identified at admission, and sample nursing care plans containing selected nursing diagnosis and interventions were placed in notebooks in the conference room for easy reference. Patient and nurse awareness and education programs were also instituted.	Comparison of patient falls before and after the intervention indicated a trend toward greater patient safety and increased staff awareness. Consciousness raising had a positive effect on increasing the accuracy in assessment and individualization of patient care plans.

	DESCRIPTION OF INTERVENTION	EVALUATION
Dubner & Creech (1988)	An infrared scanning system was installed in an 18-bed psychogeriatric unit at St. Albans Hospital in Radford, Virginia, to signal the nursing station when a patient left his bed. The system was usually activated only during the night shift. In addition, standing blood pressure was evaluated prior to administration of psychotropic medication, and medication was withheld if the patient complained of dizziness or unsteadiness.	A before-after comparison showed that there was a statistically significant reduction in the mean number of falls per month after installation of infrared scanning.
Rubenstein et al. (1990)	Within seven days of a fall, ambulatory subjects living in a long-term residential care facility for elderly persons in the Jewish Home for the Aging of Greater Los Angeles, received a comprehensive post fall assessment. This included a detailed physical examination and environmental assessment by a nurse practitioner; laboratory tests; electrocardiogram; and 24-hour Holter monitoring. (Probable) causes of falls, identified risk factors, and therapeutic recommandations were given to the patient's primary physician.	In a randomized clinical trial 160 subjects were assigned to receive either assessment (n=79) or usual care (control group, n=81). Through the assessment, many remediable problems (i.e. weakness, environmental hazards, orthostatic hypotention, drug side effects, gait dysfunction) were detected. At the end of the 2-year follow-up, this intervention group had 26% fewer hospitalizations and a 52% reduction in hospital days, compared with controls. They also had 9% fewer falls and 17% fewer deaths, but these trends were not statistically significant.

REFERENCES

Alkalay L, Alcalay J, Sherry C. Reducing falls among the elderly in a small community. *Practitioner* 1984;228:698.

Blumenthal MD, Davie JW. Dizziness and falling in elderly psychiatric outpatients. *Am J Psychiatry* 1980;137:203-6.

Dubner NP, Creech R. Using infrared scanning to decrease nighttime falls on a psychogeriatric unit. *Hosp Community Psychiatry* 1988;39:79-81.

Feist RR. A survey of accidental falls in a small home for the aged. *J Gerontol Nurs* 1978;4:15-7.

Fife DD, Solomon P, Stanton M. A risk/falls program: code orange for success. *Nurs Manage* 1984;15:50-3.

Gray-Vickrey M. Education to prevent falls. *Geriatr Nurs* 1984;5:179-83.

Hernandez M, Miller J. How to reduce falls in the elderly. *Geriatr Nurs* 1986;7:97-102.

Hill BA, Johnson R, Garrett BJ. Reducing the incidence of falls in high risk patients. *J Nurs Adm* 1988;18:24-8.

Hornbrook (1986) in Nevitt MC. Health promotion and aging. Falls and instability in the elderly: host and behavioral factors. A background paper prepared for the Surgeon General's Workshop on Health Promotion and Aging. Department of Medicine and Epidemiology, University of California, 1987.

Innes EM, Turman WG. Evaluation of patient falls. *QRB* 1983;9:30-5.

Krishna KM, Van Cleave RJ. Decrease in the incidence of patient falls in a geriatric hospital after educational programs. *J Am Geriatr Soc* 1983;31:187.

McCabe F. Mind you don't fall. *Nurs Mirror* 1985;160:52-6.

Obonyo T, Drummond M, Isaacs B. Domiciliary physiotherapy for old people who have fallen. *Rehabil Med* 1984;5:157-60.

Olson M, Malloy C. Falls: a challenge to home health aides. *Home Healthc Nurse* 1988;5:26-32.

Rainville NG. Effect of an implemented fall prevention program on the frequency of patient falls. *QRB* 1984;10:287-91.

Rubenstein LZ, Robbins AS, Josephson KR, Schulman BL, Osterweil D. The value of assessing falls in an elderly population: A randomized clinical trial. *Ann Int Med* 1990;113:308-16.

Wolf-Klein GP, Silverstone FA, Basavaraju N, Foley CJ, Pascaru A, Ma P. Prevention of falls in the elderly population. *Arch Phys Med Rehabil* 1988;69:689-91.