FALLS AMONG THE ELDERLY: RISK FACTORS AND PREVENTION STRATEGIES

by

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ABSTRACT

The occurrence of falls affects approximately one third to one half of seniors over the age of sixty-five and accounts for substantial morbidity, mortality, and disability. Falls that do not result in serious injury, hospitalization or death have the potential to affects seniors' socially and psychologically (e.g., loss of confidence, restriction of mobility, fear of falling) (Kane et al., 1989; Tideiksaar, 1989). Further, despite the low percentage of falls resulting in fractures, the absolute number of seniors that endure fractures taxes the health care system considerably (see, for example, Kellogg International Work Group, 1987). Thus, the provision of accurate information pertaining to the risk factors and preventive strategies for falls would seem essential in times of fiscal restraints.

Unfortunately, progression of knowledge within the area of falls prevention has been hampered primarily by many methodological and conceptual limitations. Additionally, no one data set or research study has been able to adequately deal with all of the issues and gaps that need to be addressed. Therefore, in order to obtain a better understanding of the "big picture" concerning falls, it would seem necessary to tap into multiple sources of data concerning fall information. Secondary data sources, in addition to the collection or primary data, were thus used to address specific gaps within the literature. Specifically, the distinction between one-time fallers and multiple fallers within different settings (e.g., community-based, institutional settings), the existence of effect modification within models, and the analysis of information at the national level pertaining to falls was conducted. Further, the testing of falls education classes and balance control exercise programs within gymnasiums and aquatic settings in the prevention of falls were examined. The data sets utilized for this analysis included the Survey on Ageing and Independence, the National Population Health Survey, data from the Program Needs Survey at Grand River Hospital:

Freeport Health Centre, and primary data collected from the completion of the intervention program for falls.

In the institutional setting, similar risk factors were obtained for one-time and multiple fallers. For example, use of psychotherapeutics, experiencing a health change within the last six months, medical diagnosis, impaired mobility and impaired transferring status maintained significance within the final model for time-to-first-fall, while a health change, impaired mobility and transferring status were the risk factors that predicted multiple fall status. Similarly, in the intervention study risk factors between one-time and multiple fallers were quite comparable. Being male, having support of family, a prior history of falling, and impairments in balance/balance confidence were the significant factors in time-to-first-fall. For multiple fallers, hours of sleep, heart conditions, experiencing an external injury within the previous year, and impaired balance/balance confidence were significant.

In the analysis of the Survey on Ageing and Independence several interaction terms maintained significance within the final models. Specifically, interaction terms between age and gender, age and activity limitations, and gender and home maintenance status were obtained within the model for internal injuries. The gender and home maintenance interaction was also obtained within the model for injuries external to the home. These findings suggest that interaction terms are of importance in determining the precise associations in the prediction of falls.

The examination of data at the national level revealed a number of risk factors for falls. General trends between the Survey on Ageing and Independence and the National Population Health Survey showed that being female, advanced age, and measures with respect to social support or homecare services predicted risk of falling; however, several variables that were not common to both data sets were also foand to predict risk. For example, medication use and impaired mobility was associated with fall risk in the National Population Health Survey, while homes in need of major repairs predicted risk within the Survey on Ageing and Independence. Therefore, although the two surveys were similar in several respects, the differences that exist offer great insight for future directions in the management of falls among seniors.

The intervention program for falls generally revealed that the seniors participating in the balance control programs experienced significantly less multiple falls, hospitalizations, fractures and deaths than the control group. Further, the experimental group significantly improved their balance and balance confidence after the intervention (Time 2) and at follow-up (Time 3) as compared to the control group. The results from this study warrant the further examination of the balance control programs within a gymnasium or pool setting, as part of a multidimensional risk abatement intervention in the prevention of falls.

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To my Mom and Dad, Shirley and Brian Fletcher, who taught me the importance of family, provided me with the utmost support and unconditional love, and who instilled me with the confidence to pursue all of my dreams.

To Mark ... my best friend and confidante ... thank you for always being in my corner.

Lastly, to my Noni, who showed me what successful aging was all about. With her as my example, I strive to live my life to the fullest, and only hope that I am able to do so with as much dignity and grace as she did.

Dedication

Dedicated to the memory of Christopher Brian Fletcher ...

This thesis is for you and for all the goals and dreams that you were not given the opportunity to accomplish. In your three short years of life, you showed the utmost courage and strength of character. No matter how brief your flame, your winning smile and heart of gold have been imprinted in my mind and soul for eternity. You touched my life beyond comparison and I regret being robbed the chance to grow with you as siblings and as friends. I love you Chrissy B ...

Fly, fly do not fear
Don't waste a breathe, don't shed a tear
Your heart is pure, your soul is free
Be on your way, don't wait for me
Above the universe you'll climb
On beyond the hands of time
The moon will rise, the sun will set
But I won't forget ...

Fly, fly little wing
Fly where only angels sing
Fly away, the time is right
Go now, find the light.

(J.J. Goldman & P. Galdston)

Table of Contents

List of Tables

List of Illustrations

CHAPTER 1: OVERVIEW OF FALLING AMONG SENIOR POPULATIONS

1.1: Magnitude of the Problem

Falls among elderly individuals account for substantial morbidity, mortality and disability, and thus constitute major health problems for seniors. It has been estimated that approximately one third of community-based seniors over the age of 65 fall each year (see, for example, Blake et al., 1988; Campbell et al., 1981; Campbell et al., 1988; Prudham & Evans, 1981; Tinetti et al., 1988). Prudham and Evans (1981) report that this rate increases to forty percent for seniors over the age of 80. Josephson et al. (1991) estimated that the annual rate of falls in community surveys of seniors living at home (Campbell et al., 1990B; Gabell et al., 1985; Perry, 1982; Robbins et al., 1989; Teno et al., 1990; Tinetti et al., 1988) was between 0.2 to 0.8 falls per person.

Falling is the leading cause of injury and the sixth leading cause of death in individuals over the age of 65 (Baker & Harvey, 1985). The Ontario Medical Association (1992) estimated that approximately 600 seniors (65 years of age and over) died each year between 1985 and 1990 as a result of falls. Seniors that do survive from falling often experience a number of complications including restricted activity, soft-tissue injuries or fractures (see, for example, Baker & Harvey, 1985; Gryfe et al., 1977; Tinetti, 1987). Although the majority of falls do not lead to serious injury, hospitalization, or death (Lilley et al., 1995; O'Loughlin et al., 1993; Tideiksaar & Kay, 1986), Tideiksaar (1989) and Kane et al. (1989) report that individuals may acquire impaired mobility from injury, fear, from a lack of self-confidence, or from restriction of ambulation, either self-imposed or imposed by family members, in an attempt to prevent subsequent falls (see also, Campbell et al., 1989; Tinetti et al., 1993B). The serious nature and consequence of non-injurious falls, such as fear of falling or lack of self-confidence, should not be underestimated (Brummel-Smith, 1990; Kiel, 1993).

For example, Nevitt et al. (1991) found that one third of seniors that had fallen reported reduced participation in social activities, while 16% of fallers reported limiting their usual activities because they feared subsequent falls. Further, Tinetti et al. (1988), found that approximately half of seniors that fell reported fear of falling, while one-quarter reported restricting their activity after a fall.

With respect to fractures and soft tissue injuries, approximately five percent of fall episodes result in fractures, while an additional five percent cause serious soft tissue injuries (see, for example, Gryfe et al., 1977; Tinetti, 1987). Both of these injuries may require hospitalization or immobilization for extended periods of time (Tinetti et al., 1988). Further, it has been found that elderly women experience higher fall rates than men and are also more likely to sustain fall-related fractures (see, for example, Sattin et al., 1990; Sjorgen & Bjornstig, 1991); however, older men have a higher rate of death as a result of falls (see, for example, Campbell et al., 1981; Hogue, 1982; Sattin et al., 1990). Approximately, 1 in 40 seniors are hospitalized as a result of their falls (Campbell et al., 1981). Gryfe et al. (1977) and Josephson et al. (1991) contend that approximately 50% of elderly individuals admitted to a hospital after a fall are alive one year later. Additionally, repeated falls are one of the factors that often lead to institutionalization of previously independent seniors (Dunn et al., 1993; Josephson et al., 1991; Kane et al., 1989). Sattin et al. (1990) report that approximately 50% of fall injury events that occurred within the home and required hospital admission, subsequently resulted in nursing home placement upon discharge. Kiel et al. (1991) concur with these findings, and report that one-time fallers, and more specifically repeated fallers (2 or more falls in the preceding year), were at greater risk of subsequent hospitalization, admission into nursing homes, and frequent contact with a physician than nonfallers, after controlling for age, gender, perceived health status, and difficulties with activities of daily living.

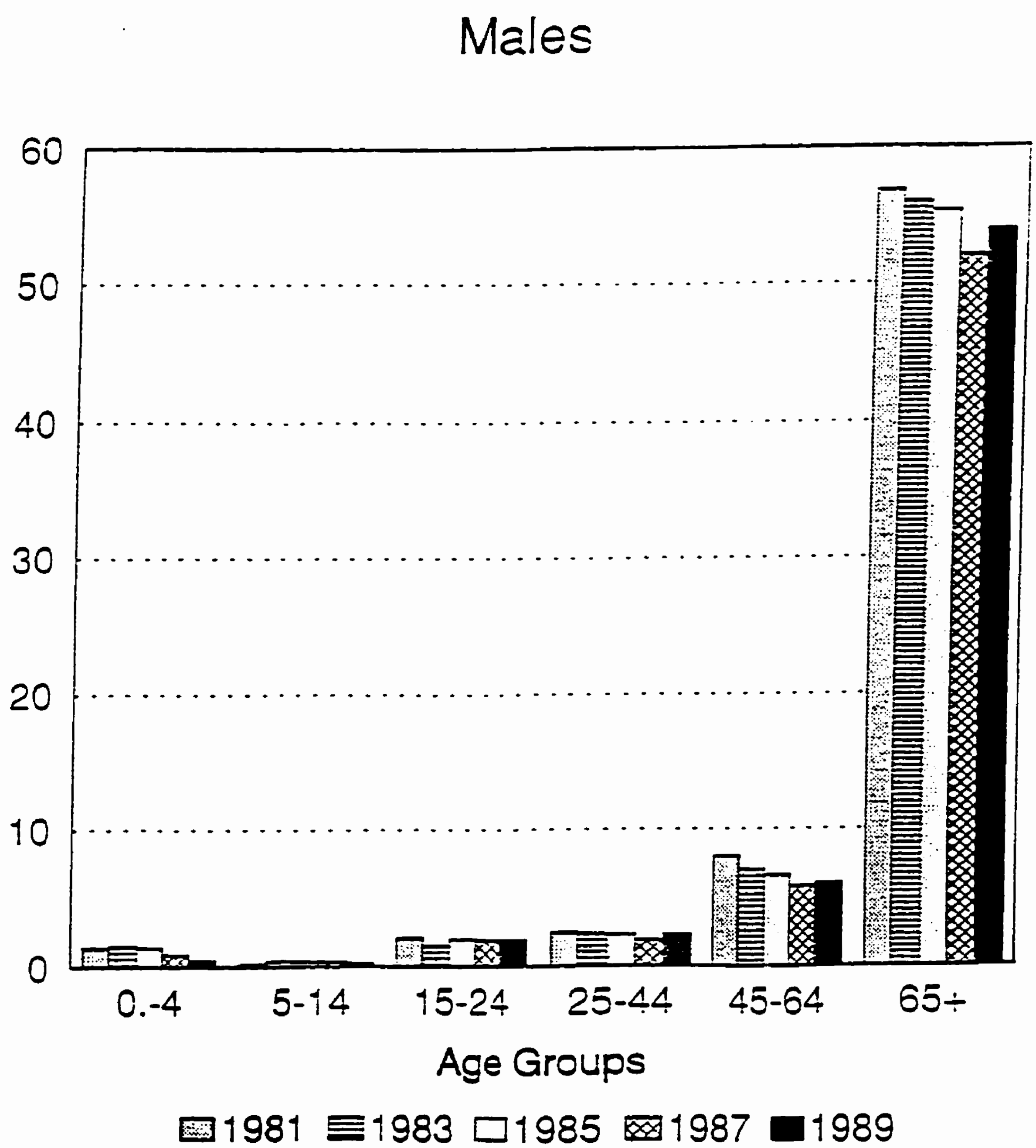
According to Riley (1992), a leading cause of hospitalization and death among seniors is the result of accidents, with accidental falls being the most frequent cause of accidents within the elderly population. In 1989, accidental falls accounted for 65% of all accident-related hospital separations (a separation form is completed whenever a patient is discharged or if a patient dies within the hospital), 72% of accident-related days of hospital care and 56% of accidental deaths for individuals over the age of 65 (Riley, 1992).

Figures 1.1A and 1.1B show that age-specific mortality rates for accidental falls were highest for those aged 65 years of age and over. Further, accidental falls were the principal cause of accidental deaths for both genders over the age of 65 (Table 1.1). Specifically, 48% and 65% of accidental deaths were accounted for by accidental falls for men and women, respectively in 1989. Among the higher age categories, the risk of death increased, with individuals aged 85 years of age being three times more likely to fall compared with those 65 to 74 years of age (Riley, 1992).

The mortality rates for accidental falls increased with age for males and females (Figures 1.2A & 1.2B). Age-specific mortality rates were somewhat higher for men in all age categories. According to Figure 1.2A & B, the fall-related mortality rate for individuals of both genders over 85 years of age was approximately 2 times greater than the rate for individuals between 74 and 84 (Riley, 1992).

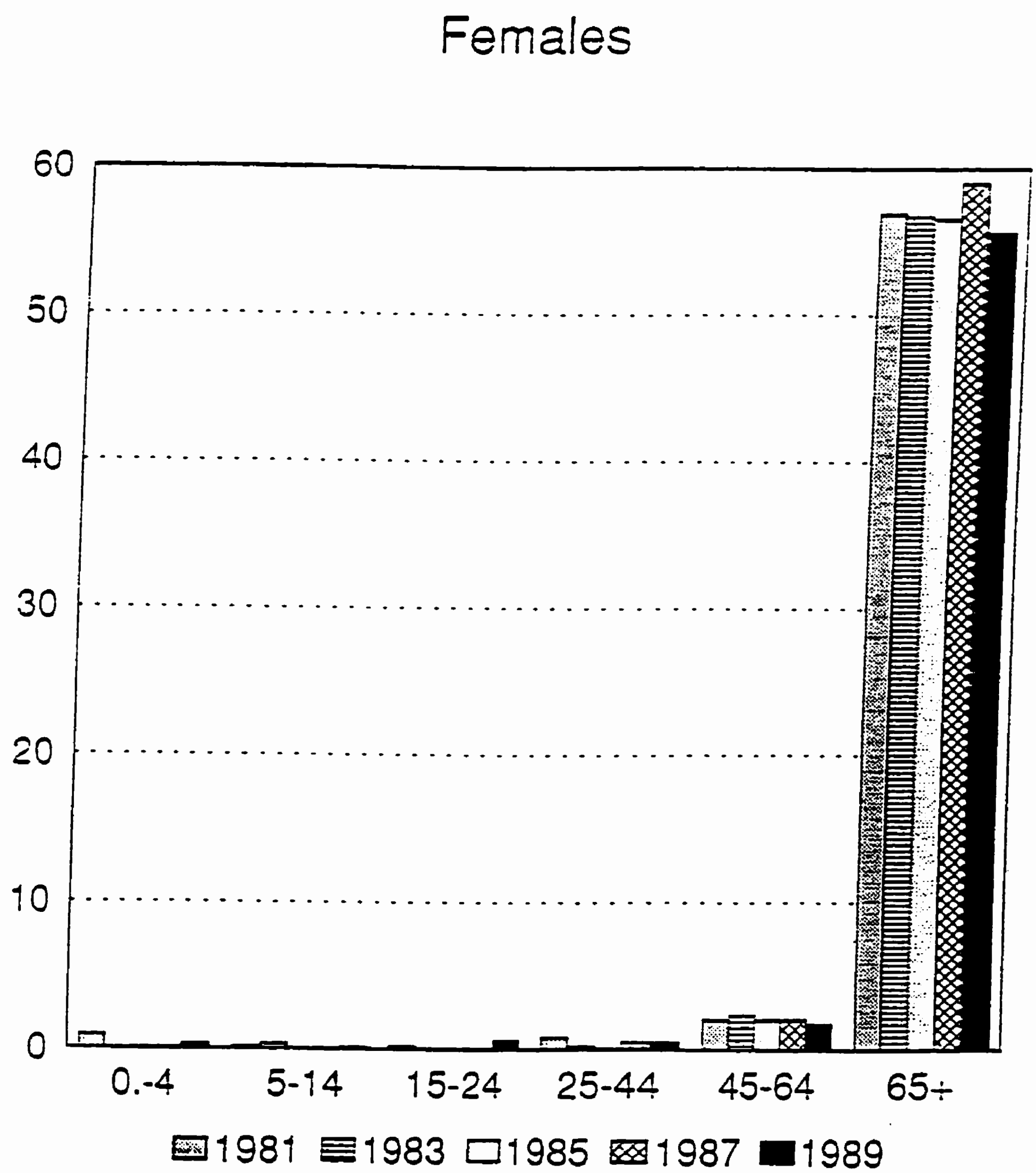
With respect to fall-related separations within hospitals, rates were higher for individuals over the age of 65 (Figures 1.3A & 1.3B) and they also tended to increase with age, as did the mortality rates. In 1989, accidental falls for men aged 65 and older accounted for 56% of all accident-related hospital separations, and 68% of accident-related hospital days. Conversely, accidental falls for women aged 65 and older accounted for 70% of accident-

Figure 1.1A: Mortality Rates for Accidental Falls for Males
(deaths per 100,000 population)



(Riley, 1992)

Figure 1.1B: Mortality Rates for Accidental Falls for Females
(deaths per 100,000 population)



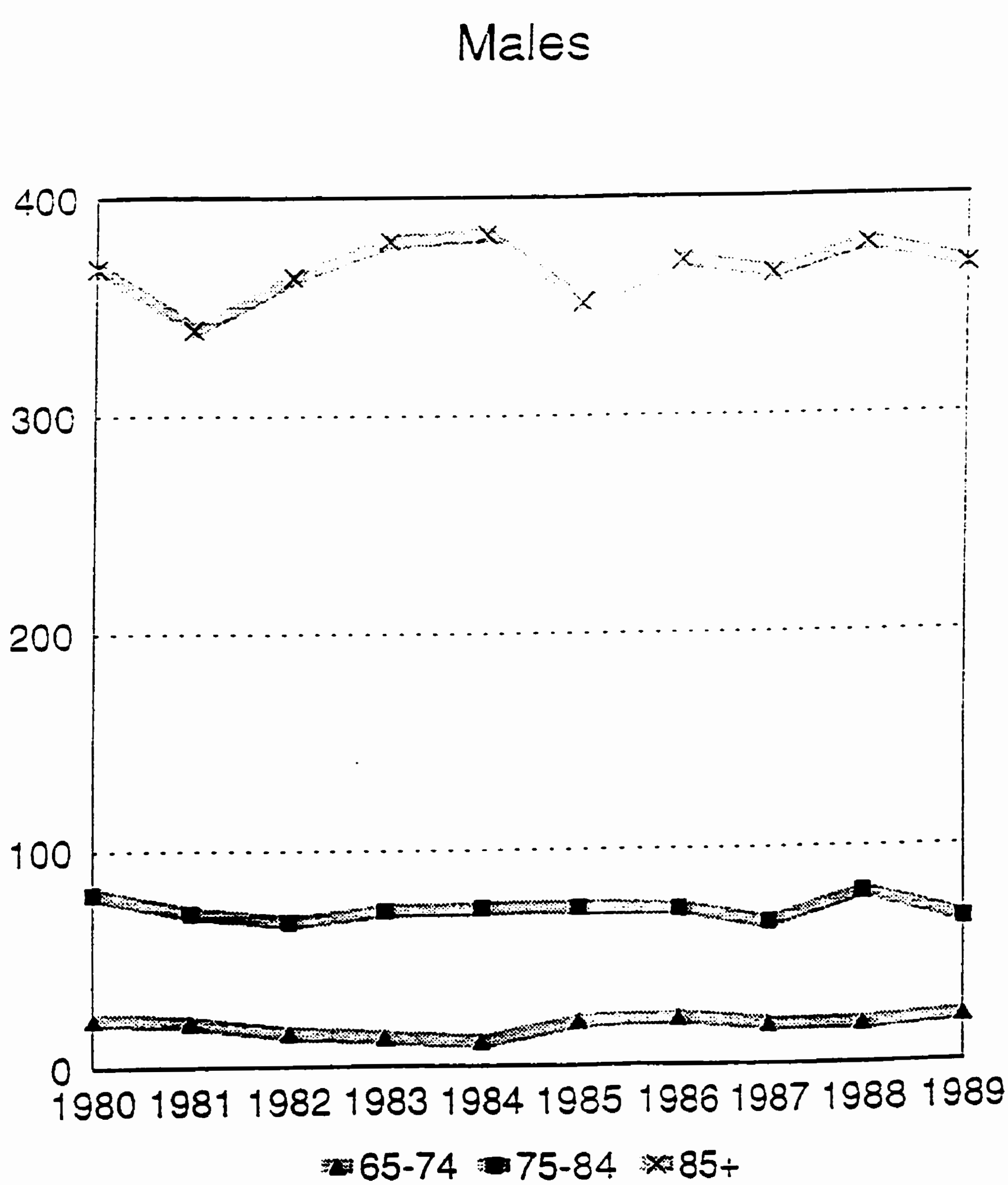
(Riley, 1992)

Table 1.1: Percent of Accidental Fall Deaths to Total Number of Accidental Deaths

		Total	65 to 74	75 to 84	85+
1985	Males	42	15	47	75
	Females	67	29	65	88
1989	Males	48	28	45	75
	Females	65	24	61	85

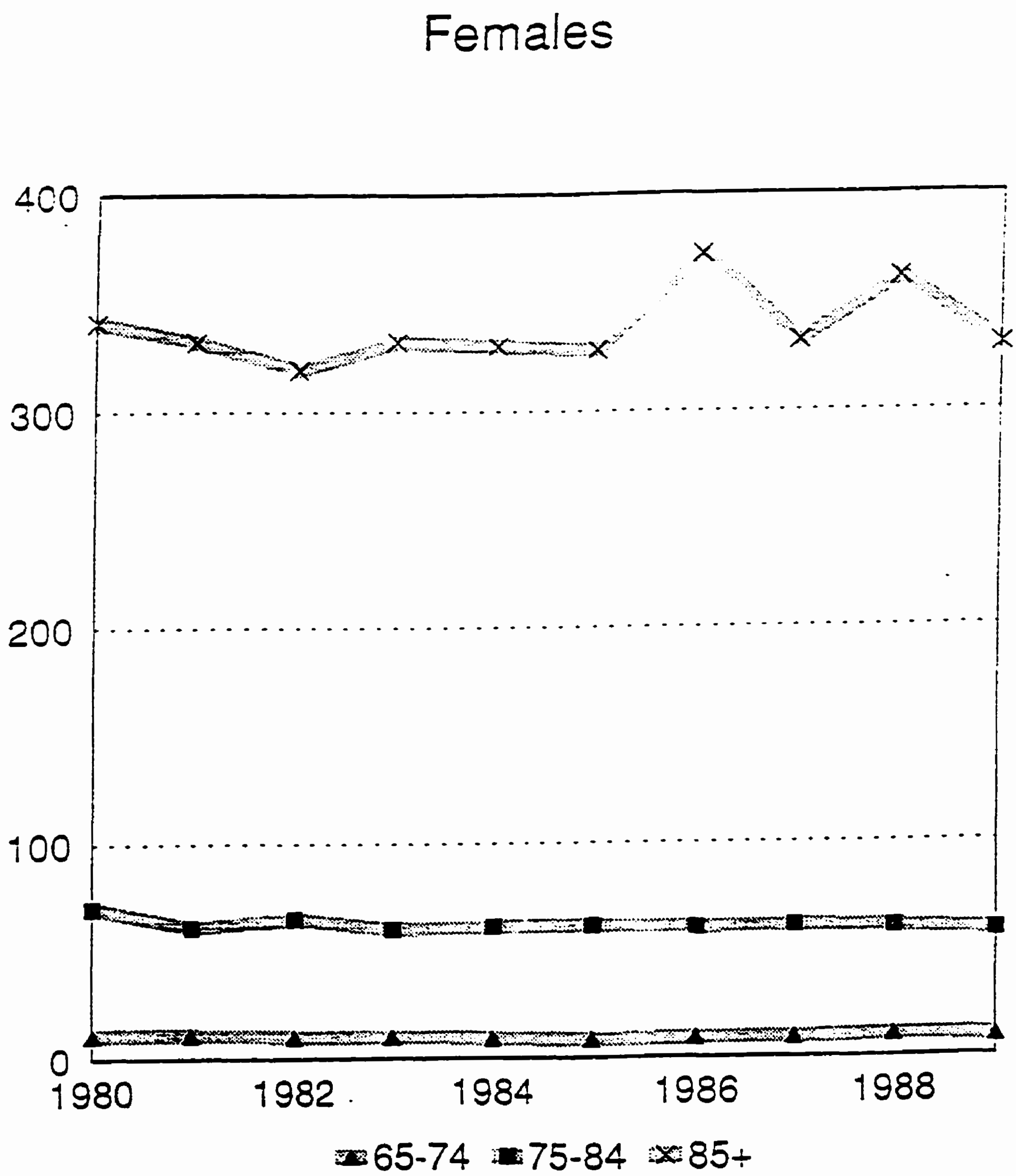
(Riley, 1992)

Figure 1.2A: Mortality Rates for Falls for Males
(deaths per 100,000 population)



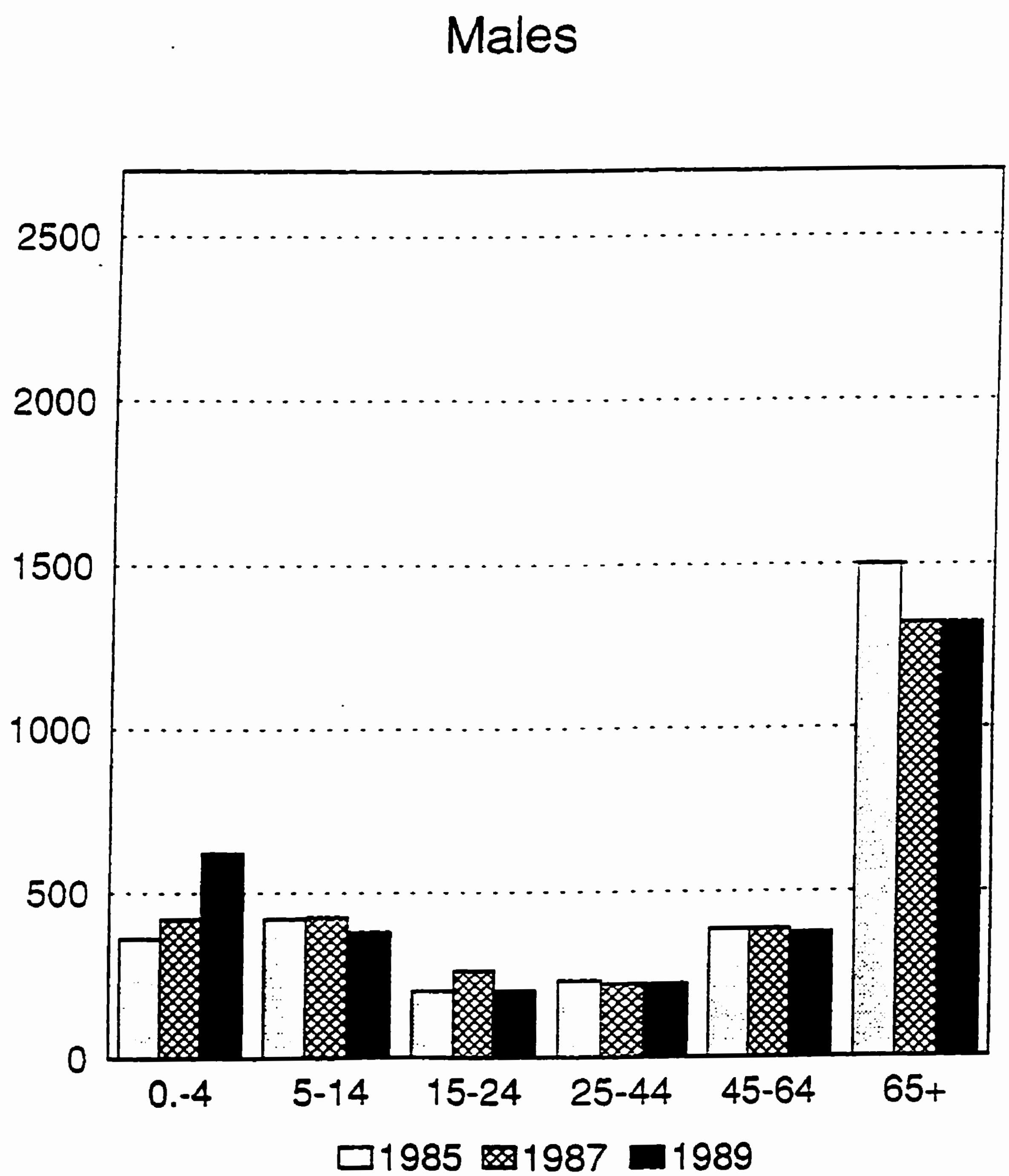
(Riley, 1992)

Figure 1.2B: Mortality Rates for Falls for Females
(deaths per 100,000 population)



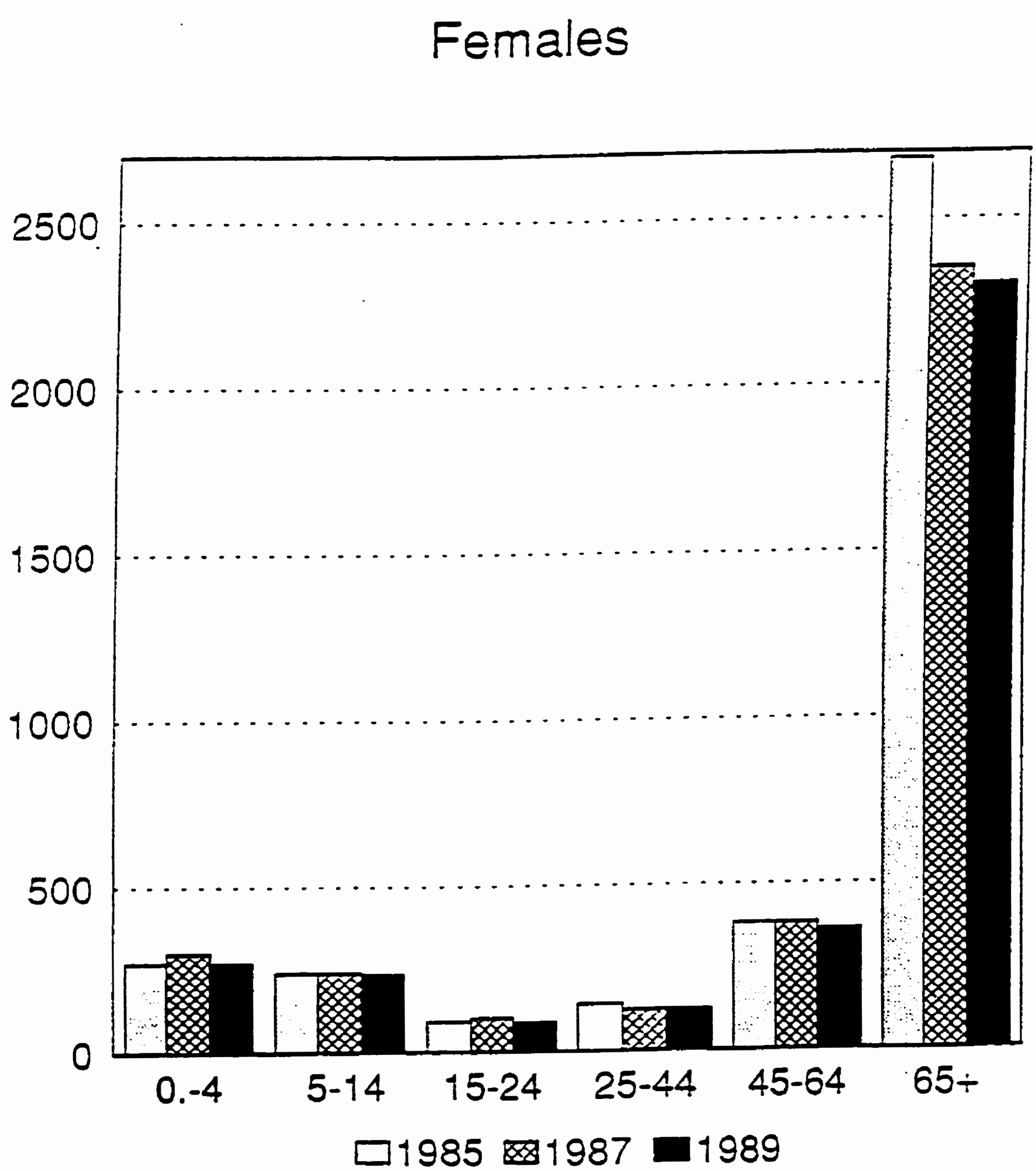
(Riley, 1992)

Figure 1.3A: Separation Rates for Falls for Males
(separations per 100,000 populations)



(Riley, 1992)

Figure 1.3B: Separation Rates for Falls for Females
(separations per 100,000 populations)



(Riley, 1992)

related separations, and 74% of accident-related hospital days (Table 1.2)

In institutional settings, the incidence rate of falls is generally higher than among the community-based elderly. Annual incidence rates of falls ranging from 0.6 to 3.6 per bed (mean of 1.7) have been reported among several studies of institutionalized seniors (see, for example, Gryfe et al., 1977; Morgan et al., 1985; Morse et al., 1985; Rubenstein et al., 1988). Brummel-Smith (1989) and Rubenstein et al. (1988) contend that higher rates of falling exist in institutions primarily because of the greater occurrence of frailty and disability among institutionalized seniors. They further note that the differences may be the result of variations in reporting between the two populations (Luukinen et al., 1995; Rubenstein et al., 1988), as all events are to be recorded within institutions. Similar to the community-based elderly, approximately 5% of falls result in fractures (see, for example, Gryfe et al., 1977; Nelson & Amin, 1990; Tinetti, 1987). Additionally, an estimated 5 to 10% result in serious injury (e.g., sprains, joint dislocations) other than fractures that require medical assistance (Gryfe et al., 1977; Nelson & Amin, 1990; Tinetti, 1987) for institutionalized seniors, although a recent study by Luukinen et al. (1995) found that injury-causing falls (e.g., minor and major soft tissue injuries, fractures) were more frequent in elderly living in long term institutions, as compared to the community-based. They contended that the differences in reporting may partially account for this finding.

According to Lilley et al. (1995) it is difficult to determine the exact cost associated with falls, given the numerous types of injuries and treatments involved. There are no readily available statistics concerning the cost of falls and fall-related outcomes in Canada. Rice's (1989) report to the United States Congress estimated the cost of falls for seniors at approximately $10 billion of the $158 billion lifetime economic cost of injury (King & Tinetti, 1995; Sattin, 1992). Further, in Washington State hospitals 5.3% ($53,346,191) of hospital costs

Table 1.2: Percent of Accidental Fall Hospital Separations to Total Accident Hospital Separations & Percent of Fall-Related Accident Hospital Days to Total Accident-Related Hospital Days

Separations		Total	65 to 74	75 to 84	85+
1985	Males	57	49	60	73
	Females	71	65	72	81
1989	Males	56	47	58	76
	Females	70	59	71	82
Accident-Related Hospital Days		Total	65 to 74	75 to 84	85+
1985	Males	72	70	73	76
	Females	75	70	76	78
1989	Males	68	60	71	73
	Females	74	67	74	78

(Riley, 1992)

($995,499,233) were attributed to fall-related trauma (Alexander et al., 1992); however, these costs did not account for long term consequences of falls (e.g., loss of independence, loss of confidence). Further, approximately 8% of elderly individuals over seventy years of age visited emergency rooms for fall-related injuries, with 30 to 40% of them being hospitalized thereafter (average length of stay = 8 to 15 days) (Sattin, 1992; Sjorgen & Bjornstig, 1991). Additionally, seniors that were hospitalized were more likely to be discharged to nursing homes, than non-fallers (Alexander et al., 1992; Tinetti et al., 1993B). After controlling for age, gender, perceived health, and differences in activities of daily living, Kiel et al. (1991) found that fallers (particularly multiple fallers) were at greater risk of hospitalization, being admitted to a nursing home and needing physician services, as compared to non-falling controls.

It is important to realize that the problem associated with falls in the elderly is not simply the result of their high incidence, since young children and athletes incur higher incidence of falls than all age groups, except for the frailest older adults. Rather, it is the combination of the high incidence of falling, with the high susceptibility to injury among seniors that accounts for the problem. This proclivity for injury is associated with the high prevalence of clinical disease (e.g., osteoporosis) and age-related changes (e.g., slowed protective reflexes) that make even a seemingly mild fall dangerous (Josephson et al., 1991; Rubenstein et al., 1988). Given the magnitude of falls, and the potential serious outcomes of falls, it would seem imperative to provide accurate information concerning the causes and potential preventive strategies to reduce falls.

1.2: Potential Causes and Potential Contributors to Falls in the Elderly

Falls are not a part of the normal aging process, but rather are attributable to such causes as underlying physical illness, medications and environmental hazards which often interact (Kellogg International Work Group, 1987). Kane et al. (1989) contend that falls and the factors contributing to falls are often preventable. Thus, in order to develop practical programs for the prevention of falls, it would seem imperative that the causes and potential contributors to falling is understood. Researchers purport that the factors that contribute to or cause falls among seniors are multiple and that in many cases, more than one of these factors is operating when falls occur (Josephson et al., 1991; Kane et al., 1989).

1.2.1: Age-Related Factors Contributing to Instability and Falls in the Elderly

One of the more complex factors associated with falling involves age-related factors that contribute to instability. Several age-related factors have been identified as contributing to instability and falls among seniors (Table 1.3). According to Kane et al. (1989) the majority of "accidental" falls are caused by one or a combination of the factors in Table 1.3, and their interactions with a variety of environmental hazards.

Changes in postural control and gait play a substantial part in a large proportion of the falls among seniors. Aging is associated with diminished proprioceptive input, slower righting reflexes, diminished strength of the muscles that are essential in maintaining posture, and increased postural sway. (Kane et al., 1989; Tideiksaar, 1990). These alterations often contribute to falling, specifically in cases in which the person is unable to recover from a fall after encountering an unexpected trip or an environmental hazard (Kane et al., 1989). Sattin (1992) contends that abnormalities in gait and balance may also be the result of disease or medication use, in addition to age-related changes.

Orthostatic hypotension or postural hypotension is defined as abnormally low blood pressure that occurs when an individual assumes the standing position (Glanze et al., 1990). Drops in systolic blood pressure of 20 mmHg or more when an individual moves from a position in which he/she is lying, to one in which he/she is standing, are typically indicative

Table 1.3: Age-Related Factors Contributing to Instability and Falls

CHANGES IN POSTURAL CONTROL

- decreased proprioception
- slower reflexes
- decreased muscle tone
- increased postural sway
- orthostatic hypotension

CHANGES IN GAIT

- feet not picked up as high
- men: develop flexed posture and wide-based, short stepped gait
- women: develop narrow-based, waddling gait

INCREASED INCIDENCE OF PATHOLOGICAL CONDITIONS (RELATIVE TO STABILITY)

- degenerative joint disease
- fractures of hip and femur
- stroke with residual deficits
- muscle weakness from disuse and deconditioning
- peripheral neuropathy
- diseases or deformities of the feet
- impaired vision
- impaired hearing
- forgetfulness and dementia
- other specific disease processes (e.g., cardiovascular disease, parkinsonism)

(Kane et al., 1989)

of orthostatic hypotension (see, for example, Campbell et al., 1989; Wild et al., 1981A). An estimated 11 to 30% of elderly individuals suffer from orthostatic hypotension (Caird et al., 1973; Mader et al., 1987). This physiological response has been found to play a role in causing instability and subsequently leading to falls in a substantial portion of seniors (Kane et al., 1989; Mader et al., 1987).

Although gait changes that occur with increasing age are not necessarily pathological in nature, these changes often increase susceptibility to falls. One of the more frequent problems is that many seniors do not pick their feet up as high when walking, thus increasing their chance of tripping or stumbling. Alterations in step length also increase individuals' risk of falling (Kane et al., 1989).

Further, a number of pathological conditions that increase in prevalence as aging occurs have been implicated in causing instability and falling (Kane et al., 1989). For example, degenerative joint disease can cause pain, unstable joints, weakness of the muscles, and neurological disturbances, while fractures of the hip and femur that have been healed, may result in an abnormal and less steady gait. Additionally, podiatric complications (e.g., bunions, calluses, nail disease, joint deformities), not only cause pain, deformities, and gait alterations, but are often correctable causes of instability (Kane et al., 1989).

1.2.2: Causes of Falls in the Elderly

Blake (1992) contends that falls are not a diagnosis, but a symptom of some underlying cause, generally multifactorial in origin. Multiple, and frequently interacting, causes of falling have been identified among elderly populations (Table 1.4), although some researchers believe that the empirical knowledge about the causes of falls remains limited (see, for example, Kellogg International Work Group, 1987). The potential causes of falling are generally and broadly categorized as intrinsic and extrinsic. Intrinsic factors refer to age-

Table 1.4: Causes of Falls

ACCIDENTS

- true accidents (trips, slips, etc..)
- interactions between environmental hazards and factors increasing susceptibility

SYNCOPE (sudden loss of consciousness)

DROP ATTACKS (sudden leg weaknesses, without loss of consciousness)

DIZZINESS AND/OR VERTIGO

- vestibular disease
- vertigo

ORTHOSTATIC HYPOTENSION

- prolonged bed rest
- impaired venous return
- drug-induced hypotension
- autonomic dysfunction
- hypovolemia (low cardiac output)

DRUG-RELATED CAUSES

- diuretics
- antihypertensives
- tricyclic antidepressants
- hypoglycemics
- sedatives
- alcohol
- antipsychotics

SPECIFIC DISEASE PROCESSES

- acute illness of any kind ("premonitory fall")
- cardiovascular (e.g., arrhythmias, aortic stenosis)

NEUROLOGICAL CAUSES

- transient ischemic attack
- seizure disorder
- cervical or lumbar spondylosis
- normal-pressure hydrocephalus
- stroke (acute)
- parkinson's disease
- cerebellar disease
- CNS lesions

IDIOPATHIC (no specific cause identifiable)

(Kane et al., 1989)

and disease-related changes that occur within an individual, and increase the individual's susceptibility or opportunity to experience a fall, while extrinsic factors are environmental hazards with which seniors are confronted (Nelson & Amin, 1990). Causes of falls that are intrinsic include hearing and visual impairments, neurologic and musculoskeletal disabilities (e.g., Parkinson's disease, arthritis), dementia, age-related changes in gait and musculature, medications, and postural hypotension (Nelson & Amin, 1990). Extrinsic or environmental causes encompass the following: cracked and uneven sidewalks, inadequate lighting or glaring, throw rugs, frayed carpets, cords, wires, slippery floors and bathtubs, uneven stairs and inadequate railings, unavailability of grab bars, beds and toilets of inappropriate heights, unstable, and/or low-lying furniture, low beds and toilet seats, poorly maintained walking aids and equipment, ill-fitting footwear (Harvey et al., 1994; Kane et al., 1989).

Although the majority of studies do not necessarily identify one specific cause of falling and focus more on the risk factors for falls, Josephson et al. (1991) compiled data from three institutional studies and six community-based studies to determine the major cause of falls and their relative frequencies. As would be expected, the relative frequencies attributed to various causes differed according to the population being studied. The results generally revealed that falls related to environmental factors were more common among the community-based than the institutionalized. Further, frail, high-risk populations experienced higher rates of medically-related falls and higher incidences of falls of all types in comparison to community-based seniors (Josephson et al., 1991). Tideiksaar (1989) concurred, and reported that the young old (seniors that are younger than 75 years of age) are more likely to fall because of normal aging changes (e.g., postural balance) and their interaction with environmental hazards, thus accounting for the high number of falls due to trips and slips (see, for example, Josephson et al., 1991; Sheldon, 1960), which decrease with advanced age

(Tideiksaar, 1989). Further, the old elderly (seniors 75 years of age and older) are more likely to fall because of some underlying health problem (e.g., presence of neurologic disease or cardiovascular disease) (Tideiksaar, 1989). This relationship proposed by Tideiksaar (1989) needs further exploration.

The results from Josephson and her collegues (1991) estimated the following percentages of falls attributable to specific causes:

(1) 38% accident/environment-related (range of 12 to 53%);

(2) 13% gait problems/muscle weakness (range of 3 to 39%);

(3) 11% drop attack (range of 1 to 25%);

(4) 8% dizziness or vertigo (range of 3 to 19%);

(5) 5% postural hypotension (range of 2 to 24%);

(6) 1% syncope (range of 0 to 13%);

(7) 17% other specified causes (range of 6 to 37%); and

(8) 7% unknown causes (range of 5 to 21%).

The category of "other specified causes" refer to CNS disturbances, acute illnesses, confusion, poor eyesight, drugs, alcohol and falling out of bed (Josephson et al., 1991). These percentages must be interpreted with caution because of the lack of consistency in the methodology and terminology employed between the studies (Rubenstein et al.,1988), and the differences in the settings of the studies.

According to the estimates proposed by Josephson et al. (1991) accidents are the most common categorized cause of falls among older adults; however, as noted by Kane et al. (1989) many falls that are attributed to accidents stem from interactions between environmental hazards or hazardous activities, and seniors' susceptibility to hazards because of the accumulated effects of age and disease (Table 1.3). Factors that decrease with age, specifically, postural control, body-orienting reflexes, muscle strength and tone, and height of stepping, impair seniors' abilities to avoid falling after an unexpected trip. Decreased hearing, vision, and memory further affect the response to environmental hazards that seniors elicit (Josephson et al., 1991; Nelson & Amin, 1990). Kane et al. (1989) suggest that a large proportion of "accidental falls" could be prevented with environmental assessments and modifications. Additionally, altering the instability associated with balance control (e.g., through exercises that challenge the balance control system) may also be instrumental in decreasing falls among seniors (Sharratt et al., 1992) through the modification of the age-related changes to the body, or by halting further age-related changes. Weindruch et al. (1991) asserted that even in relatively safe environments (e.g., no environmental hazards), risk of falls may be increased in functionally impaired elderly that are not aware of potential injury risks associated with their decreased physical capacities and/or the risk of completing behaviours that are considered "risk taking", given their frail states.

Gait problems and/or muscle weakness are the second most common cause for falls among seniors, and can be the result of age-related changes in the body and other processes (Josephson et al., 1991; Rubenstein et al., 1988). For example, gait problems can arise from specific dysfunctions of the nervous, skeletal, circulatory, muscular and respiratory systems, or can be the result of deconditioning from inactivity, as may occur after an acute illness (Josephson et al., 1991; Nelson & Amin, 1990). Further, muscle weakness has been reported to be a common problem among seniors. Approximately, 48%, 57% and 80% of lower extremity weakness were found in community-based seniors (Campbell et al., 1989), in intermediate-care facility patients (Tinetti et al., 1986), and residents of nursing homes (Robbins et al., 1989), respectively. Josephson et al. (1991) contend that although decreases in muscle strength occur during the aging process, the majority of the reduction is the result of disease and inactivity, rather than aging. For example, parkinsonism, stroke, fractures, skeletal abnormalities, arthritis, myopathies, and polyneuropathies are common causes of muscle weakness and gait problems (Josephson et al., 1991). Tinetti et al. (1986) report that abnormalities of balance and gait are more common in seniors that experience multiple falls, when compared to seniors that have fallen only once.

Drop attacks, a form of transient ischemic attack in which a brief interruption of cerebral blood flow results in a person falling to the ground without consciousness being lost (Glanze et al., 1990), accounts for 11% of falls (Josephson et al., 1991). The episode may affect the person's sense of balance or muscle tone in the legs, which causes the person to collapse (Glanze et al., 1990). The weakness experienced in the legs is generally transient; however, it may persist for hours. One precipitating event of drop attacks is a sudden change in the position of the head (Josephson et al., 1991), while another potential contributing factor may be weakness of the leg muscles or hip or joint dysfunctions (Glanze et al., 1990). In actuality, the pathophysiology is poorly understood. Seniors may often restore the tone and strength in their legs by pressing their feet against a solid object (Josephson et al., 1991; Nelson & Amin, 1990). Some researchers contend that drop attacks are over-diagnosed among seniors, and fewer than 11% of falls can be attributed to this cause (Josephson et al., 1991; Kane et al., 1989).

Dizziness is often reported to be present among seniors that have fallen, and accounts for between 5 to 20% of the falls in seniors. Dizziness is a nonspecific symptom which means different things to different people, and is attributed to a number of causes (Josephson et al., 1991; Nelson & Amin, 1990). Rubenstein et al. (1988) contend that dizziness, described as a vague lightheadedness, may reflect problems such as cardiovascular disorders, hyperventilation, orthostatis, drug side effects, anxiety, or depression. Alternatively, symptoms characterized as "imbalance on walking" may be the result of a gait disorder (Josephson et al., 1991). Further, true vertigo (rotational movement sensations) may be reflective of disorders of the vestibular system, such as Meniere's disease (Josephson et al., 1991).

Among seniors living within the community, an estimated 10% have orthostatic hypotension (Mader et al., 1987). According to Mader and associates (1987), orthostatic hypotension is more common among seniors with the following risk factors: hypovolemia, low cardiac output, parkinsonism, metabolic and endocrine disorders, medications (specifically, sedatives, antihypertensives, and antidepressants), and autonomic dysfunction (which is frequently related to diabetes, age, or damage to the central nervous system).

Syncope, a sudden loss of consciousness associated with a loss of postural tone, with spontaneous recovery (Glanze et al., 1990; Kapoor, 1987), is a serious but less common cause of falls in seniors (Josephson et al., 1991). This condition is the result of decreased cerebral blood flow or transient cerebral hypoxia (Glanze et al., 1990), or occasionally, from metabolic causes (e.g., hypoxia, hypoglycemia) (Josephson et al., 1991), and it often symptomatic of underlying disease (Lipsitz, 1983). Cardiac arrhythmias, orthostatic hypotension, vasovagal reaction, syncope of unknown etiologies (Josephson et al., 1991), emotional stress, vascular pooling in the legs, and changes in body position (Glanze et al., 1990) are some of the suggested causes of syncope in seniors; however, determining the precise cause is often difficult for the following reasons: (1) the abnormalities causing syncope are often episodic or isolated events, and thus, may not be found upon evaluation; (2) the diagnostic criteria for syncope causes are too stringent, and therefore, syncope is underestimated; and (3) individuals may not recall any of the details surrounding the syncopal episode. Further, if the event was not witnessed, valuable information can be lost and the cause of the event may therefore not be apparent (Kapoor, 1987). The difficulty in the evaluation of syncope is further compromised by the multiple co-existing diseases, multiple medications and age-related physiological changes that predispose elderly to experience syncope events (Kapoor, 1987). According to Glanze et al. (1990), syncope is often preceded by a sensation of lightheadedness. It may be prevented by lying down or by sitting with the head placed between the knees (Glanze et al., 1990). As discussed previously, this condition is often difficult to obtain a history for, since many seniors do not remember exactly what happened during the fall. Further, drop attacks or dizziness may be mistaken with syncope (Josephson et al., 1991; Kane et al., 1989).

Josephson et al. (1991) included disorders of the central nervous system, cognitive deficits, poor vision, drug side effects, alcohol intake, and acute illnesses in the "other specified causes" category. Ailments of the central nervous system, such as dementia, cerebrovascular disease and parkinsonism, often cause dizziness, orthostatic hypotension, and gait disorders, which result in falls. Alternatively, individuals with cognitive impairments are frequently unable to recognize and avert environmental hazards. Morris et al. (1987) found that patients with senile dementia of the Alzheimer's type (SDAT) fell three times as often as healthy seniors over the study period. Further, although the SDAT fallers were predominantly female and slightly older than the controls, as a group they did not differ with respect to blood pressure, number and type of medications, impairment of posture, gait or sensory motor function (Morris et al., 1987). Depression has also been found to be one of the causes of falling. Both of these impairments in cognition and falling coincide with the findings of Stelmach et al. (1985) who that found that delayed cerebral processing of sensorimotor information may underlie many of the falls that occur in geriatric populations.

Drugs, specifically drugs with sedative, antidepressant, and antihypertensive effects (e.g., diuretics, vasodilators, and beta blockers) (Granek et al., 1987; Ray & Griffen, 1990; Sorock & Shimkin, 1988), frequently cause side effects that impair seniors' mental capabilities, stability and gait. Alcohol, although understudied, is another specific cause of instability leading to falls and serious injury in the elderly. Anemia, hypothyroidism, unstable joints, foot problems, and severe osteoporosis with spontaneous fractures are other less commonly known causes of falls in seniors (Josephson et al., 1991).

A number of mechanisms by which medications might contribute to falls have been hypothesized. For example, Campbell (1991) suggests that sedation, impaired postural stability, hypotension, and iatrogenic parkinson's disease, are a few of the hypothesized mechanisms. Drugs that produce sedative effects, such as antihypertensives, psychotropic drugs, benzodiazepines, antidepressants, and antihistamines (Ray & Griffen, 1991), have all been suggested as possible contributors to falling. Sedative drugs may slow reaction time, which may in turn decrease seniors' awareness of hazards within the environment (Campbell, 1991; Sorock, 1988). Additionally, combining these effects with age-related decreases in sensory perceptions (e.g., in the lower legs) may worsen an existing unstable gait (Sorock, 1988). Further, seniors are specifically susceptible to various drugs' sedating effects because of their impaired drug elimination, increased sensitivity to drug action, impaired renal excretion, smaller body size and altered volume of distribution that may augment the plasma concentrations of the drugs (Campbell, 1991).

Medications may also impair postural stability by adversely affecting balance, particularly body sway, and thus contribute to falls; however, research studies to confirm this hypothesis are still under investigation (Campbell, 1991). Medications that result in postural hypotension (e.g., diuretics, antihypertensives, psychotropics, antidepressants, antipsychotics)

(Campbell, 1991; Ray & Griffen, 1990; 1991), particularly because of diminished baroreceptor sensitivity, increased prevalence of cardiovascular disease, and impaired efficiency of salt and water homeostatic mechanisms, increase the probability of dehydration (Campbell, 1991) and promote falling. Drugs that are capable of inducing parkinson's disease in seniors can also cause impairments in gait. Phenothiazine and butyrophenone antipsychotic medications are thought to block striatal dopamine receptors, and subsequently lead to a parkinsonian syndrome, which is not distinguishable from parkinson's disease (Campbell, 1991). Other drugs that may create confusion often leading to wandering, climbing out of bed, and lack of awareness of environmental hazards, may also contribute to falls (Morris et al., 1987). Drugs such as levodopa preparations or psychotropic medications, or benzodiazepine withdrawl may contribute to the confusion experienced by many seniors, which lead to falls (Campbell, 1991).

1.2.3: Potential Risk Factors for Falls

Tinetti and Speechiey (1991) reported, after reviewing prospective studies within the literature, that a small percent of falls actually resulted from one prominent, intrinsic cause (e.g., postural hypotension), from participation in a dangerous activity (e.g., ladder climbing), from one environmental cause (e.g., ice), or a specific disease (e.g., neurological problem, parkinsonism). They concluded that the majority of falls by seniors were multidimensional in nature, and resulted from combinations of intrinsic and extrinsic (environmental) factors (Tinetti & Speechley, 1991). Given that the exact cause of falling is frequently difficult to pinpoint or to predict, specifically with seniors that have multiple and identifiable age-related changes and/or medical conditions that often precipitate falls, identifying and treating (or modifying) relevant risk factors for falls is an alternative approach in the study and prevention of falls (Josephson et al., 1991). Several studies have been conducted with community-based, institutionalized, and hospitalized seniors in order to determine risk factors for falls among the various elderly segments of the population. Each of these areas will be discussed in turn.

1.2.3.1: Potential Risk Factors for Falls Among Community-Based Elderly

Several risk factors have been recurrently identified within the literature for the community-based elderly. Having a history of previous falls (see, for example, Prudham & Evans, 1981; Teno et al., 1990), multiple stumbles (Teno et al., 1990) and being physiologically or functionally impaired (see, for example, Campbell et al., 1981; O'Loughlin et al., 1993; Wild et al., 1981A, Vellas et al., 1987) have repeatedly been implicated as risk factors for falling. Similarly, the socio-demographic variables of age (Campbell et al., 1981; Craven & Bruno, 1986; Prudham & Evans, 1981; Wild et al., 1981A), the female gender (Campbell et al., 1988; 1990A; Craven & Bruno, 1986; Prudham & Evans, 1981; Tinetti et al., 1995A), and living alone (Craven & Bruno, 1986; Wickham et al., 1988), have also been found to increase seniors susceptibility to falls; however, with respect to gender, Campbell et al. (1981) reported that women fall more often than men until the age of 75, after which the frequency of falling is similar for both genders. Further, the need for support services were predictive of falling for women (Campbell et al., 1981).

Another noteworthy risk factor for falls was the use of various drugs among the community-based, specifically alcohol (Waller, 1978), diuretics (Cumming et al., 1991; Prudham & Evans, 1981), psychotropics, such as sedatives and tranquilizers (Campbell et al., 1989, Maxwell et al., in press, Neutel et al., 1996; Tinetti et al., 1988), antidepressants (Liu et al., 1995), vasodilators (Campbell et al., 1988; Cumming et al., 1991), and anti-inflammatories (Cumming et al., 1991). Further, Cumming et al. (1989) found that the risk of falls was increased as the number of medications that were taken was also increased.

Specific conditions or diseases were also associated with an increased risk of falling, namely cardiovascular disease (Prudham & Evans, 1981), history of hypertension (Yasumura et al., 1994), decreased vision (Campbell et al., 1981; Gabell et al., 1985; Perry, 1982), podiatric problems (Gabell et al., 1985; Tinetti et al., 1988), joint disease (Waller, 1978), and arthritis (Blake et al., 1988; Nevitt et al., 1989). Tinetti et al. (1995A) found that individuals that had two or more chronic conditions were at greatest risk of experiencing a serious fall injury. Individuals with cognitive impairments (Gabell et al., 1985; Nevitt et al., 1991; Prudham & Evans, 1981; Tinetti et al., 1995A), dementia (Waller, 1978), and depression (Campbell et al., 1981; Gabell et al., 1985) have also been found to be more susceptible to falling.

Risk factors for falls that were associated with balance, and may have contributed to instability in seniors include abnormal reflexes (Gabell et al., 1985; Sheldon, 1960), decreases in strength (Blake et al., 1988; Lord et al., 1994; Wickham et al., 1989), disability of the lower extremities (Tinetti et al., 1988), increased body sway (Overstall et al., 1977), and impairments in balance (see, for example, Campbell et al., 1981; 1988; Craven & Bruno, 1986; Sheldon, 1960; Tinetti et al., 1995A, Wild et al., 1981A) and gait (Gabell et al., 1985; O'Loughlin et al., 1993; Perry, 1982; Prudham & Evans, 1981; Tinetti et al., 1995A, Wild et al., 1981A). Other risk factors that have been reported among the community-based elderly involve the type of activity being completed and various environmental hazards that seniors were confronted with at the time the fall occurred. Activities such as bed transfers (Campbell et al., 1981), other bedroom activity (Wild et al., 1981A), climbing stairs (Sheldon, 1960; Tinetti et al., 1995B, Waller, 1978) and night urination (Stewart et al., 1992; Yasumura et al., 1994) to name a few, were some of the activities that were being undertaken at the time of the fall, while poor lighting (Wild et al., 1981A), and irregular ground surfaces (Wild et al., 1981A) were some of the environmental hazards that have been found to place seniors at risk of falling.

1.2.3.2: Potential Risk Factors for Falls Among Institutionalized Elderly

Several of the risk factors reported for the community-based were similar for the institutionalized. For example, a previous history of falling (see, for example, Myers et al., 1991; Roberts & Wykle, 1993; Ruthazer & Lipsitz, 1993) and functional or physiological impairments (Margulec et al., 1970; Pablo, 1977; Tinetti, 1986) were also found to be risk factors for falls for the institutionalized. Similarly, advanced age (Gryfe et al., 1977; Morris & Isaacs, 1980; Myers et al., 1991) and the female gender (Gryfe et al., 1977; Kalchthaler et al., 1978; Margulec et al., 1970; Morris & Issacs, 1980; Sobel & McCart, 1983) were also significant risk factors; however, Morris & Issacs (1980) reported that falls increased with age up to the age of 85, and then decreased thereafter with age. Additionally, Gross et al. (1990) and van Dijk et al. (1993) reported that men fell more than women, although Van Dijk's (1993) males were more demented than the female sample. In the institutionalized, one research study found that being divorced, single or widowed increased seniors' susceptibility to falls (Margulec et al., 1970).

Drugs or medication use were also found to be significant risk factors for falls among the institutionalized. Specifically, antidepressants (Granek et al., 1987; women only for Ruthazer & Lipsitz, 1993), psychotropics, such as sedatives and tranquilizers (Granek et al., 1987, Sobel & McCart, 1983), diuretics (Sobel & McCart, 1983), and vasodilator use (Granek et al., 1987; Myers et al., 1991) were the drugs associated with an increased risk of falling. Robbins et al. (1989) reported that increased risk was also associated with the number of medications taken. The more medications that the institutionalized were prescribed, the greater their risk of falling (Robbins et al., 1989). Decreased vision, hearing, and joint disease were associated with decreased mobility and risk of falling (Tinetti, 1986), while cardiovascular disease and hypertension (Gross et al., 1990; Sobel & McCart, 1983) and osteoarthritis (Granek et al., 1987) were found to be associated with an increased risk of falling. Further, risk was also found to increase with the presence of multiple chronic conditions (Hill et al., 1988). Having a cognitive dysfunction (Granek et al., 1987), such as dementia (Gross et al., 1990, Morris et al., 1987), were also factors associated with an increased risk of falling among the institutionalized.

Factors associated with balance control and instability were also found to significantly increase seniors' risks of falling within institutions. For example, impaired balance or gait (Pablo, 1977; Robbins et al., 1989; Tinetti, 1987), decreased muscle or hip strength (Cummings & Nevitt, 1991; Lipsitz et al., 1994; Robbins et al., 1989; Tinetti, 1987; Whipple et al., 1987), decreased reaction time (Cummings & Nevitt, 1991), and altered proprioception (Mion et al., 1989) were factors that increased the risk of falling among the institutionalized elderly. Other risk factors for the institutionalized elderly consisted of factors related to the environment, like the improper use of assistive devices, the first week of admission into an institution, decreased nursing staff, and the performance of certain activities (see, for example, Hill et al., 1988; Kalchthaler et al., 1978; Pablo, 1977; Sobel & McCart, 1987; Waller, 1978).

1.2.3.3: Potential Risk Factors for Falls Among Hospitalized Elderly

Many of the risk factors described above also apply to hospitalized elderly. A previous history of falling (Berry et al., 1981; Hernandez & Miller, 1986; Morse et al., 1987) and functional status were also associated with elderly hospitalized patients; however, with respect to functional status, individuals that were ambulatory and used walking aids were most at risk of falling (see, for example, Catchen, 1983; Morse et al., 1987). Socio-demographic factors that were found to increase an individuals risk of falling included advanced age (Berry et al., 1981; Raz & Baretich, 1987) and the male gender (Catchen, 1983; Morgan et al., 1985; Sorock, 1983); however, one hospital study revealed that women were at an increased risk of falling (Hernandez & Miller, 1986).

Individuals that had been prescribed psychotropics or other central nervous system drugs (Gales & Menard, 1995; Sorock, 1983; Tinker, 1979) had an increased risk of falling. Specific conditions or diseases associated with an increased risk of falling among the hospitalized included bladder dysfunction (Hernandez & Miller, 1986; Sorock, 1983), trauma or diseases of the nervous system (Morse et al., 1985), and cardiovascular disease (Morse et al., 1985). Additionally, Morse et al. (1987) found that individuals that had more than one chronic condition were at an increased risk.

Other factors found to increase seniors' risk of falling were impaired balance, gait, or mobility (Morse et al., 1987; Overstall et al., 1977; Studenski et al., 1994), cognitive impairments (Morgan et al., 1985; Morse et al., 1987), dementia (Catchen, 1983; Hernandez & Miller, 1986) and such environmental elements as the use of assistive devices (Berry et al., 1981; Morse et al., 1987), bedrails (Tinker, 1979), wheelchair use (Catchen, 1983; Berry et al., 1981), and the first week of hospitalization (Catchen, 1983; Tinker, 1979). Various activities found to be associated with an increased risk were night bedtime activity (Hernandez & Miller, 1986), bedroom activity (Berry et al., 1981; Hernandez & Miller, 1986; Morgan et al., 1985), and bathroom activity, including toiletting and toilet transfers (Ashley et al., 1977; Berry et al., 1981; Garcia et al., 1988; Innes and Turman, 1983; Morgan et al., 1985).

1.2.3.4: Potential Risk Factors Associated with One-Time vs Chronic Fallers

Some limited work has focussed on the issue of the differences in risk factors for falls between one-time fallers or occasional-fallers and chronic fallers. For example, Nevitt et al. (1989) suggested that risk factors for one-time fallers appeared to be less robust than for chronic fallers. Further, single falls were generally less predictable and may have been the result of an accident (e.g., environmental hazard) or an overwhelming incident (e.g., heart attack), whereas multiple falls may have been more indicative of intrinsic factors (e.g., physiological predisposition to falling, chronic disease, physiological disability) (Nevitt et al., 1989; Nickens, 1985). After completing a one-year prospective study to determine the risk factors for falling, using a sample of community-based seniors over the age of 75, Tinetti et al. (1988) concluded that the risk factors for multiple fallers, as compared to one-time fallers, were the same; however, the risk factors were stronger predictors for multiple fallers. Use of sedatives, cognitive impairments, lower-extremity disability, palmomental reflex, foot problems, and number of balance-and-gait abnormalities were the risk factors found to be significant predictors of falls. Further, the risk of falling was found to increase linearly with the number of these risk factors present (Tinetti et al., 1988).

Utilizing data from the Longitudinal Study on Aging, Dunn et al. (1992) determined that seniors that had fallen once in the past year were significantly more likely to be female, aged 80 or more, thin (BMI of less than 21), unmarried, and were more likely to report the presence of the following conditions: visual or hearing difficulties, osteoporosis/hip fracture, arthritis, vascular disease, and difficulty with activities of daily living, as compared with non-fallers. Further, individuals that had experienced more than one fall within the year possessed the same characteristics as above, and were more likely to have less than nine years of education, to report the presence of hypertension, heart disease, stroke, diabetes, and cancer, and to have had their interview completed by proxy. Further, upon analyzing mortality two years after their interview in 1984, 11.9% of non-fallers, 18.0% of one-time fallers, and 25.4% of seniors, that had fallen more than twice, had died. Multiple logistic regression analysis designed to use falls as predictors of 2-year mortality, revealed that single fallers and multiple fallers had a 1.4 and 2.0 increased risk, respectively, of dying as compared to nonfallers. These risks remained significant even after controlling for demographic variables and proxy status. Although this study did not determine the differences between risk factors for falls based on fall status (e.g., one-time vs multiple faller) at the multivariate level, the results revealed that multiple fallers may need immediate intervention, as opposed to one-time fallers (Dunn et al., 1992).

Univariate results from a study conducted by Wild et al. (1981B) revealed that factors predictive of further falls included: previous falls, inability to walk outdoors independently, and an abnormal response to the sternal test. Wild et al. (1981B) concluded after further analysis, that seniors over the age of seventy-five, primarily women, that had fallen before and who were not independently mobile, were at the greatest risk of sustaining further falls. It was further recommended that preventive efforts be concentrated on this group, in order to reduce the associated mortality with this population of seniors at home (Wild et al., 1981B).

In a study by Cumming et al. (1991), an analysis was undertaken to determine commonly taken medications and the occurrence of falls. After controlling for potential confounders (e.g., age, gender, relevant medical conditions, health status, cognitive impairment, use of alcohol, depression, and six medications of interest: diazepam, diltiazem, diuretics, laxatives, nitroglycerin, tricyclic antidepressants), it was determined that diazepam (odds ratio = 3.7; confidence interval = 1.5 - 9.3), and diuretics (odds ratio = 1.8; confidence interval = 1.2 - 2.8) were significant risk factors for multiple falls. The other four medications were found to be important risk factors for multiple falls; however, these medications did not reach significance. One possible limitation with this study is that Cumming et al. (1991) grouped non-fallers and one-time fallers together, and subsequently compared this group to multiple fallers. It is possible that non-fallers and one-time fallers may be two distinct groups, and thus may have affected the results. This possibility needs further exploration.

A discriminant analysis, which included seniors from the community, from residential homes, and from public and private hospitals, revealed that functional disability and receiving of professional and family support were the major predictors for individuals most likely to experience "pattern falls" (a fall which was assessed as resulting from only minimal upset, and primarily from a balance or postural stability disorder. These falls were considered liable to recur, since the contribution from external factors was minimal). Unfortunately, pattern fallers included individuals that may have only fallen once (Campbell et al., 1981). Thus, differences may exist between individuals that have fallen once, and individuals that have fallen more than once, among this group of "pattern fallers".

Within a nursing home setting, Gross et al. (1990) found that 40 of the 115 identified incidents, accounted for falls which involved 29 of the patients. Upon comparison of one-time fallers and non-fallers, increased age, male gender, and hyptertension were found to be significant risk factors for falls; however, this relationship was not significant in multiple falls. Organic brain syndrome, mental impairment and shorter length of stay were found to be significant risk factors for one-time fallers and for multiple fallers. A three-way comparison of the data for non-fallers, single fallers, and multiple fallers, revealed that there was a progressive increase in the risk of falling for the male gender, organic brain syndrome, hypertension, incontinence, and mental impairment. Additionally, there was a progressive decrease for the risk of falls with the variables incontinence and length of stay. No multivariate analysis was undertaken within this study, and all results were reported at the univariate level (Gross et al., 1990).

Discriminant analysis of data from a one year prospective study of 95 seniors over the age of 59 in a hostel for aged persons identified proprioception in the lower limbs, visual contrast sensitivity, ankle dorsiflexion strength, reaction time, and sway with the eyes closed, as the variables that significantly discriminated multiple fallers from non-fallers and one-time fallers. This study offered much promise in terms of identifying multiple fallers from non-fallers and one-time fallers; however, validation within community settings and more work among individuals that were not as frail as the multiple fallers in this study, is required in order to determine if the same associations exist within other populations of seniors or can be replicated within other groups (Lord et al., 1991).

At the present time, the information pertaining to the risk factors associated with one-time fallers and multiple fallers is limited. Information to date, would suggest that one-time fallers and multiple fallers may represent two distinct groups. For example, it would appear that single falls are chance events (e.g., environmental hazard; heart attack) that would not be modifiable through intervention, whereas multiple fallers would seem to represent a group of older and frailer seniors that possess a greater number of comorbid conditions. Unfortunately, firm conclusions cannot be drawn given that a large portion of the research that has been completed in this area, unfortunately, does not analyze the data at the multivariate level (see, for example, Gross et al., 1990; Vlahov et al., 1990) and/or includes one-time fallers in with non-fallers (see, for example, Campbell et al., 1981; Cumming et al., 1991). However, given that multiple falls have been found to be associated with an increased risk of institutionalization (see, for example, Dunn et al., 1993) it would seem imperative to determine the precise risk factors for multiple falls, in order to intervene at the earliest stage of the problem. Additionally, in terms of policy formation and the design of intervention programs for falls, different programs with different interventions may be needed for these two groups of fallers. Thus, it would seem that further work in this area is essential.

1.2.3.5: Interactions Among Risk Factors within the Falls Literature

According to Kelsey et al. (1986) it is important that statistical interaction, also termed effect modification, is considered in the design, analysis and interpretation of research studies. With respect to the study of falls, a statistical interaction would occur when the magnitude of the chosen measure of association between a risk factor for a fall and the fall itself, differs according to the level of a third variable or risk factor (or according to the levels of two or more variables) (Kelsey et al., 1986). An example of such an interaction exists when every age group is considered together for hip fractures. Females are found to have two to three times the risk of experiencing a hip fracture as compared to the male gender. However, clustering the age groups together obscures the actual relationship. Males at young ages are at higher risk than females, whereas females at older ages are at considerably greater risk than their male counterparts. Thus, it would appear that the association between gender and hip fractures is modified by age. In this example, age is actually a surrogate measure of the high occurrence of osteoporosis in elderly females, in addition to a measure of the tendency for young males to experience severe trauma (Kelsey et al., 1986).

Unfortunately, this issue of interactions or effect modification has been relatively understudied or under-reported within the research literature to date. For example, Lord et al. (1991) referred to testing for interactions when determining the physiological factors associated with falls; however, the results of the interaction testing were not reported within the paper. Findings of research studies that have tested for interactions in the models determining risk factors for falls will subsequently be reviewed.

After reviewing the associations between activities of daily living and fall injury events among community-based seniors, Langlois et al. (1995) found that an interaction between age and activities of daily living dependence (ADL), in addition to a number of controlled covariates, were significant within a logistic regression model. To further test this interaction, the following interaction terms were tested in a model controlling for age, sex, mental status, Quetelet index, psychoactive medication use, and alcohol use: 65 to 79 years of age with no ADL's (reference), 65 to 79 year of age with one or more ADL's, 80 years of age or older with no ADL's, and 80 years of age or older with one or more ADL's. The resulting model revealed that seniors younger than 80 years of age and dependent in one or more ADL's possessed the highest risk of a fall injury event, and the risk associated with seniors 80 and older with a dependence in one or more ADL was only slightly higher than the risk for seniors 80 years of age and older with no ADL dependence. Langlois et al. (1995) suggested that a higher risk of a fall injury event among younger-old seniors with dependence in ADL's, may be attributed to their greater risk of injury, because of the higher levels of energy they possess, and subsequently increased ability to complete more activities. Langlois et al. (1995) further suggested that the older seniors, with their increased age, may have experienced more disability, which has been associated in previous research with an increased fear of falling, and subsequently restriction in mobility (see, for example, Tinetti & Powell, 1993) and lower risk of falling. These results have not been described elsewhere (Langlois et al., 1995) and need confirmation through further research.

A case/control study of seniors within a hospital determined that the male gender (odds ratio = 3.4), urinary incontinence within 48 hours prior to the fall (odds ratio = 1.8), and psychoactive medication 12 hours prior to the fall (odds ratio = 1.8) were significant risk factors for falls (Sorock, 1983); however, the presence of two or more of these factors increased the odds of falling, as indicated by the significant interactions present within the models. For example, an odds ratio of 6.2 was found with an interaction between males and psychoactives, or an interaction of urinary dysfunction and psychoactives. Further, when a three-way interaction between the variables was examined, a risk of 11.2 was calculated between males, psychoactives, and urinary dysfunction (Sorock, 1983). Also, Grisso et al. (1991) tested for interactions when examining the importance of risk factors for falls in the epidemiology of hip fractures in a case/control study of 174 women, within a hospital setting; however, no significant interactions were detected (Grisso et al., 1991).

Myers et al. (1991) found that being able to walk (odds ratio = 4.0), being 90 years of age and older (odds ratio = 3.8), having a history of falling (odds ratio = 5.0), and taking a vasodilator (odds ratio = 3.0) were the significant risk factors for all levels of care combined within a Baltimore, Maryland long-term care facility. After further analyzing the data, a three-way interaction between history of falling, ability to walk, and seniors over the age of 90, produced an odds ratio of 51.9. However, the 95% confidence interval for this odds ratio was between 10.1 and 267.7, and this combination of traits was only present for 11% of the sample (Myers et al., 1991).

Unfortunately, the literature in the area of falls does not provide much guidance or direction in determining specific areas to investigate with respect to interactions among risk factors for falls. The interaction terms that were found within the forementioned studies, regardless of their strength of association, may be identified as areas to be examined in further detail. Namely, interactions of medication use and gender (Sorock, 1983), age and history of falling (Myers et al., 1991), age and mobility (Myers et al., 1991), and age and activities of daily living (Langlois et al., 1995) need to be assessed within future studies. Additionally, given that chronic conditions increase with age (McKim & Mishara, 1987) , that the presence of chronic conditions differs by gender (e.g., osteoporosis and females) (McKim & Mishara, 1987), and that medication use increases with age (McKim & Mishara, 1987), these interactions should also be of concern within future modelling of risk factors for falls.

This area should not be left unaddressed, as it is important to determine whether or not interactions are present within models, in order to increase the explained variance.

1.3: Fall Prevention Programs within the Literature

Hornbrook et al. (1994) and Sattin (1992) contend that although a number of risk factors for falls have been identified within the falls literature, few studies have been conducted to test the effectiveness of proposed prevention interventions for falls. Additionally, a large portion of the literature pertaining to falls prevention has been largely descriptive in nature. For example, after determining risk factors for falls for a specific population, suggestions have then made as to possible prevention strategies for falls (see, for example, DeVito et al., 1988); however, the majority of these strategies have not been tested for their effectiveness. Thus, the extent to which these prevention strategies actually prevent falls is questionable and limits the potential generalizability (or use) of these methods to other settings. Although few in number, some of the more promising approaches to the prevention of falls within community and institutional settings will be discussed.

1.3.1: Community-based Fall Prevention Programs

Within community populations, few fall prevention studies have been evaluated to determine the effectiveness of the interventions (Hornbrook et al., 1994). Of the few that have been conducted, several different approaches (e.g., exercise programs, education, environmental modification) in the prevention of falls were employed. The intervention strategies and results of some of these studies will be reviewed below.

MacRae et al. (1994) initiated a study to: (1) determine the effects of a 1-year low intensity exercise program on the falls and injuries of community-dwelling elderly women and (2) to determine the effects of the exercise program on various physical performance risk factors (e.g., poor balance, lower extremity muscular weakness, and gait abnormalities) that were associated with falling. Forty-two women were assigned to the exercise group, while 38 were assigned as controls. The exercise program, which employed a "stand-up/step-up" routine, was conducted in 1-hour sessions, 3 days a week for 12 months. The control group received a health promotion (e.g., nutrition, stress management, exercise) and safety education (e.g., falls prevention within the home and out of the home) program, which met once a week for 12 months. The exercise group also received this intervention. At the end of the study, 36% of the exercise group and 45% of the control group experienced a fall; however, there was no significant difference with respect to the number of individuals that fell between groups (chi square = 0.22, $p>0.05$). The control group did, however, experience significant declines in isometric strength of the knee extensors and ankle dorsiflexors within the year. Also, both groups declined significantly in isometric strength of the hip abductors from the pre-assessment to the post-assessment. The researchers concluded that their exercise intervention was successful in maintaining balance and strength of the knee extensors and ankle dorsiflexors within the exercise group, but unsuccessful in altering the number of falls, the injury severity of the falls, or in changing the gait of the exercisers. Further, they concluded that the exercise program was not of sufficient intensity or specific enough to affect gait performance in fairly healthy subjects. They also recommended that the variable of interest may be the severity of the injury, rather than the fall itself, given that if followed for a longer period of time, all of the women may have become fallers. The focus would thus be the effect of the exercise program on the severity of the injury, rather than fall status (MacRae et al., 1994).

Reinsch et al. (1992) studied the effectiveness of exercise and cognitive-behavioural programs in seniors, as compared to a "discussion" control group at 16 senior centres. The exercise intervention utilized the low intensity "stand-up/step-up" exercise program and a cognitive-behavioural intervention that covered topics such as health and safety for the prevention of falls, and relaxation training. The discussion control group addressed health issues, unrelated to fall prevention. Both groups meet for three hours a week for 12 months. After the 1 year program, no significant differences were obtained with respect to time-to-first-fall between the two groups. Further secondary outcome measures such as strength, balance, fear of falling and perceived health did not significantly change between the two groups. They suggested that the exercise program employed was not of a sufficient intensity to produce the desired changes in strength and balance, or to decrease falls within the exercise group (Reinsch et al., 1992). A study by Hornbrook et al. (1994) concluded similar results, concerning the inadequacy of the intervention dose, after a randomized trial of a fall prevention program that addressed home safety, exercise and behavioural risk factors, which failed to produce a marked protective effect in seniors' risk of falling. Another exercise program (Lord et al., 1995) for fall prevention found that the experimental group participating in the exercise intervention improved their reaction time, neuromuscular control and body sway, with no corresponding improvement within the non-exercising controls; however, there were no significant differences in the proportion of fallers between the two groups, although there was some evidence to suggest the trend of fall frequency and adherence to the exercise program. Lord et al. (1995) contended that exercise has the potential to improve sensorimotor function (e.g., reaction time, neuromuscular control, body sway) in the elderly, and that high compliance to exercise programs reduced the frequency of falls. The researchers further noted that additional studies are needed to determine whether exercise effectively prevents falls, by specifically focussing on the precise relationship between exercise adherence and fall prevention.

At the present time, Edwards et al. (1993) is in the process of conducting a randomized controlled trial of two interventions in preventing falls. One of the interventions is comprised of a falls clinic with follow-up home visits, while the other intervention focusses on a community mobilization technique (namely, an awareness campaign, followed by focus groups to encourage discussion about falls, and finally monthly meetings to reinforce behavioural changes). The analysis of the data will allow for the comparison of the effectiveness of the two interventions in the reduction of the incidence and risk of falls. Further, specific characteristics possessed by the seniors that are enhanced by the interventions (e.g., protect against falls) will be determined. These findings have to potential to provide new insight into the prevention of falls among the community-based elderly; however, no results have been published thus far.

A randomized controlled trial was designed to assess whether intervention by a health visitor could reduce the number of fractures over a four year period among seniors over the age of 70 (Vetter et al., 1992). Seniors in the intervention group received a four pronged approach to reducing fractures: (1) assessment and correction of nutritional deficiencies, including reducing smoking and alcohol intake; (2) assessment and referral of medical conditions (e.g., heart block or inappropriate medication use); (3) assessment and correction of environmental hazards within the home (e.g., poor lighting); and (4) assessment and improvement of fitness. These seniors were visited at least once a year, and subsequently thereafter, as often as thought necessary by the health visitor, while the control group (n = 324) received no intervention. After following the fracture rate of the seniors for a four year period, it was determined that the health visitor had no significant effect on the incidence of fractures among the intervention group (4% fracture rate) as compared to the control group (5% fracture rate) (Vetter et al., 1992). Given that this study was not designed specifically to prevent falls, the generalizability of the use of a health visitor in the prevention of falls warrants further investigation.

The FICSIT (Frailty and Injuries: Cooperative Studies of Intervention Techniques) trails have offered the most promising efforts for fall prevention. Briefly, the FICSIT study is a collaborative and multi-site (n=8 sites) research endeavour, in which specific interventions for selected target groups of seniors are tested at each of the site locations; however, all of the sites have some common measures (e.g., socio-demographics, health attributes, measures of compliance and outcomes) that allow for useful comparisons of the variables of interest across all sites. The primary aim of these interventions is twofold: to reduce frailty and fall-related injuries among seniors (Buchner et al., 1993A; Ory et al., 1993). One of the sites used a multidisciplinary risk abatement strategy to reduce risk factors that had been identified for falls (Tinetti et al., 1993A & C; 1994), while four of the other sites examined the effects that their specific interventions had on measures of strength, flexibility, balance and/or endurance exercise for community-based seniors (Buchner et al., 1993B; Hornbrook et al., 1993; Wolf et al., 1993; Wolfson et al., 1993). Two short-term FICSIT interventions, designed to improve strength in community-based seniors, revealed significant gains in strength in vigourous (healthy) (Judge et al., 1994) and frail (Fiataroni et al., 1994) seniors. Unfortunately, King and Tinetti (1995) report that the results from other FICSIT efforts have not all been published to date (e.g., Buchner et al., 1993; Wolf et al., 1993; Wolfson et al., 1993).

Initial findings from the multidisciplinary risk abatement program on falls have been published. Results from this randomized trial comparing the effectiveness of usual care plus social visits, versus a multifactorial, targeted risk abatement intervention strategy for reducing falls among community-based seniors at risk of falling, was undertaken by Tinetti et al. (1993; 1994). Community-based men and women (n=301) who were 70 years of age or older, and who possessed one of the following risk factors for falling: (1) postural hypotension; (2) use of sedatives; (3) use of at least four prescription medications; and (4) impairments in arm or leg strength, in range of motion, in balance, in the ability to move safely from the bed to a chair and/or toilet transfers, or in gait, were studied. The control group received their usual health care visits, plus social visits from the researching staff. The experimental group participated in the abatement intervention that included an environmental hazards assessment, medication review, behavioural instructions to prevent falls, and participation in exercise programs aimed at modifying their individual risks for falls (e.g., improve upper and lower extremity strength, range of motion, balance and gait). At the end of the one year intervention, the multiple-risk factor intervention strategy resulted in a significant reduction in the risk of falling among the elderly (reduction of 31%). Specifically, 35% of the experimental group fell, while 42% of the control group experienced falls (p=0.04). In addition, there was also evidence of a trend for the intervention group to require less medical treatment for injuries, as compared to the control group. Further, the proportion of seniors with targeted risk factors for falling was reduced within the intervention group, in comparison to the control group. For example, among seniors that possessed specific risk factors at the onset of the study, a smaller percentage of experimental participants continued to have these risk factors at the second assessment time, as indicated by the following for the experimental and control seniors, respectively: (1) at least four prescription medications (63% vs 86%; p=0.004); (2) balance impairment (21% vs 46%; p=0.001); (3) impairment in toilet transfers (49% vs 65%; p=0.05); and (4) gait impairment (45% vs 62%; p=0.07). Specifically, there was a reduction of 11% in risk of falling for each reduction of one risk factor (adjusted relative risk=0.89; 95% confidence intervals: 0.79-1.00) (Tinetti et al., 1994). According to King and Tinetti (1995), the cost of the intervention averaged $891.00 for each subject. They contended that the cost of the prevention of one fall needing medical care, was comparable to the hospitalization treatment cost for a fall-related injury. Tinetti et al. (1994) concluded that the reduction of falls, at a reasonable cost, found in the experimental group may be partly explained by the strategy (risk-factor abatement) utilized, given that many risk factors that also contributed to immobility and functional decline were improved within the experimental group; however, this intervention needs to be replicated in order to determine its applicability and generalizability to other settings.

Other FICSIT efforts revealed similar promising results. For example, a preplanned meta-analysis of individual data of seven of the sites was undertaken to examine the efficacy of the exercise interventions. Results revealed that individuals assigned to exercise interventions were less likely to fall during the follow-up period (adjusted incidence ratio=0.90; 95% confidence interval=0.81-0.99), as compared to non-exercising controls. Further, individuals that participated in exercise programs with a balance component, were less likely to fall (adjusted incidence ratio=0.83; 95% confidence interval=0.70-0.98), in comparison to the controls. It is important to note that the exercise components differed between the sites with respect to the type, duration, frequency, and intensity, although training was completed in one or more of the following areas: endurance, flexibility, balance, Tai Chi, and resistance. Further, several of the interventions at the various sites contained other non-exercising components (e.g., education, nutritional supplements, behavioural components, medication changes). The researchers therefore concluded that interventions that included exercise components, reduced fall risk among seniors, although conclusions were not drawn about specific exercises since many were tested in combination with other exercises and non-exercise strategies. For example, it could not be concluded that balance training reduced falling, but rather that FICSIT interventions that included balance training did have an effect on falls (Province et al.,1995).

A large portion of the literature pertaining to falls prevention in the community-based elderly have been largely descriptive in nature. For example, after risk factors for falls are identified within the literature (see, for example, Overstall, 1980; Steinmetz & Hobson, 1994; Tinetti & Speechley, 1989) or after the completion of a research study to determine risk factors (see, for example, DeVito et al., 1988; Gabell, 1986), suggestions have then been made as to possible prevention strategies for falls; however, the majority of these strategies have not been tested for their effectiveness. Thus, the extent to which these prevention strategies actually prevent falls is questionable, and limits the potential generalizability of these methods to other settings. Further, other studies were methodologically weak and did not provide evidence of effective prevention studies (see, for example, n=15 and no control group for Binder et al., 1994; n=28 for El-Faizy & Reinsch, 1994). In the future, research studies must evaluate the effectiveness of various fall prevention strategies or interventions, and consequently replicate the interventions found to prevent or decrease falls (e.g., Tinetti et al., 1994), in order that the most appropriate interventions can be determined and subsequently implemented within the community.

1.3.2: Fall Prevention Programs within Institutional Settings

At the present time, there are several proposed intervention programs for fall prevention within institutionalized settings that are currently being employed by these facilities; however, few of these prevention programs have been adequately assessed as to their effectiveness in the prevention of falls. Generally, work that has been completed within this area proposed various strategies for preventing falls based on predetermined risk factors (e.g., from the literature). For example, after determining that age, living alone, visual deficits, balance problems, and neurological programs were risk factors for falls within their institution, Craven and Bruno (1986) devised a number of nursing implications for their staff and the family members of patients to prevent or decrease falls and their subsequent injuries. Specific recommendations made by Craven and Brunn (1986) included educating patients regarding environmental safety, observation of balance during activities of daily living, and referral to a physical therapist for improvement in muscle strength and balance; however, no evaluation of these strategies was undertaken before advocating their use.

Neufeld et al. (1991) initiated the development of a Falls Consultation Service in the medical department of one nursing home in order to better address the issue of the etiology, prevention and treatment of patient falls within their institution. After establishing the risk factors for falls, the falls consultation team, which consisted of members of the medical, nursing, rehabilitation, and administration departments, devised educational conferences in which methods for reducing the risk of falling were discussed (e.g., individuals at high risk of falling would be placed near the nursing station where staff surveillance and supervision would be employed; reducing medications; etc ...). These conferences were designed to include the patients, friends, family members and hospital staff members (Neufeld et al., 1991). The recommendations from this consultation team have yet to be evaluated for their effectiveness in the reduction and prevention of falls.

One of the more promising fall prevention approaches for the institutionalized involved the determination of risk factors for falls in acute, long-term, and residential health care settings, and the subsequent development of appropriate prevention strategies for each of these settings (Heslin et al., 1992). Since there was variability for each of the settings with respect to risk factors, the different interventions used were dependent upon the location, as follows: (1) acute care area: bed sensor program, benzodiazepine utilization prevention plan, assessments of impaired mobility; (2) long-term care: restraint-free cushions, enhancements to the bed-wheelchair transfer plan, a wheelchair preventive maintenance and specialization program; and (3) residential care: trial bed-to-bathroom rest-stop strategy, altered dinner hour, and recommendation gait assessments. At the present time, the use of the bed sensor program in the acute care setting was found to reduce the occurrence of bed-based falls, and major and minor injuries, while the other two methods have not been tested for their effectiveness. After implementation of the use of the restraint-free cushion effect and the bed-to-chair transfers in the long-term care unit, no injuries have been reported with the first method, and a 55% reduction in bed-based falls was reported with the second method. The intervention results for the residential care unit are not available, as much of the work is still in the pilot stage (Heslin et al., 1992).

Two other studies have offered interesting approaches in the prevention of falls, namely, (1) the use of hip joint protective pads to reduce the occurrence and/or severity of hip injuries, resulting from falls, and (2) the use of scheduled toileting rounds for seniors. Unfortunately, only the pilot studies examining the use of these methods have been completed. The results indicated that certain individuals would wear the hip pads (e.g., cognitively intact seniors, particularly those that had prior significant injuries or fall-related injuries), and thus would have the potential to aid in the reduction of hip injuries from falls; however, the effectiveness of the elimination-rounds method did not produce such positive results. For example, it was determined that despite 80% compliance of the staff to assist in these processes, over 50% of falls occurred during toileting during the pilot testing because patients did not ask for staff assistance. Thus, it was concluded that effectiveness of this method was dependent upon compliance of the patients and staff (Rude-Ross et al., 1992).

Unfortunately, the majority of studies concerning prevention within the institutional setting have been similar in design to that of Craven and Bruno (1986), and Neufeld et al.

(1991) (see, for example, Brady et al., 1993; Soja et al., 1992; Wolf-Klein et al., 1988). Although these suggestions may in fact decrease or prevent falls from occurring, an evaluation into their effectiveness, in addition to explanations of proper implementation procedures have generally been lacking within the literature to date. Until thorough evaluations have been completed regarding the effectiveness of prevention programs for falls, it is unlikely that noticeable progress will occur.

Given the amount of research conducted in the area of fall prevention, with specific reference to the lack of established and effective prevention programs for falls, it is sufficient to conclude that more work is needed to determine specific interventions that decrease the risk of falls and fall-related injuries within senior populations. Further, the development of these intervention programs must approach fall prevention from a multidimensional approach. Additionally, researchers should determine whether the outcome of interest is fall status or the severity of injury.

1.4: Limitations in the Falls Research

The objectives of fall research are to identify the intrinsic and extrinsic factors common among fallers and the fall event, and to subsequently determine whether the removal or alteration of these factors will reduce the incidence of falls. However, there are several limitations in the available research that contribute to the lack of knowledge surrounding the fall event. These limitations will be addressed in turn.

A large proportion of the studies concerning falls have been retrospective in nature (see, for example, Blake et al., 1988; Prudham & Evans, 1981). Retrospective studies rely on the quality of the documentation of health professionals and the memory of past fallers to determine the relationship between risk factors identified and the fall episode (Tideiksaar, 1989). Additionally, the documentation from medical records or incident reports, primarily the presenting symptom terminology generally lacks precision because of the many possible causes underlying the symptoms the patient presents (Rubenstein et al., 1988). Further, fall incidence rates have more than likely been under-estimated because frail elderly may have suffered injuries as a result of their falls, leading them to be hospitalized or placed within institutions (Prudham & Evans, 1981). Thus, these fallers may have not been accounted for within community estimates within the time period prior to the study's onset.

Another limitation has been the narrow range of variables examined in relation to falls. Several studies have restricted their analyses to a few variables, and did not explore a comprehensive set of risk factors involved with the event (Ruthazer & Lipsitz, 1993; Tideiksaar, 1989). Additionally, some researchers did not approach the fall event from a multidimensional perspective (Braudy-Harris, 1989; Sobel & McCart, 1983). Therefore, the findings from these studies may have overlooked significant risk factors for falling or misinterpreted inappropriately confounding explanations for some factors associated with falling.

Under-reporting of falls may also have limited the findings of the research. Falls may have been underreported for the following reasons: (1) individuals with cognitive impairments (e.g., dementia) that were unable to report falling episodes (Tideiksaar, 1989); (2) a lack of witnesses for the fall event; (3) problems with recall among seniors (Campbell et al., 1989; Cummings et al., 1988; Perry, 1982; Prudham & Evans, 1981); (4) all falls did not necessarily result in injury and thus were not brought to medical attention, and further many seniors did not necessarily seek medical attention for fall-related injuries (Campbell et al., 1990A; Kane et al., 1989; Sattin et al., 1990); (5) reliance on self-reporting (Kane et al., 1989); and (6) some seniors may not admit that they experienced a fall (Campbell et al., 1989; Rubenstein et al., 1988) because they: (a) attribute the fall to consequences of normal aging;

(b) deny the fall because it reminded them of increasing frailty and dependency; or (c) fear that if reported, it would lead to restriction of activities or to institutionalization by family members (Tideiksaar, 1989). Additionally, community-based health professionals do not have the legal obligation to document fall episodes among seniors living in the community (Tideiksaar, 1989). This situation may lead to under-reporting of the incidence of falls within the community, in addition to an under-representation of potential risk factors for falls. The same situation may occur within an institution, even though incidence reports are to be completed with every fall episode. Falls without injury or injuries deemed to be trivial by hospital staff (Perry, 1982) may not have been reported in understaffed facilities. Further, Kanten et al. (1993) have suggested that reporting of fall frequency was dependent upon the method of ascertainment. Specifically, in a study of the examination of three reporting methods in nursing homes (e.g., incident reports, chart abstraction, interviews with patients), chart reviewing reflected a greater number of fall occurrences than other methods (Kanten et al., 1993).

A tendency to focus only on certain types of falls also has hindered the research conducted in this area. For example, falls that resulted in injury may have been the only type of fall that was studied (see, for example, Sattin et al., 1990). Although it is essential to study these types of incidents to determine the causes and risk factors for falls and to identify possible means to reduce fall-related injuries, valuable information is lost by excluding falls that do not result in an injury, particulary since the majority of seniors do not experience fall-related injuries. In actuality, the risk factors for a fall-related injury and a fall without injury may differ and should be addressed independently if the data allows for such an analysis. Given that the majority of seniors that fall do not experience an injury, studies that have not examined these types of falls, have not addressed the majority of falls experienced by the elderly (Tideiksaar, 1989). Further, Speechley & Tinetti (1991) contended that the identification of various types of falls and fallers among elderly individuals may assist in targeting individuals for prevention programs, since fall-related injuries have the potential to cause health problems for vigourous and frail individuals; however, prevention efforts should be tailored to the specific group of seniors the program has been targeted (Speechley & Tinetti, 1991).

One of the greatest limitations facing fall research has been the lack of a standard, universal definition and classification system for falls (Campbell et al., 1989; Cwikel & Fried, 1992; Lach et al., 1991; Tideiksaar, 1989) . For example, in a classification system, falls may be grouped by the presumed cause of the incident; however, the same fall might be distinguished from other falls by presenting symptoms of the fall (e.g., dizziness, drop attacks, syncope, slips) or by precipitating mechanisms of the fall (e.g., environmental hazard, postural hypotension, cardiac arrhythmia) or by underlying risk factors for falls (e.g., decreased vision, antihypertensive medications) (Rubenstein et al., 1988). This ambiguity in the various classification systems used, leads to a lack of consistency in the literature in the preparation of a falls typology. Additionally, the inclusion criteria as to what constitutes a fall has been inconsistent. For example, some researchers included fall instances in which a person unexpectedly assumed a lying position on the floor or a lower lever, while in other studies seniors that had identifiable etiologies for their falls (e.g., stroke, myocardial infarction) were excluded (see, for example, Teno et al., 1990; Tinetti et al., 1988). Further, Lach et al. (1991) contended that the multiplicity of risk factors for falls may have obscured the different risk factors and their relative contribution to the fall situation, for different types of falls. To illustrate, Kellogg International Work Group (1987) have provided the following cases: (1) a "healthy" elderly man extends his head backwards causing the ladder he is climbing to move, and he falls to the ground. His health does not suffer as a result of the injury he incurs; and (2) a frail woman's legs give way while walking, and she falls to the ground. Although she sustains little injury, she is weakened by the fall, lies on the floor for hours and eventually becomes very ill. Between these two examples are a number of types of falls that are attributable to a wide range of physical and medical characteristics. Consequently, these different kinds of falls must be clearly distinguished in order for effective intervention programs to be developed for the type of fall in question (Kellogg International Work Group, 1987). Therefore, this lack of uniformity in definitions and classifications of falls have the potential to affect the incidence of falls, in addition to the various risk factors and causes of falls that have been determined.

The cross-sectional nature of the majority of the studies has also limited the findings and conclusions that can be drawn (see, for example, Blake et al., 1988; Wickham et al., 1989). Cross-sectional designs do not allow researchers to establish a temporal order for factors associated with the fall event. Although cause and effect relationships cannot be established with observational longitudinal data, the ability to separate risk factors and outcomes by time does represent a step ahead in evidence toward a causal relationship.

One additional problem with a considerable proportion of the literature is the lack of multivariate statistical analyses to determine the risk factors for falls. Findings from several studies have reported only the univariate and/or bivariate results of the findings, and thus, have failed to control for potentially confounding risk factors for falls (see, for example, Campbell et al., 1988; Prudham & Evans, 1981; Wild et al, 1981A).

2.0: THE PROPOSED STUDIES

2.1: Rationale

Despite the increasing attention that has been given to falls among seniors, the precise causes are not understood, and consistent evidence for effective methods of preventing falls is not yet available (Kellogg Intentional Work Group, 1987; Hornbrook et al., 1994). Unfortunately, progression of knowledge within this area has been hampered primarily by the many methodological and conceptual limitations discussed previously. Additionally, no one data set or research study to date has been able to adequately address all of the issues and gaps that need further discussion. Therefore, in order to obtain a better understanding of the "big picture" concerning falls, it would seem necessary to tap into multiple sources of data containing fall information. Secondary data sources, in addition to the collection of primary data, will thus be used to address a few of the gaps that exist within the falls research. It is important to note that the current research effort cannot address all of the issues that need to be dealt with in this area of study.

The use of multiple methods has a number of advantages. For example, if the same conclusion is derived from different methods or with different populations, one may have greater confidence in the findings. Also, whereas primary data collection in an experimental design may lead to strong, detailed evidence about the effectiveness of an intervention, it is generally not possible to extrapolate such findings to the larger population because of selection biases, for example. Secondary data sources often provide only crude measures of the constructs of interest, but this may do so for nationally representative samples. It may therefore be possible to improve knowledge in this field by effectively utilizing data from a variety of sources.

2.2: Introduction to the Proposed Studies

After reviewing the falls literature, a number of gaps within the area become clearly evident. Unfortunately, restraints involving finances and access to facilities, did not permit every gap to be addressed within this dissertation.

One of the most understudied areas has been the lack of a distinction between one-time fallers and chronic fallers. Although research to date has suggested that one-time fallers and multiple fallers represent distinct groups, more research that includes multivariate analysis that separates non-fallers, one-time fallers, and multiple fallers, is necessary. Further, replication of study results need to be completed, and tested on other settings (e.g., community-based, institutions, hospitals). Thus, given the available data sets, the following questions arise with respect to these unresolved issues: (1) do the risk factors differ between non-fallers, one-time fallers and chronic fallers?; and (2) do the same risk factors between these two groups exist within the community-based and the institutionalized elderly? or do these risk factors vary across settings?

Given the lack of information pertaining to effect modification, interaction terms have been examined within each of the data sets. Specifically, age with medication use, presence of chronic conditions, mobility status, and history of falling have been examined. Further, interactions between gender and medication use, and between gender and presence of chronic conditions were also assessed. Interaction terms were examined for all of the analyses within this dissertation.

Information pertaining to falls at the national level has also been limited. Although other research efforts have addressed falls in community-based studies, the generalizability of these findings to other settings is questionable. Thus, determining risk factors for falls in nationally-based studies would aid in rectifying this problem, and would strengthen the findings of smaller community-based efforts.

Another notable gap has been the lack of knowledge and research efforts concerning the most effective prevention programs for falls. Although some effort has been made in the past, little has been concluded about prevention programs, since preventive efforts continue to remain in the infancy stages. However, the serious nature and frequent occurrence of falling within older populations establishes the need and priority for the development of falls prevention and rehabilitation programs. Since a large proportion of the falls that occur within senior populations are generally accidental, or the result of environmental hazards and their interactions with age-related changes (primarily balance control), education concerning environmental manipulation and factors surrounding falls to accommodate for balance dysfunctions (as suggested by Tideiksaar, 1990), and exercise programs aimed at altering the instability associated with falling, seem to be essential elements in fall prevention. Thus, a number of questions pertaining to the prevention of falls that were addressed included: (1) is it possible to modify any of the potential risk factors for falls through preventive efforts?; (2) given the evidence concerning education and balance control, are either methods effective in preventing falls from occurring, or in decreasing the severity of the injury incurred?; and (3) with the restraints being placed on financial spending, which of these approaches is the most effective for modifying falls?.

In order to address the proposed research questions, primary and secondary data were employed. Secondary data analyses was conducted on three data sets, consisting of information from the 1991 Survey on Ageing and Independence, the 1994-1995 National Population Health Survey, and data from the Grand River Hospital Corporation-Freeport Site. These secondary data sources primarily addressed the issues and gaps raised concerning non-fallers, one-time fallers and chronic fallers, interaction terms in modelling, and in determining information pertaining to falls at the national level. Primary data was also collected to address the issues of non-fallers, one-time fallers vs chronic fallers, interaction terms, and the testing of intervention strategies for the prevention of falls. This phase involved the development of an intervention that included different components (e.g., balance control, education). Although some effort has been made to assist seniors that have fallen within the Kitchener-Waterloo Region (e.g., Home Care, Day Hospital at Freeport Hospital), there appear to be few programs within the area that have specifically addressed the needs of individuals that have fallen and are at an increased risk of subsequent falls, hospitalization and possibly death. Thus, given that the population is aging and the number of frail seniors that will experience falls and ensuing complications will increase, it would seem essential to develop prevention programs for falls for senior populations within this area.

Common elements exist between each of the data sets to be analyzed. As shown in Table 2.1, a number of similar risk factors link the various data sets together. These common threads between the data sets permitted the comparison of risk factors and other fall information between the community and institutional settings utilized. Further, these common links allowed for the assessment of consistency in the risk factors and the direction of the associations between the risk factors and the fall event. However, given that the definition of a fall differed between the data sets, caution was taken when comparisons were drawn. Policy implications were provided, based on the findings from these analyses.

Table 2.1: Comparison of Factors Across the Proposed Studies

Classification of Variables	Variables of Interest	SAI	NPHS	Freeport Hospital	Intervention
Socio-demographic Variables	***Age***	•	•	•	•
	Gender	•	•	•	•
	Income	•	•		
	Education	•	•		•
	Lifetime Occupation				•
Health Practice Variables	***Alcohol Consumption***	•	•		•
	Smoking Status	•	•		•
	Rest/Sleep Patterns	•			•
	Medication Use		•	•	•
Social Support Variables	***Marital Status***	•	•	•	•
	Support from Family	•			•
	Support From Friends	•			•
	Composition of Household		•		

Note: Secondary Data Sources:
SAI (Survey on Ageing and Independence) (@ national level)
NPHS (National Population Health Survey) (@ national level)
Freeport Hospital (institution)

Primary Data Source:
Intervention (community)

(continued) ...

Table 2.1: Comparison of Factors Across the Proposed Studies

Classification of Variables	Variables of Interest	SAI	NPHS	Freeport Hospital	Intervention
Measures of Frailty	*Activity Limited by Health*	•			
	Mental Status			•	
	Perceived Health	•	•		•
	Change in Health	•		•	
	Medical Diagnosis		•	•	•
	Previous History of Falls				•
	Use of Homecare Services		•		
	Previous History of Injury				•
	Measure of Affect				•
Exposure to Risk	*Activity Compared to Others*	•			•
	Provided Assistance to Others	•			
	Frequency of Physical Activity		•		
	Home Maintenance	•			•

Note: Secondary Data Sources:
SAI (Survey on Ageing and Independence) (@ national level)
NPHS (National Population Health Survey) (@ national level)
Freeport Hospital (institution)

Primary Data Source:
Intervention (community)

continued ...

Table 2.1: Comparison of Factors Across the Proposed Studies

Classification of Variables	Variables of Interest	SAI	NPHS	Freeport Hospital	Intervention
Fitness Measure	***Handgrip Strength***				•
Facility Information	***Admission Date***			•	
	Date of Discharge or Death			•	
Balance and Stability Measures	***Co-ordination***			•	
	Balance			•	•
	Mobility		•	•	
	Transfer Ability			•	
	Balance Confidence				•

Note: Secondary Data Sources:
SAI (Survey on Ageing and Independence) (@ national level)
NPHS (National Population Health Survey) (@ national level)
Freeport Hospital (institution)

Primary Data Source:
Intervention (community)

CHAPTER 3: METHODOLOGY FOR THE SURVEY ON AGEING & INDEPENDENCE (SAI), 1991

Unfortunately, few nationally representative data sets specifically address the issue of falls among Canadian seniors. For example, in a very large sample of older adults, the Survey on Ageing and Independence (SAI) deals broadly with injuries in the elderly. In an attempt to determine risk factors for falls, outcomes from accidental injuries that were most likely the result of a fall (e.g., sprains, strains, fractures, bruises, dislocations) were examined.

Statistics Canada (see Appendix 1) conducted the SAI in September 1991, with the intent of examining factors that contributed to the independence and quality of life of Canadian Seniors. The SAI was sponsored by a number of agencies, including Health and Welfare Canada, Consumer and Corporate Affairs, Canada Mortgage and Housing Corporation, Veterans Affairs Canada, Secretary of State Canada, and Communications Canada. The specific aim of the SAI was to provide information concerning the retirement status and background, type of employment, work characteristics and the preparation activities toward retirement for the Canadian population. Details of socio-demographics, social support resources, health status, physical activities, activity limitations, and dwelling characteristics were also collected (Government of Canada, 1993; Statistics Canada, 1991).

The SAI collected data on a representative sample of approximately 20,000 individuals between the ages of 45 to 102. These individuals included an equal representation of "tomorrow's seniors" (45 to 65 years of age) and "today's seniors" (65 years of age and older). The survey was conducted as a sub-sample of the Labour Force Survey (LFS), which utilized a stratified, multi-stage design and included probability sampling at each of the stages. For each household contacted, one person over the age of 45 was interviewed via the telephone; however, 10% of the sessions were conducted through face-to-face interviews within the homes of the participants (Government of Canada, 1993; Statistics Canada, 1991).

This sample excluded individuals living in remote areas of Canada (i.e., the Yukon and North West Territories), residents of institutions, individuals living on Indian Reserves, and full-time members of the Canadian Armed Forces. In total, these exclusions represented approximately four percent of the Canadian population over the age of 45. It is important to note the importance of the exclusion of residents of institutions. Approximately 8% of Canadians 65 years of age and over were living within institutions at the time this survey was conducted. Further, this percentage increased to 18% and 28% for men and women, respectively, that were 80 years of age and older (Government of Canada, 1993; Statistics Canada, 1991). Therefore, the results from this analysis will not be representative of the entire elderly population. For the present analysis, only individuals over the age of 65 (n = 10, 059) were utilized.

3.1: Measures

The information that will be used from the SAI has been divided into six categories: (1) socio-demographic variables, (2) health practice variables, (3) social relationship measures, (4) variables associated with frailty, (5) exposure to risk variables and (6) accident-related injuries.

3.1.1: Socio-demographic Variables

The socio-demographic variables examined were age, gender, income, and education.

Age

Individuals were asked to provide the day, month and year of their date of birth. Age was subsequently calculated based on this information. For the purpose of data analysis, age was categorized into the following age ranges: 65 to 69, 70 to 74, 75 to 79, and

80 and over. Dummy variables were used to represent the highest age categories, while the lowest category (65 to 69) was utilized as the reference group.

Gender

The gender variable was coded as a binary variable with the categories of male (0) and female (1). Males were used as the reference group in logistic regression analysis.

Income

Responses to the questions, "What is your best estimate of the total income of all household members from all sources, before deductions during 1990? Was it ... less than, or more than, $5,000? ... $10,000? ... $20,000? ... $30,000? ... $40,000? ... $60,000? ... or $80,000?", were coded as: "under $15,000 or no income", "$15,000 or more", and "not stated". In the analysis, the "under $15,000 or no income category" was utilized as the reference group. Income was divided in this manner because over 40.0% of the sample refused to answer the question concerning their household income, thus limiting the sample size within the possible income categories.

Education

For the question pertaining to educational status, individuals were asked to report the highest level of schooling they had obtained. The responses were recoded utilizing dummy coding, with the lowest level of educational attainment as the reference group. The following categories were formed for this measure: elementary or some secondary education, high school or some post-secondary education, post-secondary certificate/diploma or university degree.

3.1.2: Health Practice Variables

The variables classified as health practice variables included individual's perceptions of their daily alcohol consumption, smoking status, and rest and sleep patterns.

Alcohol Consumption

For the question posed by the SAI, "On a daily basis, do you avoid alcohol to stay healthy?", responses were coded to form the categories: avoids alcohol (0) and does not avoid alcohol (1).

Smoking Status

Responses to the question, "On a daily basis, do you avoid smoking to stay healthy?", were coded into the categories smokers (0) or non-smokers (1).

Rest and Sleep Patterns

Responses to the question, "On a daily basis, do you get enough rest and sleep to stay healthy?", were coded into the following: does not maintain regular rest and sleep patterns (0) and maintains regular rest and sleep patterns (1).

3.1.3: Social Relationship Variables

Marital status and support from close family members and friends were examined as social relationship measures.

Marital Status

Responses to the question, "What is your current marital status: married or living common-law? separated? divorced? widowed? or singe (never married)?", were collapsed into a binary variable, and subsequently coded as married (0) or not married (1). All individuals that were not married were included within the same category since over 80.0% of the sample were married. Thus, further breakdown of this category would have limited the sample size within each of the groupings.

Social Support

For the measure of social support, individuals were asked the following: "Do you have any family members (spouse, partner, children, and other relatives) you feel close to? That is, family members you feel at ease with, can talk to about private matters, or can call on for help?", and "Not counting family members, do you have any close friends? That is, do you have any friends with whom you feel at ease, can talk to about private matters, or can call on for help?". Responses for social support were coded into having support from family members and/or friends (0) or not having support from family or friends (1).

3.1.4 Measures of Frailty

Measures of frailty that were used for this analysis included activity limitations because of health status and perceived health.

Activity Limitations

Responses to the question, "Are you limited in the kind or amount of activity you can do because of a long-term illness, physical condition or health problem?", were coded into two categories, activity limitations (0) and no activity limitations (1). In this question, a long-term illness referred to conditions that persisted or were expected to persist for more than six months.

Perceived Health

For the variable perceived health, individuals were asked to report whether they perceived their general state of health to be excellent, good, fair, or poor. For the purpose of this analysis, the categories were collapsed into excellent/good health (0) and fair/poor health (1).

3.1.5: Exposure to Risk Variables

Exposure to risk variables encompassed measures that increased an individual's opportunity to experience a fall-related injury. These measures included: activity status compared to others of the same age, information pertaining to whether or not the individual provided assistance to others, and home maintenance status.

Activity Status

Responses to the question, "Compared to other people your age, would you say that you are physically more active? as active? or less active?", were coded with dummy variables, utilizing "more active" as the reference group. For this question, individuals were informed that physical activity referred to activities that they completed at work, at home, and in their leisure time. Examples of activities included walking, gardening, washing windows, dancing and golfing.

Provided Assistance to Others

Individuals were asked whether or not they had provided assistance to others within the past twelve months. Specifically, individuals were asked if they performed any of the following activities for others: housework, yardwork, meal preparation, grocery shopping, transportation, babysitting, managing money, personal care, emotional support, or volunteer work through a group or organization. Responses were coded into did not provide assistance (0) or provided assistance (1).

Home Maintenance Status

Responses to the questions, "Is your home in need of any repairs? and "Does it require major or minor repairs?", were collapsed to form the dummy variables no repairs, minor repairs, and major repairs. Having no repairs was used as the reference variable in the analysis. For this question, minor repairs included repairs such as broken windows, leaking sinks or small cracks in the interior walls, while major repairs referred to sagging floors, damaged walls or damaged electrical wiring. Further, responders were informed that repairs did not include desirable remodelling, additions or conversions to their homes.

3.1.6: Accident-Related Injuries

This section included variables with respect to safety in the home and away from the home, and the severity of these injuries.

Internal Accident-Related Injuries

For injuries within the home (internal injuries), the questions, "Thinking about the past twelve months, were you injured in an accident around your home, that altered your routine for at least one day?" and "Thinking about the most recent accident, what injuries did you have ... cuts? bruises? dislocations? fractures? sprains/strains? choking? suffocation? swelling? burns? scalds? poisoning? concussion? or tenderness?", were subsequently coded into experienced no accident-related injury (0) or experienced an accident-related injury (1); however, since the intent of the analysis was to determine risk factors related to falls, only outcome injuries that were perceived by the researcher to most likely be attributable to a fall were utilized. Therefore, the injuries included were fractures, sprains, strains, and dislocations.

External Accident-Related Injuries

For injuries away from the home, similar questions were posed, "In the past twelve months, were you injured in an accident away from your home (not including automobile accidents), that altered your routine for at least one day?" and, further, "Thinking about the most recent accident, what injuries did you have ... cuts? bruises? dislocations? fractures? sprains/strains? choking? suffocation? swelling? burns? scalds? poisoning? concussion? or tenderness?". Once again, only outcome injuries that were perceived by the researcher to most likely be attributable to a fall were utilized. Thus, fractures, sprains, strains and dislocations were used to develop the binary coding schemes "did not experience an accident-related injury external to the home" (0) and "experienced an accident-related injury external to the home" (1).

Severity of Accident-Related Injuries within the Home (Internal)

Individuals that experienced injuries were posed the following question: "Did you get treatment from a health care professional, such as a doctor, or did you treat the injury yourself?". Responses to the question were coded into "individuals that did not experience an injury or that experienced an injury, but did not receive treatment from a health care professional" (0), and "individuals that experienced an injury and received treatment from a health care professional" (1). For the purpose of this analysis, injuries that were treated by a health professional were considered severe injuries, compared to injuries that were not treated.

Severity of Accident-Related Injuries outside of the Home (External)

The same question was posed to individuals that experienced external injuries: "Did you get treatment from a health care professional, such as a doctor, or did you treat the injury yourself?". Binary coding was employed for the responses: "individuals that did not experience an injury or that experienced an injury, but did not receive treatment from a health care professional" (0), and "individuals that experienced an injury and received treatment from a health care professional" (1). Injuries were considered severe if they were examined by a health professional.

3.1.7: Data Analysis

Data concerning accident-related injuries and severity of injuries were used as the dependent or outcome variables within logistic regression analysis, while the remaining variables were employed as the independent variables. Only the independent variables found to be significant at the bivariate level were further analyzed in multivariate models. The final logistic regression models were used to estimate the adjusted odds ratios for the main and interactive effects for the measures investigated. Given the large number of seniors within this survey (n = 10,059), a more stringent criteria for statistical significance was utilized. Specifically, for main effect variables and interaction terms significance levels of $p<0.05$ and $p<0.01$, respectively, were utilized.

The probability of an event given a set of continuous or dummy variables is estimated by logistic regression models (Cleary and Angel, 1984; Kelsey et al., 1987). The equation for the general logistic regression model takes the form:

$$P_i = \frac{e^{a \cdot \sum B_j X_{ji}}}{1 + e^{a \cdot \sum b_j X_{ji}}}$$

In this model P_i represents the probability of the outcome (e.g., occurrence of a fall), a represents the intercept term, and $\sum B_j X_{ji}$ represents the effect of the set of j independent variables.

It is important to note that parameter estimates in logistic models are linearly related to the log odds of the dependent variable. Therefore, these values can be conveniently interpreted in the form of an odds ratio. Confidence intervals that overlap 1.0 (reference group) indicate no significant difference between the reference group and the comparison groups. Further, values obtained that are larger than 1.0 indicate a greater risk for falls, while values lower than 1.0 are indicative of a lower risk for falls than the comparison group. Odds ratios for each specific independent variable found to be significant within the final model were obtained using the exponentiation of the applicable parameter estimate (e.g., $OR=e^B$).

3.2: Results for the Survey on Ageing and Independence, 1991

3.2.1: Univariate Distributions for the Survey on Ageing and Independence, 1991

The univariate distributions for the independent variables have been summarized into five tables according to the groupings mentioned earlier. The first table provides results for age, gender, income, and education (Table 3.1). Of the 10,059 individuals approximately 60% of the sample were in between the age ranges of 65 to 69 (36.6%) and 70 to 74 (27.9%). Females constituted 57.1% of the sample, while 42.9% of the sample were males. For income, the majority of the sample (41.4%) did not state their household income, while 38.8% and 19.8% were categorized with incomes greater or less than $15,000, respectively. When stratified by gender, a larger percentage of females were placed within the lowest income category compared to men. Further, fewer women were within the highest income group. For educational attainment, 64.5% of the sample had an elementary or some secondary education, 21.4% had received a high school diploma or had completed some post-secondary education, and 14.1% had obtained a college or a university degree.

The univariate distributions of health variables, including alcohol consumption, smoking status, and rest and sleep patterns, for the sample are presented in Table 3.2. Approximately 90.8% of the sample reported avoiding alcohol consumption, while 78.6% reported that they were non-smokers. Approximately 94.0% claimed to have regular rest and sleep patterns. Upon gender stratification, 4.9% and 3.6% more women reported being non-smokers and obtained irregular rest and sleep patterns, respectively, as compared to men. Hence, it appeared that the SAI sample generally engaged in positive health practices.

Marital status and support from close family members and friends were classified as social relationship measures (Table 3.3). In the overall sample, 60.4% were married. When stratified by gender, 81.5% of males were married, while only 44.6% of females were married.

Approximately 92.4% of the sample received support from close family members and/or friends, while 7.6% did not receive support from family or friends.

The independent variables associated with frailty consisted of activity limitations attributed to health and perceived health (Table 3.4). Stratification by gender revealed that approximately 6% more females reported activity limitations than males. According to the data collected, 66.6% of the overall sample felt that their activity was not limited by health. Similarly, 63.7% reported that they perceived themselves to be in good health.

Table 3.5 summarizes the variables related to exposure to risk for fall-related accidental injuries. The largest proportion of the subjects (39.7%) claimed to be as active as individuals of the same age; however, when stratified by gender the trend remained for females, but a larger percentage of males reported being more active than individuals of the same age. In the overall sample, 69.2% reported that they provided assistance to others. Approximately 11.0% of the seniors contended that their homes were in need of minor or major repairs.

Tables 3.6 and 3.7 summarize the distributions of the dependent variables employed in logistic regression. The dependent variables of accident-related injuries within the home and external to the home revealed that 5.4% and 3.3% of the overall sample, respectively, reported experiencing an injury (Table 3.6). For severity of injury, 3.8% and 2.5% of individuals experienced severe internal and external injuries, respectively (Table 3.7). When the sample was stratified by gender, a larger percentage of females reported experiencing more injuries, regardless of the location or severity of the injury.

3.2.2: Bivariate and Multivariate Associations for the Survey on Ageing and Independence, 1991

The main effects and interaction terms for variables that were found to be significant at the bivariate level were analyzed through multiple logistic regression models. Since all of the variables were categorized into dummy variables, it was not necessary to include quadratic terms to test for curvilinearity in the models. Although several of the variables were found to be significant at the bivariate level, not all of these variables remained significant in the final logistic regression models. Results for the bivariate associations and the resulting model for each of the four outcome variables will be discussed in turn.

3.2.2.1: *Bivariate and Multivariate Associations for Risk of Accident-Related Injury within the Home (Internal)*

Bivariate results for the socio-demographic variables revealed that increased age, being female and obtaining a minimum of a high school diploma were significantly associated with an increased risk of experiencing an accidental injury (Table 3.8). Conversely, not stating a value for income was associated a lower risk of accidental injury. Upon gender stratification, similar trends remained only for increased age for females, higher education levels for males, and for the not stated income category for females.

Avoidance of alcohol consumption was associated with a significant increased risk of accidental injury for males and females combined, as indicated by an odds ratio of 1.38 (Table 3.9). Smoking status was significant only for females when stratified by gender and not for the total sample. Specifically, non-smoking females were less likely to experience an injury than smoking females, as indicated by an odds ratio of 0.73. Odds ratios of 0.73 and 0.61 revealed the protective effect of rest and sleep patterns against accidental injury for the total sample and for females, respectively. Once again, the relationship for males was not significant (Table 3.9).

Results for the bivariate associations for measures of social relationships indicated that having support of family and friends was associated with an increased risk of experiencing an accidental injury for the total sample, and for males and females when stratified by gender (Table 3.10). Additionally, risk of injury was also significantly increased for individuals that were not married; however, the 0.05 level of significance was only obtained for the total sample of subjects (odds ratio = 1.35).

Bivariate associations for measures of frailty (Table 3.11) revealed that individuals without activity limitations had decreased risks of experiencing an accidental injury across the total sample and when stratified by gender. Conversely, perceived poor health was associated with an increased risk of accidental injury for the total sample and for females. This relationship was not significant for males.

Activity compared to others and home maintenance status were the variables that reached significance at the bivariate level for the exposure to risk variables for the total sample (Table 3.12). Individuals that stated they were as active as others of the same age were at a decreased risk of injury compared with those who were more active. Conversely, seniors that reported living in homes in need of major repairs were 2.45 times more likely to experience an accidental injury, as compared to those with no repairs or minor repairs. The same trends were evident for females upon stratification by gender. Providing assistance to others reached the 0.05 level of significance for males but not for females or the total sample.

In the final logistic regression model for accident-related injuries within the home, the independent variables that remained significant included age, gender, education, alcohol consumption, smoking status, rest and sleep patterns, support from family and friends, activity limited by health, activity level, and home maintenance status (Table 3.13). Further, interactions were found between the following variables: (1) age and gender; (2) activity limitations and age; (3) gender and home maintenance.

Generally, individuals that had attained higher levels of education had an increased risk of injury when compared to individuals with lower education levels, as indicated by odds ratios of 1.40 and 1.46. Similarly, individuals that reported avoiding alcohol and having support from family and friends were 1.44 times and 2.97 times, respectively, more likely to experience an injury. Conversely, not smoking, and regular rest and sleep patterns appeared to have a protective effect against injury, as indicated by odds ratios of 0.72 and 0.65, respectively. Further, individuals that perceived themselves to be as active or less active than individuals their own age were also less likely to experience an injury.

Several interaction terms were identified in this model. The first of the interactions, age and gender, generally revealed that regardless of age, women had a higher risk of experiencing an accident-related injury (Figure 3.1). Odds ratios for the men ranged between 1.00 to 1.15, while the risk for women was between 1.38 and 2.10 dependent upon the age category. It is of interest to note that injury risk progressively increased for women as age increased, while risk for men varied little across the age groups.

The interaction between age and activity limitation revealed that individuals that reported no activity limitation were at a decreased risk of experiencing an accident-related injury, across all age groups (Figure 3.2). However, individuals that were limited in their activity, appeared to have an increased risk of injury, although risk did not increase progressively with increasing age. Individuals that were 70 to 74 years of age and had activity limitations were most likely to experience an accident-related injury, compared to the other age groupings.

The gender by home maintenance interaction generally revealed that women whose homes had no repairs or minor repairs to be completed, were at a somewhat decreased risk of injury compared to men (Figure 3.3). However, women whose homes were in need of major repairs, were 2.75 times more likely to experience an injury. The trend for men indicated that risk of injury progressively increased as need of repairs increased. For example, men with minor repairs were 1.08 times more likely to experience an injury, whereas men with major repairs were 1.25 times more likely to experience an injury.

3.2.2.2: Bivariate and Multivariate Associations for Risk of Accident-Related Injury away from the Home (External)

Being female was the only socio-demographic factor found to be significantly associated with an increased risk of injury outside the home, as indicated by as odds ratio of 1.85 (Table 3.14). Conversely, an income of $15,000 or greater, not stating income, and having a high school or some post-secondary education appeared to be protective against injury risk. These patterns did not persist when the analysis was stratified by gender, except for females that did not state their income.

Non-smokers and individuals that avoided alcohol were 1.46 times and 1.89 times, respectively, more likely to experience an injury outside the home (Table 3.15). Upon gender stratification, the increased risk was only significant for females that avoided alcohol. Regular rest and sleep was associated with a decreased risk of injury. This protective relationship obtained significance when stratified by gender for males only.

The only social relationship variable that was significant at the bivariate level was marital status (Table 3.16). Results revealed that individuals that were not married were 1.90 times more likely to experience an accidental injury. This relationship persisted when analysis was completed separately for males and females; however, a significant association was obtained only for females. Receiving support from family and friends was not significant at the bivariate level.

Bivariate results for measures of frailty revealed that having an activity limitation was the only variable significant for the total sample (O.R. = 0.55) (Table 3.17). Specifically, individuals with activity limitations appeared to be protected from risk of accidental injury. A similar trend also existed for females (O.R. = 0.45); however, activity limitations appeared to place males at risk, although the association was not significant (O.R. = 1.08). Perceived health did not obtain the 0.05 level of significance for the total sample, or when stratified by gender.

Individuals that were as active as others their age appeared to be protected against injury risk only in the female sample (Table 3.18). Other significant findings for exposure to risk variables revealed that assisting others, and need of major repairs to the home were associated with increased risks of accidental injury. Similar significant findings were evident when stratified by gender.

Gender, marital status, education, alcohol consumption, rest and sleep patterns, activity limited by health, providing assistance to others, activity levels compared to others of the same age, and home maintenance status were the significant independent variables in the final logistic regression model for accident-related injuries external to the home (Table 3.19). Further, an interaction between gender and home maintenance was found.

The results for marital status revealed that individuals that were not married had a 1.66 times greater risk of injury. Further, individuals that avoided alcohol (O.R.=1.72) and assisted others (O.R.=1.64) were also at an increased risk of injury, as compared to those that consumed alcohol and did not assist other individuals. Having a high school degree or some post-secondary education appeared to have a protective effect against injuries external to the home, while a college diploma or university education was not significant. Having regular rest and sleep patterns, and not having an activity limitation were also found to have a protective effect against experiencing an accident-related injury external to the home.

The interaction between gender and home maintenance status revealed that females were at a greater risk of injury, as compared to men (Figure 3.4). Risk increased for females as home maintenance progressed from no repairs (O.R.= 1.19), to minor repairs (O.R. = 1.84), to major repairs (O.R. = 3.42). Men that had minor or major repairs appeared to be protected against injury risk, as compared to men who had homes without repairs to be completed. In fact, risk of injury was lowest for men with homes in need of major repairs (O.R. = 0.20).

3.2.2.3: *Bivariate and Multivariate Associations for Risk of a Severe Accident-Related Injury within the Home*

Advanced age, being female, and higher levels of education were the socio-demographic variables that were associated with an increased risk of experiencing a severe accident-related injury within the home (Table 3.20). When stratified by gender, similar significant associations were obtained for age for females, and for males with higher levels of education. Not stating income was associated with a decreased risk of injury.

Bivariate results for the health practice variables revealed that regular rest and sleep was associated significantly with the outcome of a severe accident-related injury (Table 3.21). An odds ratio of 0.73 was indicative of the protective effect that regular rest and sleep had with respect to injury risk. When stratified by gender, regular rest and sleep was protective against injury risk for females (O.R. = 0.55), but increased the risk for males (O.R. = 4.15). Alcohol consumption and smoking status were not significant at the bivariate level, with the exception of non-smoking females.

Both of the social relationship measures were significant at the bivariate level (Table 3.22). Specifically, odds ratios of 1.46 and 2.96 revealed that individuals that were not married, and those receiving support from family and friends, respectively, were associated with increased risks of experiencing severe accident-related injuries. These trends were generally supported when stratified by gender.

Increased risks of injury were associated with perceptions of poor health for the total sample and separately for females (Table 3.23). Significance was not obtained at the 0.05 level of significance for males in poor health. With respect to activity limitations, individuals that were not limited for health reasons were protected from injury risk for the total sample, and for males and females separately.

For variables dealing with exposure to risk, individuals that reported being as active as other individuals of the same age had a decreased risk of injury (Table 3.24). Conversely, living in homes in need of major repairs was associated with an increased risk of injury, as indicated by an odds ratio of 2.94. The direction of these associations was maintained when stratified by gender. Providing assistance to others did not reach significance at the bivariate level.

The following variables remained significant within the final model for severe accident-related injuries within the home: gender, education, rest and sleep patterns, support from family and friends, activity limited by health, perceived health, activity level, and home maintenance status. No interaction terms were significant within the final model (Table 3.25).

A large portion of the variables significant within the final model were associated with increased risks of experiencing a severe accident-related injury within the home. For example, odds ratios of 1.52 and 1.44 indicated that having a high school/some post-secondary education or a university/college degree were at an increased risk of injury. Additionally, individuals that were receiving support from family and friends, and perceived their health to be poor were also more likely to experience an injury. Odds ratios of 3.05 and 1.33 were obtained for those receiving support and those perceiving their health to be poor, respectively.

Other measures, such as obtaining regular rest and sleep, and being as or less active than others appeared to have protective effects against injury. Odds ratios below 1.0 for these measures were indicative of the decreased risk of injury for seniors that possessed these characteristics.

3.2.2.4: Bivariate and Multivariate Associations for Risk of a Severe Accident-Related Injury away from the Home

Only two of the four of the socio-demographic variables were significant at the bivariate level for the total sample (Table 3.26). Women were 1.59 times more likely to experience an accident-related injury as compared to men. Further, individuals that did not state their income level had a lower risk of injury, as indicated by an odds ratio of 0.56. This trend also applied to those within the higher income group, although the findings were not significant. Significance at the 0.05 level was not obtained for the total sample for age or for education, although age was significant for females only.

Rest and sleep patterns was the only health practice variable that reached significance at the bivariate level for the total sample (Table 3.27). Specifically, regular rest and sleep emerged as a protective factor against injury risk, as indicated by an odds ratio of 0.68. Smoking status and alcohol consumption did not obtain significance for the total sample.

The bivariate analysis for the social relationship measures indicated that individuals that were not married were more likely to experience a severe accident-related injury, as compared to those that were married (O.R. = 1.70) (Table 3.28). This finding was supported by males and females, when stratified by gender. Support from family and friends was not significant for injury risk outside of the home.

For both measures of frailty, the results were only significant for females when stratified by gender; however, the only frailty measure that obtained significance for the total sample was activity limitations for health reasons. These results indicated that seniors that were not limited in their activity were less likely to be at risk of injury.

Two exposure to risk variables were significant at the bivariate level (Table 3.30). Assisting others and having major repairs that needed to be fixed placed seniors at risk of experiencing severe accident-related injuries, as evidenced by odds ratios of 1.61 and 1.55, respectively. Similar trends were evident with gender stratification, with the exception of home maintenance status for men. Activity level compared to others of the same age did not reach significance at the bivariate level.

The final model for severe accident-related injuries outside of the home contained the following variables: rest and sleep patterns, marital status, providing assistance to others, and activity limited by health. No interaction terms were present within this final model. Results revealed that individuals that obtained regular rest and sleep were protected from injury risk as indicated by an odds ratios of 0.64. Conversely, unmarried individuals and people that assisted others were more likely to experience a severe accident-related injury. Odds ratios of 1.72 and 1.84 were reported for seniors that were not married, and seniors that assisted others, respectively. Further, injury risk was also decreased for individuals that did not have activity limitations. An odds ratio of 0.58 indicated the protective effect that this measure had against experiencing a severe accident-related injury external to the home.

Table 3.1: Percentage (Frequency) Distributions for Sociodemographic Variables, by Gender, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Age (***)			
65 to 69 years of age	39.3 (1699)	34.5 (1980)	36.6 (3679)
70 to 74 years of age	28.6 (1237)	27.3 (1565)	27.9 (2802)
75 to 79 years of age	17.5 (757)	19.3 (1110)	18.6 (1867)
80 years of age and older	14.5 (626)	18.9 (1086)	17.0 (1711)
Gender			
male	42.9 (4319)	na	42.9 (4319)
female	na	57.1 (5740)	57.1 (5740)
Income (***)			
under $15,000 / no income	12.6 (542)	25.2 (1449)	19.8 (1992)
$15,000 or more	46.1 (1991)	33.4 (1914)	38.8 (3907)
not stated	41.3 (1784)	41.4 (2377)	41.4 (4161)
Education			
elementary/some secondary	65.6 (2620)	63.8 (3555)	64.5 (6175)
high school/some post sec	20.5 (818)	22.0 (1225)	21.4 (2044)
diploma/university	13.9 (557)	14.2 (793)	14.1 (1350)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 3.2: Percentage (Frequency) Distributions for Health Practice Variables, by Gender, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Alcohol Consumption (***)			
does not avoid alcohol	10.6 (444)	8.2 (457)	9.2 (908)
avoids alcohol	89.4 (3735)	91.8 (5141)	90.8 (8876)
Smoking Status (***)			
smoker	24.2 (1011)	19.3 (1077)	21.4 (2089)
non-smoker	75.8 (3167)	80.7 (4515)	78.6 (7682)
Rest/Sleep Patterns (***)			
irregular rest/sleep patterns	4.3 (178)	7.9 (444)	6.4 (623)
regular rest/sleep patterns	95.7 (4001)	92.1 (5161)	93.6 (9162)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 3.3: Percentage (Frequency) Distributions for Measures of Social Support, by Gender, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Marital Status (***)			
married	81.5 (3302)	44.6 (2408)	60.4 (5709)
not married	18.5 (752)	55.4 (2291)	39.6 (3743)
Support From Family & Friends			
no support	9.7 (420)	6.0 (343)	7.6 (763)
support	90.3 (3899)	94.0 (5397)	92.4 (9296)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 3.4: Percentage (Frequency) Distributions for Measures of Frailty, by Gender, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Activity Limited by Health (**)			
activity limited	29.6 (1279)	36.2 (2080)	33.4 (3360)
activity not limited	70.4 (3039)	63.8 (3660)	66.6 (6699)
Perceived Health (**)			
good	65.9 (2764)	62.1 (3490)	63.7 (6255)
poor	34.1 (1430)	37.9 (2134)	36.3 (3564)

* p<0.05 ** p<0.01 *** p<0.001

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 3.5: Percentage (Frequency) Distributions for Exposure to Risk Measures, by Gender, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Activity Compared to Others (***)			
more active	40.9 (1697)	35.2 (1946)	37.6 (3643)
as active	38.4 (1594)	40.6 (2245)	39.7 (3840)
less active	20.7 (859)	24.2 (1340)	22.7 (2200)
Provided Assistance to Others (**)			
did not assist others			
assisted others	29.3 (1267)	32.0 (1834)	30.8 (3102)
	70.7 (3051)	68.0 (3906)	69.2 (6957)
Home Maintenance			
no repairs	88.5 (3811)	88.4 (5058)	88.5 (8869)
minor repairs	5.5 (239)	5.8 (333)	5.7 (585)
major repairs	5.9 (254)	5.8 (331)	5.8 (572)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 3.6: Percentage (Frequency) Distributions for Internal and External Injuries, by Gender, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Internal Injury (**)			
no injury	95.7 (4135)	93.7 (5379)	94.6 (9513)
injury	4.3 (184)	6.3 (362)	5.4 (546)
External Injury (**)			
no injury	97.8 (4222)	95.9 (5507)	96.7 (9728)
injury	2.2 (97)	4.1 (234)	3.3 (331)

* p<0.05 ** p<0.01 *** p<0.001

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 3.7: Percentage (Frequency) Distributions for Severity of Internal and External Injuries, by Gender, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Severity of Internal Injury (**)			
no injury	97.1 (4174)	95.5 (5458)	96.2 (9632)
injury	2.9 (126)	4.5 (257)	3.8 (384)
Severity of External Injury (**)			
no injury	98.1 (4238)	97.1 (5572)	97.5 (9810)
injury	1.9 (81)	2.9 (168)	2.5 (249)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 3.8: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of Accident-Related Injury within the Home (Internal), by Sociodemographic Variables, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Age			
65 to 69 years of age	1.00	1.00	1.00
70 to 74 years of age	0.85 (0.59, 1.24)	1.11 (0.82, 1.48)	1.00 (0.79, 1.27)
75 to 79 years of age	0.83 (0.54, 1.27)	1.50 (1.12, 2.02) **	1.24 (0.97, 1.57)
80 years of age and older	0.87 (0.55, 1.36)	1.80 (1.34, 2.42) ***	1.48 (1.17, 1.87) ***
Gender			
male	not applicable	not applicable	1.00
female			1.51 (1.26, 1.80) ***
Income			
under $15,000 / no income	1.00	1.00	1.00
$15,000 or more	0.99 (0.64, 1.52)	0.86 (0.65, 1.12)	0.83 (0.67, 1.03)
not stated	0.67 (0.42, 1.07)	0.75 (0.58, 0.97) *	0.68 (0.54, 0.86) ***
Education			
elementary/some secondary	1.00	1.00	1.00
high school/some post sec	1.76 (1.24, 2.52) **	1.12 (0.87, 1.45)	1.33 (1.07, 1.64) **
diploma/university	2.23 (1.53, 3.23) ***	1.05 (0.77, 1.44)	1.40 (1.11, 1.78) **

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.9: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of Accident-Related Injury within the Home (Internal), by Health Practice Variables, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Alcohol Consumption			
does not avoid alcohol	1.00	1.00	1.00
avoids alcohol	1.40 (0.86, 2.29)	1.31 (0.89, 1.94)	1.38 (1.03, 1.85) *
Smoking Status			
smoker	1.00	1.00	1.00
non-smoker	1.36 (0.96, 1.94)	0.73 (0.58, 0.93) **	0.94 (0.77, 1.13)
Rest/Sleep Patterns			
irregular rest/sleep patterns	1.00	1.00	1.00
regular rest/sleep patterns	1.54 (0.79, 2.99)	0.61 (0.46, 0.82) **	0.73 (0.56, 0.97) *

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.10: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of Accident-Related Injury within the Home (Internal), by Measures of Social Relationships, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Marital Status			
married	1.00	1.00	1.00
not married	1.06 (0.72, 1.57)	1.25 (1.00, 1.54)	1.35 (1.13, 1.61) ***
Support From Family & Friends			
no support	1.00	1.00	1.00
support	3.22 (1.44, 7.20) **	2.49 (1.28, 4.84) **	2.91 (1.75, 4.85) ***

* p<0.05   ** p<0.01   *** p<0.001

Table 3.11: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of Accident-Related Injury within the Home (Internal), by Measures of Frailty, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Activity Limited by Health			
activity limited	1.00	1.00	1.00
activity not limited	0.57 (0.42, 0.76) ***	0.41 (0.33, 0.50) ***	0.44 (0.37, 0.53) ***
Perceived Health			
good	1.00	1.00	1.00
poor	0.90 (0.66, 1.24)	1.92 (1.54, 2.38) ***	1.53 (1.28, 1.82) ***

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.12: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of Accident-Related Injury within the Home (Internal), by Exposure to Risk Variables, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Activity Compared to Others			
more active	1.00	1.00	1.00
as active	0.90 (0.65, 1.26)	0.68 (0.52, 0.87) **	0.77 (0.63, 0.93) **
less active	1.18 (0.82, 1.72)	1.07 (0.82, 1.37)	1.14 (0.92, 1.41)
Provided Assistance to Others			
did not assist others	1.00	1.00	1.00
assisted others	1.45 (1.02, 2.06) *	0.98 (0.78, 1.23)	1.09 (0.90, 1.33)
Home Maintenance			
no repairs	1.00	1.00	1.00
minor repairs	1.34 (0.61, 2.13)	0.93 (0.57, 1.52)	1.00 (0.68, 1.48)
major repairs	1.34 (0.76, 2.36)	3.17 (2.31, 4.32) ***	2.45 (1.85, 3.20) ***

* $p<0.05$ ** $p<0.010$ *** $p<0.001$

Table 3.13: **Multiple Logistic Regression Model for Accident-Related Injuries Within the Home (n = 10059), Survey on Ageing and Independence 1991.**

Independent Variables	Parameter Estimate	Standard Error	Odds Ratio	95% C. I.
Age				
65 to 69	0.00			
70 to 74	0.14	0.23	see figures 3.1 & 3.2	
75 to 79	0.05	0.27		
80 and over	0.11	0.27		
Gender				
male	0.00		see figures 3.1 & 3.3	
female	-0.09	0.16		
Education				
element/some secon.	0.00		1.00	
high school/some post	0.33 **	0.11	1.40	1.12, 1.73
diploma/university	0.38 **	0.13	1.46	1.13, 1.89
Alcohol Consumption				
does not avoid	0.00			
avoids	0.37 *	0.18	1.44	1.02, 2.06
Smoking Status				
smoker	0.00		1.00	
non-smoker	-0.33 **	0.12	0.72	0.57, 0.91
Rest/Sleep Patterns				
irregular	0.00		1.00	
regular	-0.42 **	0.15	0.65	0.49, 0.88
Support From Family & Friends				
no support	0.00		1.00	
support	1.09 ***	0.27	2.97	1.75, 5.05
Activity Limited by Health				
activity limited	0.00		see figure 3.2	
activity not limited	-0.45 **	0.17		
Activity Level				
more active	0.00		1.00	
as active	-0.36 ***	0.11	0.70	0.56, 0.87
less active	-0.27 *	0.12	0.76	0.60, 0.97

Home Maintenance			
no repairs	0.00		see figure 3.3
major repairs	0.22	0.29	
minor repairs	0.08	0.32	
Interaction			
(age*gender)			see figure 3.1
age (70-74)*gender	0.27	0.24	
age (75-79)*gender	0.61 *	0.27	
age (80+)*gender	0.72 **	0.28	
Interaction			
(activity limited*age)			see figure 3.2
not limited*age (70-74)	-0.60 **	0.24	
not limited* age (75-79)	-0.48	0.26	
not limited*age (80+)	-0.52 **	0.26	
Interaction			
(maintenance*gender)			
minor repairs*gender	-0.22	0.41	see figure 3.3
major repairs*gender	0.88 **	0.33	

* $p<0.05$ ** $p<0.010$ *** $p<0.001$

Figure 3.1: Adjusted Odds Ratios for Accident-Related Injuries within the Home, by Gender and Age

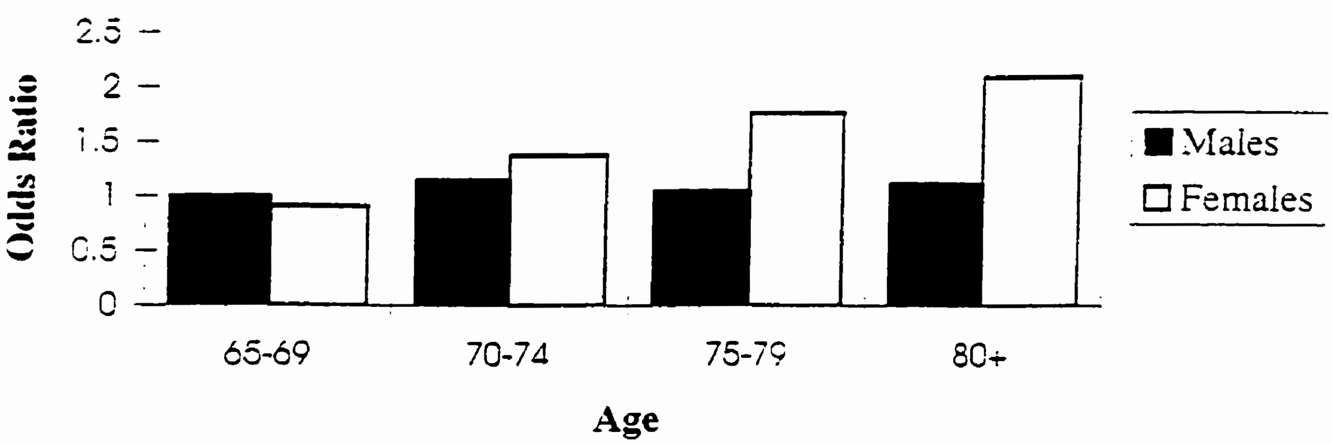


Figure 3.2: Adjusted Odds Ratios for Accident-Related Injuries within the Home, by Activity Limitation and Age

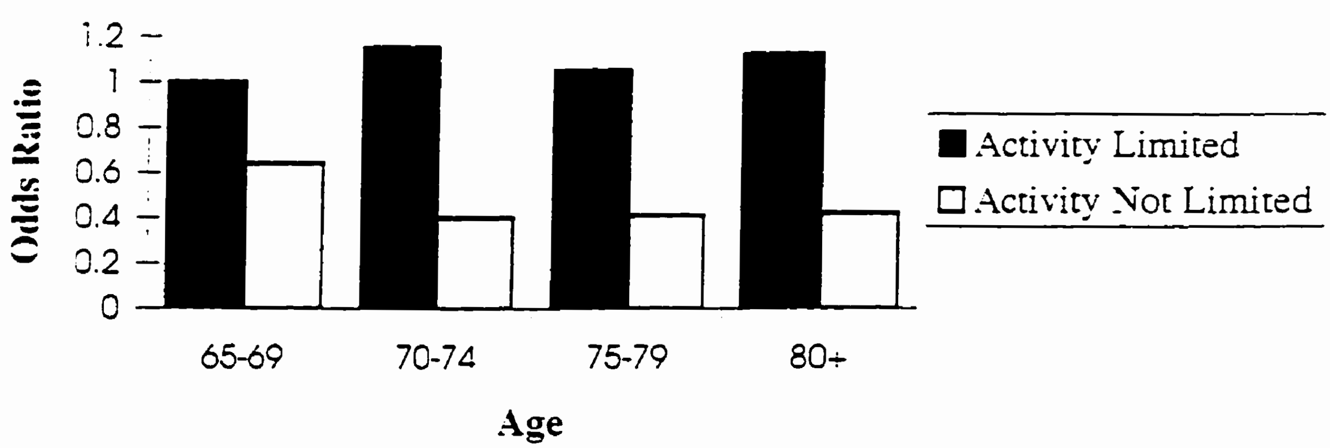


Figure 3.3: Adjusted Odds Ratios for Accident-Related Injuries within the Home, by Gender and Home Maintenance Status

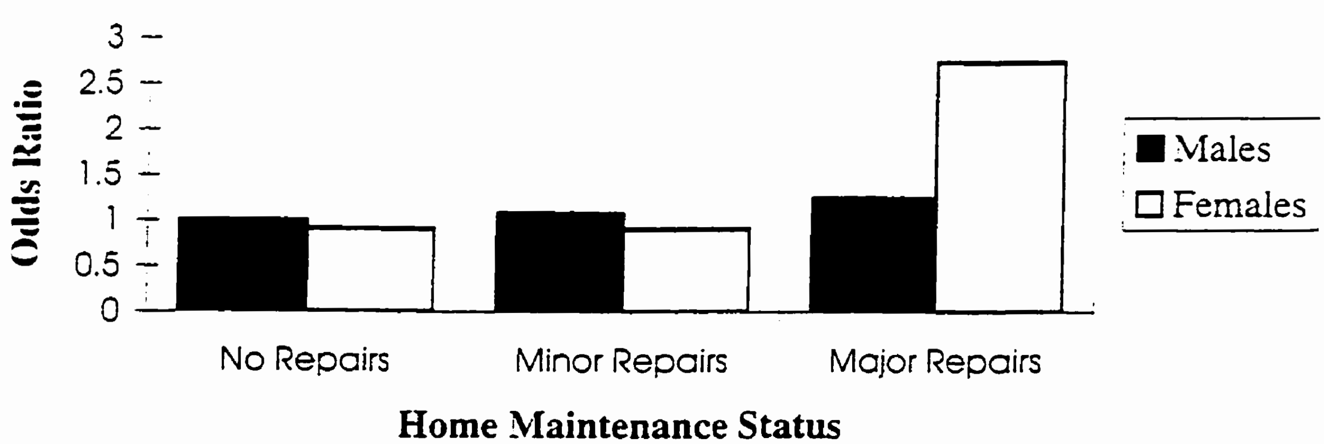


Table 3.14 Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of Accident-Related Injury outside of the Home (External), by Sociodemographic Variables, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Age			
65 to 69 years of age	1.00	1.00	1.00
70 to 74 years of age	1.05 (0.64, 1.72)	0.96 (0.68, 1.37)	1.00 (0.76, 1.32)
75 to 79 years of age	1.08 (0.61, 1.91)	1.32 (0.93, 1.88)	1.29 (0.96, 1.72)
80 years of age and older	0.78 (0.39, 1.55)	1.10 (0.76, 1.60)	1.07 (0.77, 1.50)
Gender			
male	not applicable	not applicable	1.00
female			1.85 (1.45, 2.33) ***
Income			
under $15,000 / no income	1.00	1.00	1.00
$15,000 or more	1.07 (0.57, 2.01)	0.77 (0.56, 1.06)	0.71 (0.54, 0.94) **
not stated	0.88 (0.46, 1.68)	0.51 (0.36, 0.71) ***	0.53 (0.40, 0.69) ***
Education			
elementary/some secondary	1.00	1.00	1.00
high school/some post sec	0.61 (0.32, 1.14)	0.71 (0.49, 1.03)	0.70 (0.51, 0.96) *
diploma/university	1.54 (0.92, 2.56)	1.19 (0.84, 1.70)	1.31 (0.98, 1.76)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.15: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of Accident-Related Injury outside of the Home (External), by Health Practice Variables, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Alcohol Consumption			
does not avoid alcohol	1.00	1.00	1.00
avoids alcohol	1.31 (0.61, 2.07)	2.58 (1.38, 4.84) **	1.89 (1.22, 2.89) **
Smoking Status			
smoker	1.00	1.00	1.00
non-smoker	1.39 (0.85, 2.27)	1.41 (0.99, 2.00)	1.46 (1.09, 1.96) **
Rest/Sleep Patterns			
irregular rest/sleep patterns	1.00	1.00	1.00
regular rest/sleep patterns	0.42 (0.24, 0.75) **	0.70 (0.48, 1.04)	0.58 (0.42, 0.80) ***

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.16: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of Accident-Related Injury outside of the Home (External), by Measures of Social Relationships, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Marital Status			
married	1.00	1.00	1.00
not married	1.35 (0.83, 2.20)	1.74 (1.33, 2.30) ***	1.90 (1.53, 2.35) ***
Support From Family & Friends			
no support	1.00	1.00	1.00
support	0.86 (0.45, 1.64)	1.51 (0.77, 2.93)	1.26 (0.80, 1.98)

* p<0.05 ** p<0.01 *** p<0.001

Table 3.17: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of Accident-Related Injury outside of the Home (External), by Measures of Frailty, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Activity Limited by Health			
activity limited	1.00	1.00	1.00
activity not limited	1.08 (0.68, 1.68)	0.45 (0.35, 0.58) ***	0.55 (0.44, 0.68) ***
Perceived Health			
good	1.00	1.00	1.00
poor	0.81 (0.52, 1.27)	1.21 (0.92, 1.59)	1.11 (0.87, 1.40)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.18: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of Accident-Related Injury outside of the Home (External), by Exposure to Risk Variables, Survey of Ageing and Independence 1991.

Variables	Males	Females	Total
Activity Compared to Others			
more active	1.00	1.00	1.00
as active	0.98 (0.62, 1.54)	0.69 (0.51, 0.93) *	0.79 (0.62, 1.03)
less active	0.94 (0.54, 1.63)	0.85 (0.60, 1.18)	0.91 (0.68, 1.23)
Provided Assistance to Others			
did not assist others	1.00	1.00	1.00
assisted others	2.15 (1.24, 3.70) **	1.43 (1.07, 1.92) *	1.56 (1.20, 2.00) ***
Home Maintenance			
no repairs	1.00	1.00	1.00
minor repairs	0.93 (0.39, 2.25)	1.72 (1.05, 2.80) *	1.46 (0.97, 2.21)
major repairs	0.21 (0.04, 1.21) *	3.40 (2.33, 4.92) ***	2.21 (1.55, 3.14) ***

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.19: Multiple Logistic Regression Model for Accident-Related Injuries External to the Home (n = 10059), Survey on Ageing and Independence 1991.

Independent Variables	Parameter Estimate	Standard Error	Odds Ratio	95% C. I.
Gender				
male	0.00		see figure 3.4	
female	0.17	0.14		
Marital Status				
married	0.00		1.00	
not married	0.51 ***	0.12	1.66	1.32, 2.11
Education				
element/some second.	0.00		1.00	
high school/some p-sec	-0.34 *	0.16	0.71	0.52, 0.97
diploma/university	0.28	0.15	1.32	0.99, 1.78
Alcohol Consumption				
does not avoid	0.00		1.00	
avoids	0.54 *	0.23	1.72	1.09, 2.69
Rest/Sleep Patterns				
irregular	0.00		1.00	
regular	-0.57 ***	0.17	0.56	0.41, 0.79
Activity Limited by Health				
activity limited	0.00		1.00	
activity not limited	-0.52 ***	0.11	0.59	0.48, 0.74
Assisted Others				
did not assist others	0.00		1.00	
assisted others	0.49 ***	0.14	1.64	1.24, 2.15
Home Maintenance				
no repairs	0.00			
minor repairs	-0.17	0.45	see figure 3.4	
major repairs	-1.59	0.89		
Interaction (gender*repair)				
gender*minor repairs	0.61	0.52	see figure 3.4	
gender*major repairs	2.65 **	0.91		

* p<0.05 ** p<0.01 *** p<0.001

Figure 3.4: Adjusted Odds Ratios for Accident-Related Injuries External to the Home, by Gender and Home Maintenance Status

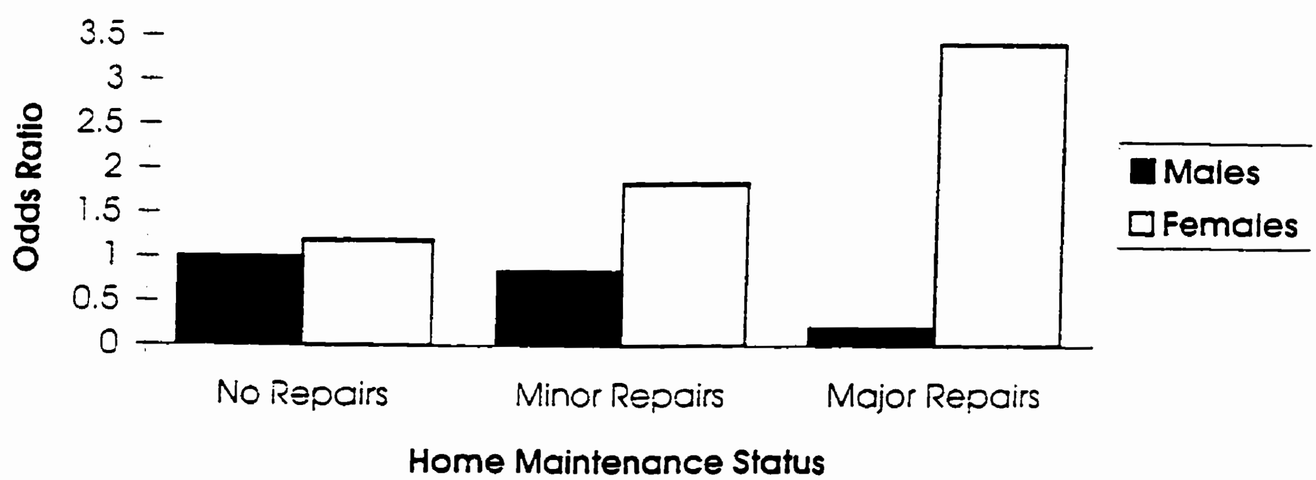


Table 3.20: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of a Severe Accident-Related Injury within the Home (Internal), by Sociodemographic Variables, Survey on Ageing and Independence 1991.

Variables	Males	Females	Total
Age			
65 to 69 years of age	1.00	1.00	1.00
70 to 74 years of age	0.98 (0.62, 1.54)	1.14 (0.82, 1.59)	1.09 (0.82, 1.43)
75 to 79 years of age	1.07 (0.64, 1.79)	1.52 (1.07, 2.17) *	1.39 (1.04. 1.87) *
80 years of age and older	1.29 (0.78, 2.16)	1.53 (1.08, 2.19) *	1.49 (1.11, 2.00) **
Gender			
male	not applicable	not applicable	1.00
female			1.56 (1.26, 1.95) ***
Income			
under $15,000 / no income	1.00	1.00	1.00
$15,000 or more	0.96 (0.56, 1.61)	0.86 (0.63, 1.18)	0.80 (0.62, 1.04)
not stated	0.71 (0.41, 1.23)	0.64 (0.47, 0.87) **	0.61 (0.47, 0.81) ***
Education			
elementary/some secondary	1.00	1.00	1.00
high school/some post sec	2.03 (1.32, 3.13) ***	1.20 (0.89, 1.61)	1.44 (1.14, 1.83) **
diploma/university	2.54 (1.61, 3.98) ***	0.94 (0.64, 1.39)	1.38 (1.03, 1.85) *

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.21: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of a Severe Accident-Related Injury within the Home (Internal), by Health Practice Variables, Survey on Ageing and Independence 1991.

Variables	Males	Females	Total
Alcohol Consumption			
does not avoid alcohol	1.00	1.00	1.00
avoids alcohol	1.10 (0.65, 1.88)	1.08 (0.71, 1.62)	1.12 (0.80, 1.56)
Smoking Status			
smoker	1.00	1.00	1.00
non-smoker	1.11 (0.73, 1.67)	0.72 (0.55, 0.95) *	0.86 (0.68, 1.09)
Rest/Sleep Patterns			
irregular rest/sleep patterns	1.00	1.00	1.00
regular rest/sleep patterns	4.15 (1.16, 14.79) *	0.55 (0.39, 0.76) ***	0.73 (0.53, 0.99) *

* p<0.05 ** p<0.01 *** p<0.001

Table 3.22: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of a Severe Accident-Related Injury within the Home (Internal), by Measures of Social Relationships, Survey on Ageing and Independence

Variables	Males	Females	Total
Marital Status			
married	1.00	1.00	1.00
not married	1.05 (0.67, 1.65)	1.38 (1.08, 1.79) **	1.46 (1.20, 1.78) ***
Support From Family & Friends			
no support	1.00	1.00	1.00
support	2.55 (1.06, 6.18) *	3.05 (1.28, 7.19) **	2.96 (1.62, 5.46) ***

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.23: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of a Severe Accident-Related Injury within the Home (Internal), by Measures of Frailty, Survey on Ageing and Independence 1991.

Variables	Males	Females	Total
Activity Limited by Health			
activity limited	1.00	1.00	1.00
activity not limited	0.62 (0.43, 0.91) **	0.47 (0.36, 0.60) ***	0.50 (0.41, 0.60) ***
Perceived Health			
good	1.00	1.00	1.00
poor	0.94 (0.64, 1.35)	1.80 (1.40, 2.33) ***	1.49 (1.23, 1.81) ***

* p<0.05   ** p<0.01   *** p<0.001

Table 3.24: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of a Severe Accident-Related Injury within the Home (Internal), by Exposure to Risk Variables, Survey on Ageing and Independence 1991.

Variables	Males	Females	Total
Activity Compared to Others			
more active	1.00	1.00	1.00
as active	0.71 (0.46, 1.08)	0.53 (0.39, 0.71) ***	0.60 (0.47, 0.76) ***
less active	1.18 (0.76, 1.81)	0.81 (0.59, 1.11)	0.95 (0.74, 1.23)
Provided Assistance to Others			
did not assist others	1.00	1.00	1.00
assisted others	1.06 (0.72, 1.57)	0.95 (0.72, 1.25)	0.97 (0.78, 1.20)
Home Maintenance			
no repairs	1.00	1.00	1.00
minor repairs	1.18 (0.56, 2.47)	0.79 (0.42, 1.49)	0.93 (0.58, 1.48)
major repairs	1.84 (1.02, 3.31) *	3.61 (2.53, 5.12) ***	2.94 (2.19, 3.95) ***

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.25: **Multiple Logistic Regression Model for Severe Accident-Related Injuries Within the Home (n = 10021), Survey on Ageing and Independence**

Independent Variables	Parameter Estimate	Standard Error	Odds Ratio	95% C. I.
Gender				
male	0.00		1.00	
female	0.36 ***	0.11	1.44	1.16, 1.78
Education				
element/some secon.	0.00		1.00	
high school/some post	0.42 ***	0.13	1.52	1.18, 1.96
diploma/university	0.36 *	0.15	1.44	1.07, 1.92
Rest/Sleep Patterns				
irregular	0.00		1.00	
regular	-0.42 *	0.17	0.66	0.47, 0.92
Support From Family & Friends				
no support	0.00		1.00	
support	1.11 ***	0.32	3.05	1.62, 5.68
Activity Limited by Health				
activity limited	0.00		1.00	
activity not limited	-0.66 ***	0.12	0.52	0.41, 0.65
Perceived Health				
good	0.00		1.00	
poor	0.28 *	0.13	1.33	1.03, 1.71
Activity Level				
more active	0.00		1.00	
as active	-0.64 ***	0.13	0.53	0.41, 0.68
less active	-0.55 ***	0.15	0.58	0.43, 0.77
Home Maintenance				
no repairs	0.00		1.00	
minor repairs	-0.17	0.25	0.89	0.52, 1.38
major repairs	0.99 ***	0.15	2.69	2.01, 3.61

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: 38 observations were deleted due to missing values for the response or explanatory variables

Table 3.26: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of a Severe Accident-Related Injury outside of the Home (External), by Sociodemographic Variables, Survey on Ageing and Independence 1991.

Variables	Males	Females	Total
Age			
65 to 69 years of age	1.00	1.00	1.00
70 to 74 years of age	1.30 (0.77, 2.22)	0.64 (0.41, 0.98) **	0.85 (0.60, 1.18)
75 to 79 years of age	1.15 (0.61, 2.15)	1.34 (0.90, 1.98)	1.33 (0.96, 1.86)
80 years of age and older	0.98 (0.47, 2.02)	0.86 (0.55, 1.35)	0.94 (0.65, 1.37)
Gender			
male	not applicable	not applicable	1.00
female			1.59 (1.20, 2.08) ***
Income			
under $15,000 / no income	1.00	1.00	1.00
$15,000 or more	1.00 (0.51, 1.95)	0.98 (0.68, 1.42)	0.87 (0.64, 1.19)
not stated	0.72 (0.36, 1.43)	0.55 (0.37, 0.82) **	0.56 (0.40, 0.78) ***
Education			
elementary/some secondary	1.00	1.00	1.00
high school/some post sec	0.65 (0.32, 1.28)	0.82 (0.55, 1.21)	0.79 (0.55, 1.12)
diploma/university	1.68 (0.97, 2.91)	0.85 (0.53, 1.36)	1.11 (0.78, 1.57)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.27: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of a Severe Accident-Related Injury outside of the Home (External), by Health Practice Variables, Survey on Ageing and Independence 1991.

Variables	Males	Females	Total
Alcohol Consumption			
does not avoid alcohol	1.00	1.00	1.00
avoids alcohol	0.91 (0.48, 1.69)	2.06 (1.06, 4.00) *	1.46 (0.93 2.30)
Smoking Status			
smoker	1.00	1.00	1.00
non-smoker	1.15 (0.69, 1.91)	1.05 (0.72, 1.53)	1.21 (0.82, 1.53)
Rest/Sleep Patterns			
irregular rest/sleep patterns	1.00	1.00	1.00
regular rest/sleep patterns	0.34 (0.19, 0.59) ***	1.05 (0.63, 1.75)	0.68 (0.47, 0.98) *

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.28: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of a Severe Accident-Related Injury outside of the Home (External), by Measures of Social Relationships, Survey on Ageing and Independence 1991.

Variables	Males	Females	Total
Marital Status			
married	1.00	1.00	1.00
not married	1.20 (0.69, 2.07)	1.66 (1.22, 2.28) **	1.70 (1.32, 2.19) ***
Support From Family & Friends			
no support	1.00	1.00	1.00
support	0.80 (0.40, 1.58)	1.18 (0.59, 2.40)	1.04 (0.64, 1.70)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 3.29: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of a Severe Accident-Related Injury outside of the Home (External), by Measures of Frailty, Survey on Ageing and Independence 1991.

Variables	Males	Females	Total
Activity Limited by Health			
activity limited	1.00	1.00	1.00
activity not limited	1.06 (0.65, 1.73)	0.44 (0.32, 0.60) ***	0.56 (0.43, 0.72) ***
Perceived Health			
good	1.00	1.00	1.00
poor	0.79 (0.49, 1.30)	1.42 (1.04, 1.94) *	1.21 (0.94, 1.56)

* p<0.05   ** p<0.01   *** p<0.001

Table 3.30: Unadjusted Odds Ratios (95% Confidence Intervals) for Risk of a Severe Accident-Related Injury outside of the Home (External), by Exposure to Risk Variables, Survey on Ageing and Independence 1991.

Variables	Males	Females	Total
Activity Compared to Others			
more active	1.00	1.00	1.00
as active	1.31 (0.79, 2.18)	0.88 (0.62, 1.26)	1.03 (0.77, 1.38)
less active	1.31 (0.73, 2.36)	1.18 (0.80, 1.75)	1.27 (0.93, 1.74)
Provided Assistance to Others			
did not assist others	1.00	1.00	1.00
assisted others	3.15 (1.59, 6.27) ***	1.31 (0.92, 1.86)	1.61 (1.18, 2.21) **
Home Maintenance			
no repairs	1.00	1.00	1.00
minor repairs	0.70 (0.23, 2.13)	1.52 (0.86, 2.69)	1.23 (0.74, 2.05)
major repairs	0.25 (0.04, 1.44)	2.35 (1.43, 3.82) ***	1.55 (0.99, 2.44) *

* p<0.05   ** p<0.01   *** p<0.001

Table 3.31: Multiple Logistic Regression Model for Severe Accident-Related Injuries Outside of the Home (External) (n = 10059), Survey on Ageing and Independence 1991.

Independent Variables	Parameter Estimate	Standard Error	Odds Ratio	95% C. I.
Rest/Sleep Patterns				
irregular	0.00		1.00	
regular	-0.45 *	0.20	0.64	0.43, 0.94
Marital Status				
married	0.00		1.00	
not married	0.54 ***	0.13	1.72	1.33, 2.21
Provided Assistance to Others				
did not assist others	0.00		1.00	
assisted others	0.61 ***	0.16	1.84	1.35, 2.52
Activity Limited by Health				
activity limited	0.00		1.00	
activity not limited	-0.55 ***	0.13	0.58	0.45, 0.74

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

3.3: Summary Discussion for the Survey on Ageing and Independence, 1991.

National data dealing with risk factors for falls among the elderly is relatively uncommon. Although the specific outcome of interest is falls, these results deal with more general accidental injuries from a variety of causes, including falls. Thus, when interpreting these results, it is important to remember that the extent to which these findings pertain directly to falls is not clear.

3.3.1: Interpretation of the Results

Comparison of the final models for the four outcome variables reveal that several commonalities exist, regardless of the location or the severity of the injury. The general trends that persist across models will be highlighted, and comparisons between the models will be made were applicable.

Education reached the 0.05 level of significance in the final model for external injuries (Table 3.19) and for the two internal injury models (Tables 3.13 & 3.25). For injuries within the home, higher educational attainment is associated with an increased risk of injury; however, a protective effect against injury risk is evident for individuals with a high school or some post-secondary education in the external model. A possible explanation for this finding is that individuals with lower levels of education were more likely to hold a greater number of blue collar jobs, which provided them with a greater opportunity to experience work-related injuries. Thus, a portion of the external injuries may have been injuries that occurred on the job. Additionally, those with higher levels of education may not have had the same opportunity to experience work-related injuries, and thus experience more injuries at home then at their work place. It is also possible that individuals with lower educations had more appropriate knowledge and skills to complete repairs around the home, and thus are less likely to sustain an injury in comparison to those with higher education levels.

Given that education is a surrogate measure of socio-economic status, and a measure that would be readily able to define those at risk, further work in this area is necessary.

All of the health practice variables reached the 0.05 level of significance in one or all of the final logistic regression models. For example, avoiding alcohol consumption is associated with an increased risk of experiencing an injury for internal and external injuries (Tables 3.13 & 3.19). Support for these findings lie in the work of Nelson et al. (1992), who found that light and moderate-to-heavy drinkers had a slightly decreased risk of fall injury events, as compared to non-drinkers, after adjusting for potential confounding variables. Further, O'Loughlin et al. (1993) found that daily use of alcohol was protective against risk of falls for community-based seniors. Therefore, despite the physiological explanations (e.g., decreased ability to attend to incoming sensory information, impaired proprioceptor sensation, motor ataxia) (Kalant & Khanna, 1989), higher levels of alcohol use do not clearly increase the risk of fall-related injuries; however, some doubt has been cast upon the actual composition of the "non-drinker" category that may account for them being at greater risk than those that drink. The category of non-drinkers includes former heavy drinkers that have to refrain from drinking for health reasons and frail individuals whose failing health prohibits drinking (Fletcher & Hirdes, 1996). In addition, premature death caused by heavy long-term drinking of alcohol may "select out" frailer individuals who would be at the greatest risk of fall events during the later years of life (Nelson et al., 1992). In fact, Campbell et al. (1989) have suggested that daily alcohol use may actually be an indicator of good health status.

Being a non-smoker and obtaining adequate rest and sleep appeared to have a protective effect against the risk of experiencing an injury. Although smoking and inadequate rest may not be direct risk factors for falls, they may be indicative of overall health status and disease states of those at risk of falling. For example, Sattin (1992) has suggested that educating individuals about certain health behaviours, such as smoking cessation and exercise promotion, may decrease the development of chronic diseases and one of the potential outcomes of these chronic diseases - falls. Given that rest was significant across all models, this measure may be of importance in the prevention of falls. Alternatively, rest patterns may be related to sedative use, so that those with poor rest and sleep are more likely to use medications that elevate their risk.

Being unmarried is also associated with an increased risk of experiencing both types of external injuries (Tables 3.19 & 3.31). This finding is supported by Craven and Bruno (1986) and Mossey (1985). It is conceivable that unmarried individuals do not have the physical support that married couples have. For example, an unmarried frail person may not have a spouse to "lean on" in slippery weather, and experience a fall. Further, the same incentive to go for a walk without a partner, may result in a decrease in activity leading to a loss of agility and strength, and a subsequent fall injury (Campbell et al., 1990). Campbell et al. (1990) suggest that women who live alone may also carry out tasks (e.g., carry garbage to the curb, changing light bulbs) that are ordinarily completed by men, resulting in an increased risk of a fall. Since females comprise the largest portion of married individuals in the sample, it would seem essential that fall prevention efforts be targeted towards females, particularly the unmarried and the oldest-old females, given that they appear to be at the greatest risk of experiencing a fall-related injury.

Seniors with no activity limitations due to health reasons are at a decreased risk of incurring an injury for all final models. Individuals in better health may have been more likely to recover from a potential fall, whereas individuals in poor health, whose physical and psychological compositions may have been compromised, could have been less likely to react to a fall. This finding has been substantiated in several studies concerning falls within elderly populations (see for example O'Loughlin et al.,1993; Prudham & Evans, 1981; Tinetti et al., 1988). For example, through the use of multivariate analyses, O'Loughlin et al (1993) reported that elderly individuals that experienced days in which their activities were limited by a health problem were 1.8 times more likely to experience a fall.

For the two model of injuries external to the home (Tables 3.19 & 3.31), individuals that assisted others are more likely to experience an injury. The possible explanation for this finding is twofold: individuals that assist others increase their opportunities to injure themselves (e.g., repairing others homes, physically supporting individuals), or individuals that did not assist others are unable to do so and thus do not have the same level of exposure to situations in which they could injure themselves.

Perceived poor health is associated with an increased risk of experiencing a severe injury within the home. The Kellogg International Work Group (1987) reports that poor health status, as measured by the presence of chronic illness, impaired mobility and postural stability, and a history of falls are associated with an increased risk of falling. Studies by Wickham et al. (1989) and Brocklehurst et al. (1978) support this contention. Thus, future work should determine the precise relationship between falls and perceived health status, or the surrogate role that perceived health possesses for other measures of health.

The results for activity level reveal that individuals that classified themselves in the highest category for activity are more likely to experience an injury (Tables 3.13, 3.19 & 3.25). Conversely, Campbell et al. (1989) found that decreased levels of physical activity in men was associated with an increased risk of falling. In a study conducted by O'Loughlin et al. (1993), two indicators of physical activity levels were measured. One indicator revealed that frequent participation in physical activity was associated with an increased risk of falling, while the second measure showed that participation in a number of activities was a protective factor against falls. O'Loughlin et al. (1993) contended that in some incidences physical activity may play a protective role with respect to falls, and simultaneously increase the rate of falls. Physically active individuals may be able to counteract postural imbalance through the maintenance of balance, flexibility, reflexes, muscular strength, co-ordination and reaction time; however, frequent participation in physical activity may also increase seniors' exposure to opportunities to fall (O'Loughlin et al., 1993). The Kellogg International Work Group (1987) provides another possible explanation for this finding: falls generally occur when an individual performs an activity in which he/she cannot correct for an unexpected displacement that has occurred. Individuals that realize their ability to recover from a "fall" situation has been comprised, tend to slow down and reduce their risks. Given the complexity of the relationship between falls and physical activity, further investigation is warranted in order that interventions with the appropriate levels of physical activity can be developed.

Several interaction terms have been identified within the present analysis for risk factors for accident-related injuries. According to Kelsey et al. (1987), statistical interactions occur when the magnitude of a chosen measure of association between a risk factor and an outcome variable differ according to the level of a third variable (or risk factor).

The interaction between age and gender within the model for internal injuries within the home reveals that being female and being older is associated with an increased risk of injury (Figure 3.1). Males' risk of injury increases with age, but not to the same extent as with females. This interaction is not surprising given that a substantial portion of research has found falls to be associated with advanced age (see for example, Campbell et al., 1981; Vellas et al., 1987; Wild et al., 1981) and the female gender (see for example, Campbell et al., 1981; Craven & Bruno, 1986; Prudham & Evans, 1981). The question arises as to what is it about advanced age and the female gender that increase risk of falling. This issue will be addressed in further detail in the summary discussion section.

An interaction between activity limitations and age reveals that individuals without limitations are protected from injury risk, while those with limitations are more likely to experience an internal injury (Figure 3.2). Moreover, the differences between these two groups increases with age. For those without activity limitations, the progressive decrease that occurs in the odds ratios as age advances, may be attributed to selection bias, whereby only the healthiest old-old individuals remain in the community. These findings coincide with results from a community-based study which found a significant interaction between age and dependence in activities of daily living within logistic models for risk of fall injury (Langlois et al., 1995). Langlois et al. (1995) found that seniors between 65 and 79 years of age, and dependent in one or more activities of daily living, possessed the highest risk of a fall injury event (Langlois et al., 1995). It is probable that individuals without activity limitations experience decreases in risk with advancing age because of selection bias.

In both of the final models for internal (Figure 3.3) and external (Figure 3.4) injuries, the gender and home maintenance interaction term generally reveals similar results. Females tend to have an increased risk of injury as repair status increases, particularly for the major repairs category. However, for males, risk is somewhat increased for minor and major repairs for injuries at home, but appears to have a protective effect against external injuries. It is possible that within the home both genders are at risk of injury from exposure to hazards within their environment, while outside of the home, other factors related to home repair may actually place seniors (particularly women in the major repairs category) at risk. Future work is warranted in this relatively understudied area in order to better understand the relationship between gender and home maintenance status.

3.3.2: Implications for Future Research

Several of the findings pertaining to the risk factors for accidental injuries are consistent with prior falls research among senior populations. For instance, being female (see for example, Craven & Bruno, 1986; Prudham & Evans, 1981), and poor health, as measured by inadequate rest, smoking, and activity limitations for health reasons (see for example, Kellogg International Work Group, 1987; Wickham et al., 1989), have been implicated as risk factors for falls in previous research. However, the completion of sound, national longitudinal studies that specifically address falls, rather than accidental injuries are needed. The cross-sectional nature of the study does not allow for the event to be temporally related to the individual characteristics of the situation.

Future research should include broader multidisciplinary frameworks of study involving substantially more social variables, since these have been largely neglected within the falls research. Identifying key social risk factors that are relatively unintrusive measures would aid in targeting seniors at high risk for fall prevention measures. Additionally, future analyses should investigate interactions between the risk factors for falls, in order that the precise associations can be determined and understood. Further, research should continue to focus on risk factors that increase seniors' exposure to "fall situations" (e.g., home repairs, activity levels), and on health practice measures (e.g., medication use) that were not studied within this survey.

CHAPTER 4: METHODOLOGY FOR THE NATIONAL POPULATION HEALTH SURVEY (NPHS)

After the 1991 recommendation from the National Health Information Council (NHIC) that an on-going national survey of population health be conducted, the National Population Health Survey (NPHS) was designed. The NHIC believed that the existing sources of health data failed to provide a complete picture of the health status of Canadians, and the contributing factors that affected their health. Information obtained from the survey would also be used as a basis for the formation and evaluation of health policies and programs in Canada.

The first cycle of the NPHS was conducted in 1994, with plans for data to be collected every two years thereafter. The NPHS was designed to collect cross-sectional data to monitor health programs in Canada. Further, longitudinal data from a sub-sample of individuals at every two year interval would be collected to aid in the understanding of the determinants of good health (Statistics Canada, 1996).

Household residents in all provinces were the target population of the survey, with the exclusion of individuals living on Indian reserves, in remote areas of Canada (i.e., some areas in Quebec and Ontario), and on Canadian Forces bases. Most of the information was collected from a single household member, since interviewing one respondent would facilitate longitudinal follow-up in the future; however, upon follow-up, the same general health-related information would be collected for all members of the household in which the initial responder was living (Statistics Canada, 1996).

In order to strengthen the representativeness of the panel, a rejective technique was applied. This approach was utilized since an individual's chance of being included in the panel would been inversely related to the number of individuals living in the household, if households had been randomly selected. Thus, the panel selected would have under-represented individuals living in larger households (i.e., generally parents and dependent children) and over-represented those in smaller households (i.e., generally single or elderly individuals). This technique was exercised by identifying a portion of the sample households for screening, and subsequently discarding those that did not have at least one household member that was under the age of twenty-five (Statistics Canada, 1996).

The content of the NPHS generally included questions pertaining to health status (i.e., self-perception of health, chronic conditions, activity restrictions), use of health services (i.e., visits to health care providers, use of drugs and other medications), determinants of health (i.e., smoking, alcohol use, physical activity, stress, self-esteem, social support), and demographic and economic information (i.e., age, gender, education, household income, labour force status). The NPHS data set consists of two sections, namely the general section and the health section. The general section contains information about all of the household members, while the health section consists only of information from the selected person (12 years of age or older) that responded to in-depth questions (Statistics Canada, 1996). Although the 1994-1995 NPHS surveyed a sample of 20,000 Canadian households, with a response rate of approximately 88.0%, only information from individuals over the age of 65 was used for this analysis. Further, the information for the analysis was obtained from the health portion of the survey.

4.1: Measures

The information that was used from the NPHS for the analysis was divided in the following sections: (1) socio-demographic variables, (2) health practice variables, (3) social relationship measures, (4) variables associated with frailty, (5) exposure to risk variables, (6) balance and stability measures, and (7) information pertaining to falls. Each of these sections will be addressed in turn.

4.1.1: Socio-demographic Variables

The socio-demographic variables that were examined included age, gender, income, and education.

Age

Statistics Canada categorized the responses to the age question into grouped age cohorts. For the purpose of this analysis the following grouped age categories were utilized: 65 to 69 years of age (0), 70 to 74 years of age (1), 75 to 79 years of age (2), 80 years of age and older (3). Dummy variables were used for the 3 highest age groupings, while the 65 to 69 age range was utilized as the reference group.

Gender

For the binary variable gender, the category male (0) was used as the reference group, and the category female (1) was coded as a dummy variable.

Income Adequacy

The variable income adequacy, developed by Statistics Canada, was based on the responses for the questions pertaining to household income (derived household income from all sources in the past 12 months) and the size of the household (number of household members) (see Table 4.1). The categories derived for income adequacy included lowest income, lower-middle income, middle income, upper-middle income, and highest income; however, for this analysis recoding was completed and the following classification was used: low/low-middle income (0), middle income (1), and upper-middle/upper income (2). The lowest income category was used as the reference group, while the remaining variables were coded as dummy variables.

Education

Responses to the question pertaining to educational attainment were recoded utilizing dummy coding, with the lowest level of educational attainment used as the reference group. The categories formed were: elementary or some secondary education (0), high school or some post-secondary education (1), and post-secondary certificate diploma or university degree (2).

4.1.2: Health Practice Variables

The variables classified as health practice measures consisted of information pertaining to alcohol consumption, smoking status, and use of the following medications: analgesics, tranquilizers, anti-depressants, cardiovascular drugs, high blood pressure drugs, diuretics, sleeping pills, and psychotropics.

Alcohol Consumption

The variable used within this analysis for alcohol consumption, developed by Statistics Canada, was derived from the questions, "During the past 12 months, how often did you drink alcoholic beverages?" and "Did you ever have a drink?". The responses formed from these questions included: regular drinker (a drink at least once a month) (0), occasional drinker (less than one drink a month) (1), don't drink now (did not have a drink in the last 12 months) (2), and abstinent (never drank) (3). For analysis purposes, regular drinker was used as the reference group and the remaining categories were coded as dummy variables.

Smoking Status

Smoking status was derived from the questions, "At the present time do you smoke cigarettes daily, occasionally, or not at all?", "Have you ever smoked cigarettes at all?", and "Have you ever smoked cigarettes daily?". Responses to these questions were combined to form the categories daily smoker, occasional smoker (but former daily smoker), always an occasional smoker, former daily smoker, former occasional smoker, and never smoker. Recoding was used to form the categories never smoker (0), smoker (included daily and occasional smokers) (1), and former-smoker (2) for this analysis, with never smoker coded as the reference category.

Medication Use

Individuals were asked a series of questions pertaining to medication use. The questions posed, " In the past month, did you take pain relievers (*analgesics*)?, *tranquilizers* such as Valium?, *anti-depressants*?, *medicine for the heart*?, *medicine for blood pressure*?, *diuretics* or water pills?, or *sleeping pills*?, were coded to form the categories "non-use" (0) or "use" (1) of the particular medication in question. Non-use was utilized as the reference group within the analysis. Further, a count of *psychotropic medications* was formed, and left as a continuous variable within the analysis.

4.1.3: Social Relationship Variables

Marital status and the composition of the household were examined as the social relationship variables.

Marital Status

Responses to the question pertaining to marital status were grouped into the categories married/common-law partner, single, and other (widowed, divorced, separated). In order to be consistent with the first national data set analyzed (SAI in Chapter 3), the responses were collapsed into the binary variable, married (0) and not married (1). Married was used as the reference group within the analysis.

Composition of Household

Statistics Canada developed this measure, based on the ages and reported relationships of each person to all other persons within the household, in order to determine the living arrangements within the household (Table 4.2). The formed categories included the following: couple with children <25, couple with children>25, single, single with others, couple with dependent child(ren)<25 and other relatives, couple alone, single-parent with dependent child(ren)<25, other single parent households, other household types. After examining the univariate distributions for this measure, the following categories were formed for the purposes of this analysis: single person in home (0), couple in home (1), other (2). Single person in home was used as the reference group within this analysis.

Amount of Social Involvement

The measure of social involvement, designed by Statistics Canada, reflected the frequency of participation in associations or voluntary organizations, and the frequency of attendance at religious services in the previous year. This measure was left continuous within the analysis. Higher scores (Range = 0 to 8) were indicative of greater social involvement.

Amount of Social Support

The social support measure was also developed by Statistics Canada. This measure incorporated the items which indicated whether the respondents felt that they had someone they could confide in, someone they could count on, someone that could give them advice, and someone that made them feel loved. The scores (Range = 0 to 4) were left continuous within the analysis. Higher scores for this measure were indicative of greater perceived social support.

4.1.4: Measures of Frailty

The measures of frailty included the variables perceived health, homecare services, and the medical conditions dementia, high blood pressure, stroke, heart condition, diabetes, arthritis, urinary problems, and vision problems.

Perceived Health

Responses to the question, "In general, how would you describe your health: excellent, very good, good, fair, poor?", were recoded to form the categories good health (0) and poor health (1). Good health included excellent and good health, while poor health included fair and poor health. For the purpose of this analysis, good health was used as the reference category.

Homecare

Responses to the question, "Have you received any home care services in the past 12 months?", was coded to form the categories did not receive homecare services (0) and received homecare services (1). Homecare services included services such as the following:

nursing care, housework, personal care, meal preparation, and shopping. Not receiving these services was used as the reference category.

Medical Conditions

A series of questions were posed to the respondents concerning medical conditions that had been diagnosed by a health professional. For this analysis, the medical conditions examined included *Alzheimer's disease/dementia, high blood pressure, effects of a stroke, heart disease, diabetes, arthritis/rheumatism,* and *urinary problems.* Responses for each of the medical conditions in question were categorized to form the responses "no condition/problem" (0) and "condition/problem" (1), with no condition/problem used as the reference group within the analysis.

The last medical condition that was examined pertained to *visual problems.* Individuals were asked whether or not they had visual problems, and whether these problems had been corrected. Responses included the following: no visual problems, problems corrected by lenses, problem seeing distance/corrected, problem seeing distance/not corrected, problem seeing close/not corrected, and problem seeing close & distance/no sight. For the purpose of this analysis, the responses were recoded to form the categories no vision problems (0), vision problem corrected (1), vision problem not corrected/no sight (2). Having no vision problems was used as the reference group within the analysis.

4.1.5: Exposure to Risk Variables

Frequency of physical activity was the only exposure to risk variable used within this analysis.

Frequency of Physical Activity

The measure of frequency of physical activity, developed by Statistics Canada, classified respondents based on their monthly frequency of physical activities lasting more than 15 minutes. Categories for this measure included regularly (12 or more times per month) (0), occasionally (4 to 11 times per month) (1), and infrequently (0 to 3 times per month) (2). Physical activities included a range of activities such as walking, for exercise, gardening, yard work, swimming, bicycling, social dance, home exercise, ice hockey, skating, downhill skiing, jogging/running, golfing, participating in exercise classes, cross-country skiing, bowling, baseball, tennis, weight training, volleyball, and yoga. The category "regular" was used as the reference group within the analysis.

4.1.6: Balance and Stability Measures

Mobility was the only balance and stability measure for the analysis.

Mobility

The measure of mobility was based on questions related to the presence of a mobility impairment and whether the impairment had been corrected. Responses to these questions formed the following categories: no mobility problems, mobility problems/no aid, problems/mechanical support, and problems/cannot walk. For the purpose of this analysis, these responses were recoded to form the categories no problems with mobility (0), problems with mobility (included mobility problems/no aid), and problems/mechanical support) (1), and non-ambulatory (2). No problems with mobility was used as the reference group within the analysis.

4.1.7: Information Pertaining to Falls

Responders were posed the following questions, "In the past 12 months, did you have injuries that limited normal activities?", and "What happened: motor vehicle accident, accidental fall, fire, accidently struck by an object/person, physical assault, accidental explosion, environmental accident, accident with hot liquids/food/substances, machinery accident, cutting or piercing accident, accidental poisoning, or other accident (i.e., drowning, suicide)?". Since the variable of interest was falls, only *accidental falls* were included within the analysis. Responses to the question pertaining to accidental falls were coded as "non-fallers" (0) and "fallers" (1 or more falls) (1), with the category non-fallers being used as the reference group within the analysis.

Descriptive information pertaining to the accidental falls that occurred was also examined. Specifically, information relating to the number of falls within the past year, the types and body locations of the fall injury that occurred for the most serious fall, and the precise location of the fall were studied. Further, strategies that the responders used to prevent future falls were explored.

4.1.8: Data Analysis

Logistic regression was employed with the NPHS. Fall status was used as the dependent variable, while the remaining variables were used as the independent variables. Only the independent measures found to be significant at the bivariate level were further analyzed within the final logistic regression model, which was subsequently used to estimate the adjusted odds ratios for the main and interactive effects. Further, where applicable, quadratic terms were examined for continuous measures. The same criteria for statistical significance, which was employed with the SAI, was applied to the NPHS.

Table 4.1: Income Adequacy in Five Discrete Categories Derived from Household Income and the Size of the Household, National Population Health Survey, 1994-1995.

Code	Description	Income	Household Size
1	*lowest income*	• less than $10,000 or • less than $15,000	• 1 to 4 persons or • 5 or more persons
2	*lower-middle income*	• $10,000 to $14,999 or • $10,000 to $19,000 or • $15,000 to $29,000	• 1 or 2 persons or • 3 or 4 persons or • 5 or more persons
3	*middle income*	• $15,000 to $29,999 or • $20,000 to $39,999 or • $30,000 to $59,000	• 1 or 2 persons or • 3 or 4 persons or • 5 or more persons
4	*upper-middle income*	• $30,000 to $59,999 or • $40,000 to $79,999 or • $60,000 to $79,999	• 1 or 2 persons or • 3 or 4 persons or • 5 or more persons
5	*highest income*	• $60,000 or more or • $80,000 or more	• 1 or 2 persons or • 3 persons or more
9	*unknown*	• not stated	• not applicable

(Statistics Canada Codebook, 1996)

Table 4.2: Household Type Derived from Ages & Reported Relationships of Each Person to All Others in the Household, National Population Health Survey, 1994-1995.

Code	Description	Derivation
1	*couple with children <25*	Married or common-law couple with at least one partner being the parent of the dependent child. No other relationships are allowed.
2	*couple with children >25 with or without other relatives*	Married or common-law couple with no dependent child(ren) <25 years old. Any other relationships are allowed.
3	*single*	Unattached individual living alone. Household size=1.
4	*single with others*	Unattached individuals living together. There cannot be a marital/common-law or parental relationship, but other relationships such as siblings are allowed
5	*couple with dependent child(ren) <25 and other relatives*	At least one partner must be the parent of one child <25 years old in the household. Other relationships are allowed.
6	*couple alone*	Married or common-law couple alone. No other relationships are permitted.
7	*single-parent with dependent child(ren) <25*	One child must be <25 years old. No other relationships are permitted.
8	*other single parent households*	One child must be <25 years old. Other relationships are permitted.
9	*other household types*	All other household types.

(Statistics Canada Codebook, 1996)

4.2: Results for National Population Health Survey 1994-1995

4.2.1: Univariate Distributions for National Population Health Study, 1994-1995

The univariate distributions for the independent variables for the National Population Health Survey have been summarized into five tables, according to the groupings previously discussed. Table 4.3 provides results for the socio-demographic variables of age, gender, income and education. Of the 3,142 individuals sampled, the largest percentages were between the ages of 65 to 69 years of age (34.0%) and 70 to 74 years of age (29.3%). Females comprised 57.0% of the sample, while 43.0% of the sample were males. With respect to income, 43.1% and 31.1% had incomes that were considered middle and upper-middle/upper incomes, respectively. The remaining 25.8% had incomes that were categorized as low/low-middle incomes. When stratified by gender more females were classified within the low/low-middle category then the total sample, while more men were classified within the upper income category than the total sample. For educational attainment, the majority of the sample had obtained an elementary or some post-secondary education (53.9%), while 29.0% and 17.1% had acquired a secondary/some post-secondary or a diploma/university education, respectively.

The univariate distributions for the health variables consisting of alcohol consumption, smoking status, and medication use have been summarized in Table 4.4. For the total sample, the majority were classified as consuming alcohol regularly (40.0%). The remaining individuals were considered occasional drinkers (21.3%), did not drink now (23.3%), and were abstinent (15.4%). These percentages were not consistent when stratified by gender, whereas men were more likely to be regular drinkers and women abstinent. With respect to smoking status, 40.6% and 44.8% of the sample were never smokers or former-smokers, respectively. Approximately 15.0% of the sample constituted smokers. When stratified by gender, the greatest percentages of females were classified as never smokers (55.6%), while more men were classified as former-smoker (62.3%).

With respect to the several medications examined, over 70.0% of the sample reported not using the following the following: tranquilizers (95.0% did not use), anti-depressants (96.3% did not use), cardiovascular medications (78.7% did not use), high blood pressure medications (70.8% did not use), diuretics (89.1% did not use), and sleeping pills (92.6% did not use); however, only 41.0% of the sample reported not using analgesics.

Marital status and composition of the household were classified as the social relationship variables (Table 4.5). In the overall sample, 59.5% and 40.5% were married or not married, respectively; however, when stratified by gender, more females were not married (53.0%), while more males (76.2%) were married. For household composition, 50.6% reported living in a "couple" situation. The remaining individuals lived alone (31.5%) or in another type of living situation (17.9%).

Table 4.6 summarizes the distributions for the measures of frailty, consisting of measures of perceived health, homecare and several medical conditions. The majority of the sample (73.4%) reported perceiving their health to be good. For use of homecare services, 89.7% of the sample did not receive homecare services. With respect to the medical conditions, over 70.0% of the sample reported not having the following conditions: dementia (99.4%), high blood pressure (71.4%), stroke (96.0%), heart condition (86.3%), diabetes (88.8%), urinary problems (96.0%). Approximately, 60.0% of the sample did not report having arthritis. Further, 14.1% and 78.3% of the sample reported having no vision problems, or having a vision problem that was corrected, respectively.

The independent variables associated with exposure to risk variables and balance/stability measures have been summarized in Table 4.7. With respect to frequency of physical activity, 50.5% of the sample was categorized as exercising regularly, while 14.7% and 34.8% were occasional or infrequent exercisers, respectively. For the measure of mobility, 86.3% of the sample reported not having a problem with mobility; however, 9.7% and 3.9% were classified as having problems with mobility or being non-ambulatory, respectively.

Table 4.8 summarizes the distributions for the dependent variable employed within the logistic regression analysis. With respect to fall status, 95.3% of the sample were classified as non-fallers, while 4.7% were classified as fallers. Detailed information pertaining to the falls that occurred have been summarized in Tables 4.9 and 4.10. Of the 4.7% of the sample that fell, 90.7% of these fallers fell only one time within the year prior to the survey (Table 4.9). With respect to the most serious fall that occurred, 40.9% and 26.5% reported fracturing bones and/or sprains/strains (Table 4.9). The body parts that were injured the most for these serious falls were the arms/hands (21.3%) and the legs/feet (25.9%) (Table 4.9). The majority of the accidents were not work-related (96.4%), and occurred in or surrounding the home (57.0%), at a place for recreation (19.1%), or on the street/highway (14.1%) (Table 4.9). The results from Table 4.10 revealed that over 80.0% of the sample did not give up the activity being completed when the fall occurred (93.3%), did not begin to use protective equipment (97.3%), and did not change the physical situation (96.4%) to prevent future falls from occurring; however, 79.5% and 94.6% reported being more careful and taking precautions in order to prevent falls from occurring.

4.2.2: Bivariate and Multivariate Associations for NPHS, 1994-1995

The main effects and interaction terms for variables that were found to be significant at the bivariate level were further analyzed in multiple logistic regression models. Since the majority of the variables had been coded as dummy variables, it was not necessary to include quadratic terms to test for curvilinearity in the final model; however, for the continuous variables use of psychotropics, amount of social involvement, and amount of social support quadratic terms were examined. Although several of the variables were found to be significant at the bivariate level, not all of these variables maintained significance within the final logistic regression model for risk of falling. The results for the bivariate associations and the final model will be discussed in turn.

Bivariate results for the socio-demographic variables revealed that all of the measures were significantly associated with risk of falling (Table 4.11). For example the age categories 70 to 74 and 80 years of age and older were significantly associated with an increased risk of falling as indicated by odds ratios of 1.66 and 2.42, respectively. Upon gender stratification, the results for the highest age category maintained significance for both genders. Being female was also associated with an increased risk of falling (O.R.=1.92). Individuals that were classified with incomes in the middle-upper/upper class and with a secondary/some secondary education were less likely to fall, as indicated by odds ratios of 0.63 and 0.66. This relationship was maintained for education for females when stratified by gender. Further, males classified into the middle income category were also less likely to experience a fall; however, females and the total sample did not reveal the same results for this income category.

Four of the health practice variables were significantly associated with risk of falling at the bivariate level (Table 4.12). Using analgesics, sleeping pills, and psychotropics were all found to be significantly associated with risk of falling. These relationships were maintained when stratified by gender, but were not significant for females using sleeping pills. Conversely, users of high blood pressure medications (antihypertensives) were less likely to fall, as indicated by an odds ratio of 0.57. When stratified by gender, the relationship was also found for males and females; however, the association was not significant at the 0.05 level for females.

Results for the social relationship variables indicated that individuals that were not married or were receiving homecare had a significantly higher risk of falling for the total sample (Table 4.13). These relationships were maintained when stratified by gender, but was not significant at the 0.05 level for unmarried females. Further, higher levels of social support appeared to have a protective effect against falling, as indicated by an odds ratio of 0.83. Upon gender stratification the relationship was maintained, but only significant at the 0.05 level for females. With respect to household composition, males that lived alone were less likely to fall (O.R.=0.49). This relationship was not significant for the total sample or for females.

The bivariate associations for measures of frailty revealed that perceived poor health (O.R.=1.58), presence of dementia (O.R.=3.63), presence of arthritis (O.R.=2.29), urinary problems (O.R.=3.12), and visual problems that were corrected (O.R.= 1.31) or not corrected (O.R.=2.63) were all significantly associated with an increased risk of falling, as indicted by odds ratios above 1.00 (Table 4.14). When stratified by gender these relationships were maintained for females for perceived poor health, arthritis, urinary problems, and visual problems that were corrected or not corrected. Having urinary problems was the only significant bivariate association for an increased risk of falling for males. Further, an increased risk of falling was also associated for females with diabetes, but the relationship was not maintained for males or for the total sample.

The exposure to risk variable, frequency of physical activity, was not associated with falling at the bivariate level (Table 4.15). Conversely, with respect to the sole balance and stability measure, mobility was found to be associated falling (Table 4.15). Individuals that reported having problems with mobility or being non-ambulatory were more likely to fall, as indicated by odds ratios of 2.78 and 2.60. These associations were maintained when stratified by gender; however, the relationship was not significant at the 0.05 level for non-ambulatory females.

In the final logistic regression model for risk of falling, the independent variables that remained significant included age, gender, use of analgesics, use of high blood pressure medications (antihypertensives), use of sleeping pills, homecare, arthritis, urinary problems, and mobility status (Table 4.16). No interaction terms were significant within the final model for risk of falling.

Generally, being female and the age category of 80 years of age and older was associated with an increased risk of falling as indicated by odds ratios of 1.71 and 1.81, respectively. Similarly, the use analgesics and sleeping pills were also found to increase risk of falling. The medical conditions of arthritis and urinary problems were also associated with risk of falling. Individuals that received homecare services were 1.92 times more likely to fall, than individuals that did not receive these services. Having a mobility problem was the last of the variables found to be significantly associated with an increased risk of falling (O.R.=1.65). Conversely, taking high blood pressure medications (antihypertensives) appeared to protect individuals from falling, as indicated by an odds ratio of 0.42.

Table 4.3: **Percentage (Frequency) Distributions for Socio-demographic Variables, By Gender, National Population Health Survey, 1994-1995.**

Variables	Males	Females	Total
Age (**)			
65 to 69 years of age	37.5 (506)	31.4 (563)	34.0 (1069)
70 to 74 years of age	28.3 (383)	30.1 (539)	29.3 (922)
75 to 79 years of age	18.4 (249)	19.6 (350)	19.1 (600)
80 years of age and older	15.8 (213)	18.9 (339)	17.6 (552)
Gender			
male	100.0 (1352)	na	43.0 (1352)
female	na	100.0 (1791)	57.0 (1790)
Income (***)			
low/low-middle income	18.8 (241)	31.1 (526)	25.8 (766)
middle income	45.2 (580)	41.5 (701)	43.1 (1280)
upper middle/upper income	36.0 (461)	27.3 (461)	31.1 (923)
Education (**)			
elementary/some secondary	52.7 (707)	54.8 (980)	53.9 (1687)
secondary/some post-secondary	27.6 (370)	30.0 (536)	29.0 (906)
diploma/university	19.7 (265)	15.2 (271)	17.1 (536)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 4.4: Percentage (Frequency) Distributions for Health Practice Variables, By Gender, National Population Health Survey, 1994-1995.

Variables	Males	Females	Total
Alcohol Consumption (***)			
regularly	52.2 (702)	30.8 (550)	40.0 (1252)
occasionally	19.3 (260)	22.8 (406)	21.3 (666)
do not drink now	21.2 (285)	24.9 (445)	23.3 (730)
abstinent	7.4 (99)	21.5 (384)	15.4 (484)
Smoking Status (***)			
never smoked	20.8 (281)	55.6 (992)	40.6 (1273)
smoker	16.9 (229)	12.8 (228)	14.6 (457)
former-smoker	62.3 (843)	31.6 (564)	44.8 (1407)
Use of Analgesics (***)			
non-use	44.9 (601)	38.1 (675)	41.0 (1276)
use	55.1 (739)	61.9 (1094)	59.0 (1833)
Use of Tranquilizers (***)			
non-use	96.3 (1291)	94.1 (1664)	95.0 (2955)
use	3.7 (50)	5.9 (104)	5.0 (154)
Use of Antidepressants (**)			
non-use	97.4 (1306)	95.4 (1687)	96.3 (2994)
use	2.6 (34)	4.6 (81)	3.7 (115)
Use of Cardiovascular Medications (*)			
non-use	76.8 (1030)	80.1 (1416)	78.7 (2446)
use	23.2 (310)	19.9 (352)	21.3 (663)
Use of High Blood Pressure Medications (***)			
non-use	76.4 (1025)	66.5 (1176)	70.8 (2201)
use	23.6 (316)	33.5 (593)	29.2 (908)
Use of Diuretics (***)			
non-use	92.3 (1238)	86.6 (1531)	89.1 (2769)
use	7.7 (103)	13.4 (237)	10.9 (340)
Use of Sleeping Pills (**)			
non-use	93.9 (1258)	91.6 (1620)	92.6 (2879)
use	6.1 (82)	8.4 (148)	7.4 (230)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Note: another health practice variables used within this analysis was ***use of psychotropics*** (***) (Range= 0 to 4); however, use of psychotropics was left as a continuous variable and was not included within the univariate table

Table 4.5: Percentage (Frequency) Distributions for Social Relationship Variables, By Gender, National Population Health Survey, 1994-1995.

Variables	Males	Females	Total
Marital Status (***)			
married	76.2 (1030)	47.0 (841)	59.5 (1871)
not married	23.8 (322)	53.0 (950)	40.5 (1272)
Composition of Household (***)			
single person in home	18.7 (253)	41.2 (739)	31.5 (991)
couple in home	64.4 (871)	40.1 (718)	50.6 (1589)
other	16.9 (228)	18.7 (334)	17.9 (562)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Note: two other social support measures were used within this analysis were ***amount of social involvement*** (***) (Range = 0 to 8) and ***amount of social support*** (**) (Range = 0 to 4); however, amount of social involvement and social support were left as a continuous variables and were not included within the univariate table

Table 4.6: Percentage (Frequency) Distributions for Measures of Frailty, By Gender, National Population Health Survey, 1994-1995.

Variables	Males	Females	Total
Perceived Health			
good	73.7 (997)	73.1 (1309)	73.4 (2306)
poor	26.3 (356)	26.9 (482)	26.6 (837)
Homecare (***)			
did not receive homecare services	91.7 (1240)	88.1 (1578)	89.7 (2819)
received homecare services	8.3 (112)	11.9 (212)	10.3 (324)
Dementia			
no dementia	99.6 (1345)	99.3 (1776)	99.4 (3120)
dementia	0.4 (6)	0.7 (12)	0.6 (18)
High Blood Pressure (***)			
no high blood pressure	76.6 (1034)	67.4 (1205)	71.4 (2239)
high blood pressure	23.4 (317)	32.6 (582)	28.6 (899)
Stroke (*)			
no stroke	95.1 (1284)	96.8 (1730)	96.0 (3014)
stroke	4.9 (67)	3.2 (58)	4.0 (124)
Heart Condition (**)			
no heart condition	81.4 (1099)	84.8 (1516)	86.3 (2615)
heart condition	18.6 (252)	15.2 (271)	16.7 (523)
Diabetes (*)			
no diabetes	87.3 (1179)	89.9 (1608)	88.8 (2787)
diabetes	12.7 (172)	10.1 (180)	11.2 (351)
Arthritis (***)			
no arthritis	66.5 (898)	54.3 (971)	59.6 (1869)
arthritis	33.5 (453)	45.7 (816)	40.4 (1269)
Urinary Problems			
no urinary problems	96.2 (1299)	95.8 (1712)	96.0 (3011)
urinary problems	3.8 (52)	4.2 (75)	4.0 (127)
Vision Problems (***)			
no vision problems	17.6 (237)	11.3 (200)	14.1 (437)
vision problem corrected	77.4 (1039)	78.9 (1394)	78.3 (2433)
vision problem not corrected	4.9 (66)	9.7 (172)	7.7 (238)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 4.7: Percentage (Frequency) Distributions for Exposure to Risk Variables and Balance & Stability Measures, By Gender, National Population Health Survey 1994-1995.

Variables	Males	Females	Total
Frequency of Physical Activity (***)			
regularly	56.0 (675)	46.6 (796)	50.5 (1471)
occasionally	13.7 (166)	15.4 (263)	14.7 (429)
infrequently	30.3 (365)	38.0 (649)	34.8 (1014)
Mobility (***)			
no problems with mobility	88.8 (1192)	84.5 (1496)	86.3 (2688)
problems with mobility	9.4 (126)	10.0 (177)	9.7 (303)
non-ambulatory	1.8 (24)	5.5 (98)	3.9 (122)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 4.8: Percentage (Frequency) Distributions for Non-Fallers and Fallers, By Gender, National Population Health Survey, 1994-1995.

Variables	Males	Females	Total
Non-Faller			
no falls	96.8 (1309)	94.1 (1685)	95.3 (2994)
(***)			
Faller			
1+ falls	3.2 (42)	5.9 (106)	4.7 (148)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 4.9: **Information Pertaining to Falls, National Population Health Survey, 1994-1995.**

Variables	Total
Number of Falls in Past Year	
1 fall	90.7 (135)
2 falls	5.1 (8)
3 falls	3.5 (5)
5 falls	0.6 (1)
11 falls	0.2 (1)
Injury Type for Most Serious Fall	
multiple injuries	4.4 (7)
fractured bones	40.9 (61)
dislocations	1.6 (2)
sprains/strains	26.5 (39)
cuts/scrapes	3.0 (4)
bruises/abrasions	11.8 (18)
concussions	3.7 (6)
other	8.2 (12)
Body Injuries for Most Serious Fall	
multiple sites	6.7 (10)
head	5.1 (8)
neck	1.8 (3)
shoulder	4.8 (7)
arms/hands	21.3 (32)
hip	11.2 (17)
legs/feet	25.9 (39)
back/spine	13.2 (20)
trunk (excluding back and spine)	9.9 (15)
Location of Injury	
home and surrounding area	57.0 (85)
farm	0.2 (1)
place for recreation or sport	3.4 (5)
street or highway	19.1 (28)
building used by general public	14.1 (21)
residential institution	3.0 (4)
industrial place	0.8 (1)
other	2.4 (4)
Work-Related Fall	
work-related	3.6 (5)
not work-related	96.4 (143)

Table 4.10: Information Pertaining to Preventing Future Falls, National Population Health Survey, 1994-1995.

Variables	Total
Given Up Activity	
gave up activity	6.7 (10)
did not give up	93.3 (138)
Being More Careful	
being more careful	79.5 (118)
not being more careful	20.5 (30)
Using Protective Equipment	
protective equipment	2.7 (4)
no protective equipment	97.3 (144)
Changed Physical Situation	
changed physical situation	3.6 (5)
did not change physical situation	96.4 (143)
Taking No Precautions	
taking no precautions	5.4 (8)
taking precautions	94.6 (140)

Table 4.11: Unadjusted Odds Ratio (95% Confidence Intervals) for Risk of a Fall for Socio-demographic Variables, by Gender, National Health Promotion Survey, 1994-1995.

Variables	Males	Females	Total
Age			
65 to 69 years of age	1.00	1.00	1.00
70 to 74 years of age	1.69 (0.78, 3.61)	1.58 (0.93, 2.69)	1.66 (1.08, 2.56) *
75 to 79 years of age	0.43 (0.12, 1.65)	1.08 (0.57, 2.07)	0.92 (0.52, 1.63)
80 years of age and older	2.62 (1.17, 5.83) *	2.20 (1.27, 3.81) **	2.42 (1.54, 3.78) ***
Gender			
male	na	na	1.00
female			1.92 (1.35, 2.73) ***
Income			
low/low-middle income	1.00	1.00	1.00
middle income	0.38 (0.18, 0.81) **	1.25 (0.79, 1.96)	0.85 (0.59, 1.24)
upper middle/upper income	0.54 (0.26, 1.12)	0.72 (0.41, 1.27)	0.63 (0.40, 0.98) *
Education			
elementary/some secondary	1.00	1.00	1.00
secondary/some post-secondary	1.02 (0.48, 2.15)	0.54 (0.32, 0.90) *	0.66 (0.44, 0.99) *
diploma/university	1.54 (0.73, 3.24)	1.02 (0.60, 1.73)	1.10 (0.72, 1.70)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 4.12: Unadjusted Odds Ratios (95% Confidence Intervals) for Health Practice Variables, By Gender, National Population Health Survey, 1994-1995.

Variables	Males	Females	Total
Alcohol Consumption			
regularly	1.00	1.00	1.00
occasionally	0.72 (0.31, 1.65)	0.80 (0.45, 1.40)	0.84 (0.53, 1.35)
do not drink now	0.61 (0.26, 1.44)	1.17 (0.70, 1.95)	1.09 (0.72, 1.65)
abstinent	0.90 (0.28, 2.88)	1.00 (0.57, 1.73)	1.16 (0.73, 1.86)
Smoking Status			
never smoked	1.00	1.00	1.00
smoker	0.60 (0.19, 1.87)	1.26 (0.69, 2.31)	0.88 (0.52, 1.51)
former-smoker	1.03 (0.49, 2.17)	1.50 (0.98, 2.32)	1.08 (0.76, 1.54)
Use of Analgesics			
non-use	1.00	1.00	1.00
use	2.93 (1.41, 6.02) **	2.03 (1.30, 3.19) **	2.35 (1.58, 3.46) ***
Use of Tranquilizers			
non-use	1.00	1.00	1.00
use	0.23 (0.01, 5.67)	1.27 (0.59, 2.73)	1.11 (0.54, 2.28)
Use of Antidepressants			
non-use	♪ no convergence	1.00	1.00
use		1.27 (0.54, 3.01)	1.10 (0.47, 2.54)
Use of Cardiovascular Medications			
non-use	1.00	1.00	1.00
use	0.90 (0.43, 1.89)	1.01 (0.62, 1.65)	0.94 (0.62, 1.42)
Use of High Blood Pressure Meds			
non-use	1.00	1.00	1.00
use	0.16 (0.04, 0.65) **	0.66 (0.42, 1.04)	0.57 (0.38, 0.86) **
Use of Diuretics			
non-use	1.00	1.00	1.00
use	0.73 (0.20, 2.70)	1.28 (0.76, 2.18)	1.26 (0.77, 2.05)
Use of Sleeping Pills			
non-use	1.00	1.00	1.00
use	3.36 (1.47, 7.64) **	1.68 (0.93, 3.03)	2.15 (1.32, 3.53) **
Use of Psychotropics	1.80 (1.22, 2.67) **	1.51 (1.17, 1.94) **	1.64 (1.33, 2.05) ***

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

♪ convergence was not attained at the bivariate level for the independent variable use of antidepressants (for males only)

Table 4.13: Unadjusted Odds Ratios (95% Confidence Intervals) for Social Relationship Variables, By Gender, National Population Health Survey, 1994-1995.

Variables	Males	Females	Total
Marital Status			
married	1.00	1.00	1.00
not married	2.57 (1.41, 4.75) **	1.11 (0.75, 1.65)	1.64 (1.18, 2.30) **
Homecare			
did not receive homecare services	1.00	1.00	1.00
received homecare services	2.69 (1.23, 5.89) **	2.78 (1.73, 4.44) ***	2.90 (1.95, 4.27) ***
Composition of Household			
single person in home	1.00	1.00	1.00
couple in home	0.49 (0.24, 0.99) *	1.00 (0.64, 1.52)	0.70 (0.48, 1.01)
other	0.65 (0.26, 1.60)	1.09 (0.64, 1.86)	0.90 (0.57, 1.45)
Amount of Social Involvement	1.12 (0.97, 1.28)	1.01 (0.92, 1.08)	1.04 (0.98, 1.10)
Amount of Social Support	0.83 (0.56, 1.24)	0.79 (0.62, 0.99) *	0.83 (0.68, 0.99) *

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 4.14: Unadjusted Odds Ratios (95% Confidence Intervals) for Measures of Frailty, By Gender, National Population Health Survey, 1994-1995.

Variables	Males	Females	Total
Perceived Health			
good	1.00	1.00	1.00
poor	1.65 (0.88, 3.09)	1.54 (1.02, 2.32) *	1.58 (1.10, 2.23) **
Dementia			
no dementia	♪ no convergence	♪ no convergence	1.00
dementia			3.63 (0.98,13.51) *
High Blood Pressure			
no high blood pressure	1.00	1.00	1.00
high blood pressure	0.52 (0.22, 1.26)	0.76 (0.50, 1.17)	0.75 (0.51, 1.11)
Stroke			
no stroke	♪ no convergence	1.00	1.00
stroke		1.24 (0.45, 3.42)	0.68 (0.25, 1.86)
Heart Condition			
no heart condition	1.00	1.00	1.00
heart condition	1.45 (0.71, 2.93)	0.77 (0.43, 1.39)	0.94 (0.60, 1.48)
Diabetes			
no diabetes	1.00	1.00	1.00
diabetes	0.58 (0.19, 1.76)	2.19 (1.31, 3.63) **	1.50 (0.95, 2.34)
Arthritis			
no arthritis	1.00	1.00	1.00
arthritis	1.72 (0.93, 3.15)	2.39 (1.58, 3.60) ***	2.29 (1.64, 3.20) ***
Urinary Problems			
no urinary problems	1.00	1.00	1.00
urinary problems	3.08 (1.11, 8.49) *	3.10 (1.59, 6.03) ***	3.12 (1.81, 5.41) ***
Vision Problems			
no vision problems	1.00	1.00	1.00
vision problem corrected	0.55 (0.27, 1.11)	2.78 (1.13, 6.83) *	1.31 (0.77, 2.22)
vision problem not corrected	1.27 (0.39, 4.12)	4.76 (1.72,13.19) **	2.63 (1.35, 5.14) **

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

♪ convergence was not attained at the bivariate level for the independent variables dementia (for males and females) and stroke (for males only)

Table 4.15: Unadjusted Odds Ratios (95% Confidence Intervals) for Exposure to Risk Variables and Balance & Stability Measures, By Gender, National Population Health Survey, 1994-1995.

Variables	Males	Females	Total
Frequency of Physical Activity			
regularly	1.00	1.00	1.00
occasionally	0.36 (0.10, 1.37)	1.03 (0.56, 1.89)	0.84 (0.50, 1.43)
infrequently	0.60 (0.28, 1.28)	1.23 (0.79, 1.88)	1.09 (0.76, 1.54)
Mobility			
no problems with mobility	1.00	1.00	1.00
problems with mobility	4.07 (1.96, 8.37) ***	2.28 (1.35, 3.89) **	2.78 (1.84, 4.19) ***
non-ambulatory	6.15 (1.80,21.22) **	1.76 (0.84, 3.72)	2.60 (1.38, 4.84) **

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 4.16: Multiple Logistic Regression for Risk for Falling, National Health Promotion Survey, 1994-1995.

Independent Variables	Parameter Estimate	Standard Error	Odds Ratio	95% C.I.
Age				
65 to 69 years of age	0.00		1.00	
70 to 74 years of age	0.42	0.23	1.52	0.97, 2.39
75 to 79 years of age	-0.25	0.30	0.78	0.43, 1.40
80 years of age and older	0.53 *	0.25	1.71	1.04, 2.77
Gender				
male	0.00		1.00	
female	0.59 **	0.19	1.81	1.24, 2.62
Use of Analgesics				
non-use	0.00		1.00	
use	0.63 **	0.21	1.88	1.24, 2.83
Use of High Blood Pressure Meds				
non-use	0.00		1.00	
use	-0.86 ***	0.22	0.42	0.27, 0.65
Use of Sleeping Pills				
non-use	0.00		1.00	
use	0.52 *	0.26	1.69	1.01, 2.80
Homecare				
did not receive homecare services	0.00		1.00	
received homecare services	0.65 **	0.23	1.92	1.22, 3.01
Arthritis				
no arthritis	0.00		1.00	
arthritis	0.49 **	0.18	1.63	1.15, 2.32
Urinary Problems				
no urinary problems	0.00		1.00	
urinary problems	0.75 **	0.30	2.12	1.18, 3.81
Mobility				
no problems with mobility	0.00		1.00	
problems with mobility	0.50 *	0.24	1.65	1.03, 2.64
non-ambulatory	0.14	0.36	1.15	0.57, 2.33

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

4.3: Summary Discussion for the National Population Health Survey, 1994-1995.

As previously mentioned in the chapter examining the Survey on Ageing and Independence (SAI) (Chapter 3.0), national data sets that contain information pertaining to risk factors for falls among the elderly are relatively uncommon. However, the two national data sets analyzed within this thesis afford interesting contrasts. The two data sets, the SAI and the NPHS, consisted of similar socio-demographic (i.e., age, gender, income, education), health (i.e., alcohol consumption, smoking status), social support (i.e., marital status, support), and frailty measures (i.e., perceived health); however, certain variables in other categories were unique to each of these data sets. For example, the SAI contained questions pertaining to home maintenance (i.e., no repairs, minor repairs, major repairs) and providing assistance to others, both factors which have the potential to expose an elderly person to risk of falling. Conversely, the NPHS contained comprehensive sections on medication use and medical conditions that were not included within the SAI. Further, the NPHS provided information pertaining to the mobility patterns of Canadian elderly. Therefore, although the two surveys are similar in some respects, the differences that exist offer great insight for future directions for managing falls within senior populations.

4.3.1: Interpretation of the Results from the National Population Health Survey 1994-1995.

Advanced age and being female were the two socio-demographic variables that were significant within the final model for risk of falling (Table 4.16). These findings are associated with a substantial portion of past research completed for elderly and risk of falling. For example, Craven and Bruno (1986) reported that advanced age (80 years of age and older) was one of the main contributing risk factors for falling, in a sample of non-institutionalized, ambulatory elderly. Other confirmatory evidence regarding the association between advanced age and falling can be found in several other community-based studies (see, for example, women only for Campbell et al., 1981; Prudham & Evans, 1981; Sattin et al., 1990; Wild et al., 1981).

With respect to gender, Campbell et al. (1990) found that even after controlling for a number of physical and social measures, women were 1.55 times and 2.02 times more likely to experience an internal or external fall, respectively, as compared to men. According to Campbell et al. (1990) an internal fall was a fall in "in which there was no or minimal external contribution to the fall and the person fell primarily from a disorder of stability or balance", while an external fall referred to a fall "in which there was a major external contribution judged to be sufficient to cause a fit and active person to fall, such as a fall off a ladder or a fall while jumping over a ditch". Campbell et al. (1991) suggested that the difference in risk between the genders may be attributed to the reluctance of men to report falling or the result of variables not examined (i.e., differences in gait, knee action). Other studies confirmed the findings of women being more susceptible to falling then men (see, for example, Campbell et al., 1981, Craven & Bruno, 1986; Prudham & Evans, 1981; Tinetti et al., 1995A). For example, in a study determining the effect of benzodiazepine use on falls for new and repeat users, women were more at greater risk of being hospitalized for fall-related injuries (Maxwell et al., in press). Psychotropic use not only increases risk of falling (see, for example, Blake et al., 1988; women only for Campbell et al., 1981; Maxwell et al., in press, Neutel et al., 1996; Tinetti et al., 1988), but has also been associated with fractures (see, for example, Cali et al., 1995; Macdonald & Macdonald, 1977; Ray et al., 1987). Campbell et al. (1990A) contend that the use of psychotropic drugs contribute to increased fall risk in women compared to men, and is maintained even after controlling for factors such as depression and dementia (Campbell et al., 1989). Further, osteoporosis occurs more frequently in women, and has been associated with higher incidence rates of fractures among females of advanced age (Lindsay, 1988; Melton et al., 1986). The interaction between age and gender in the analysis of the SAI (Chapter 3.0) revealed that being female and advanced age was associated with an increased risk of experiencing a fall-related accidental injury, which provides additional evidence for this finding.

Tideiksaar (1989) contends that several elements may account for falls related to medication use namely, pharmacokinetic capability to excrete and metabolize medications, the type, dosage, and the number of medications (over-the-counter and prescribed) taken, drug-drug and drug-disease interactions, and medication compliance. Macdonald (1985) suggests that there is a general consensus that some medications (i.e., diuretics, hypotensives, anticonvulsants, hypnotics, psychotropics) have the potential to increase the risk of falling in the elderly, despite the fact that not all studies have shown a significant relationship between medication use and falling (see, for example, Perry, 1982; Robbins et al., 1989). In this analysis, several medications were significant at the 0.05 level of significance in the final model for risk of falling. Use of sleeping pills and analgesics were associated with an increased risk of falling, as indicated by odds ratios of 1.69 and 1.88, respectively. Conversely, the use of antihypertensives appeared to have a protective effect against risk of falling (O.R.=0.42).

Sleeping pill use, which has the potential to increase sedation, has been frequently implicated as a risk factor for falls among the elderly. For example, Sorock and Shimkin (1988) found that continuous use of benzodiazepines (a commonly prescribed class of drugs that includes sleeping pills) increased the risk of falling once in a community-dwelling elderly sample, while any use of benzodiazepines (use as needed, or continuous use) was associated with multiple fall risk. Additional evidence of fall risk and use of benzodiazepines (see, for example, Cumming et al., 1991; Neutel et al., 1996; Maxwell et al., in press) and psychotropics, which may include sleeping pills (Ray et al., 1987) further substantiates these findings.

Prior research concerning analgesic use and risk of falling does not provide much convergence with this finding. For example, Liu et al. (1995) found no significant association with analgesic use and falling. Additionally, Cumming et al. (1991) revealed that unadjusted odds ratios for multiple falls (two or more falls) among seniors (n=40) associated analgesic and anti-inflammatory use with fall risk (O.R.=1.56), although this finding was not significant with risk of one or more falls. The researchers hypothesized that the association with multiple falls and analgesic use may be attributable to the illnesses for which the seniors were taking the medications. After stratifying by relevant medical conditions and summary measures of health, the odds ratio was reduced close to 1.00 for analgesic and anti-inflammatory use (Cumming et al., 1991).

Use of antihypertensive medications have the potential to produce orthostatic or postural hypotension (Tideiksaar, 1989), a reduction of blood pressure on standing, thus potentially impairing cerebral perfusion resulting in dizziness or syncope (Rubenstein et al., 1988). However, in these results, antihypertensive use was associated with a decreased risk of falling. Campbell (1991) contends that no substantial evidence has been provided to date that links use of antihypertensives or diuretics with an increased risk of falling, and further suggests that the information has generally been conflicting (see, for example, Blake et al., 1988; Prudham & Evans, 1981; Liu et al., 1995). Further, in a community-based study of the elderly, Tinetti et al. (1988) did not find a significant association between use of antihypertensives and diuretics and fall risk. Campbell et al. (1989) reported that medications that had the potential to cause postural hypotension were significantly associated at the bivariate level for women only, but were not significant within multivariate logistic regression models. At the present time, the existing data do not seem definitive to make conclusive decisions regarding antihypertensives as a risk factor for falls. Ray and Griffen (1990) contend that since the use of antihypertensives is widespread, further studies that include the following elements are needed, particularly if use is protective as suggested within this study: (1) classify individuals by the duration of the use of the medication, indicating new users of the medication, (2) control for medication conditions/diseases that may result from use of the medication and a predisposition to falling, (3) examine specific medication families, and (4) conduct studies with sufficient numbers of seniors in order to ascertain increases in risk of falling (Ray & Griffen, 1990).

Receiving homecare services, consisting of nursing care, housework, personal care, meal preparation or shopping, was also found to be associated with an increased risk of falling. Other evidence for these findings lie in the work of Langlois et al. (1995) who showed that dependence in activities of daily living was significantly related to an increased risk of falling. With respect to dependence in activities of daily living in this study, individuals were considered dependent in activities of daily living if they needed assistance from another person in completing one or more of the following activities: bathing, dressing, toiletting, transferring, and eating. Further, Campbell et al. (1981) found, through the use of discriminant analysis, that one of the "predictors" of pattern falls (multiple falls) for elderly individuals was receiving support or assistance from family members or professionals. Confirmation of these results have been reported elsewhere (see, for example, Nevitt et al., 1989; Prudham & Evans, 1981; Tinetti et al., 1988). Conversely, other findings have found that the provision of support provides a protective effect against negative health outcomes. For example, Hirdes and Forbes (1992) reported that individuals with middle and high scores on a social relationship index (consisting of the indicators of marital status, number of living children, family contact, membership in fraternities, service or religious organizations, and the number of groups or organizations in which individuals participated) were protected against risk of mortality, as indicated by odds ratios of 0.54 and 0.30. Further, Penninx (1996) concluded the following about the association between social support and seniors with chronic diseases: (1) individuals that received social support from social network members experienced less depressive symptoms and had a lower risk of death; (2) seniors that perceived their support networks to be adequate reported less feelings of loneliness; and (3) beneficial effects of psychological health were noted for elderly individuals with structural aspects of support (e.g., having a partner, having many social relationships); however, both of these studies did not specifically examine the effect of social support on fall risk. The findings from this study (NPHS) do however, coincide with the findings from the SAI (chapter 3), which concluded that those that received support of family and friends had a greater risk of experiencing a fall-related accidental injury. It would appear that social support is related to health in two distinct manners: social support may protect individuals from negative health outcomes (see, for example, Hirdes & Forbes, 1992; Penninx, 1996), or those whose health places them at an increased risk of experiencing negative health outcomes (e.g,. falls), are recipients of support in order to deal with their illness or disability (see, for example, results from SAI and NPHS). It is possible that in the latter case, social support is actually a surrogate measure of poor health. Therefore, requiring homecare or having support would be factors indicative of frailty which in turn renders seniors at risk of falling.

Individuals suffering from arthritis and urinary problems were also shown to be associated with an increased risk of falling. Blake et al.(1988) report similar findings concerning arthritis and fall risk. After entering independent measures (i.e., age, sex, presence or absence of specific health conditions, medication use, anthropometric measurements of dominant handgrip strength, weight, flexibility and stature) into discriminant function analysis, arthritis was found to be one of the significant factors that discriminated fallers from non-fallers (Blake et al., 1988). Additionally, Nevitt's et al. (1989) multivariate analysis determined that arthritis was one of the risk factors for multiple falls in community-dwelling elderly, while arthritis in the knees among men was a significant risk factor for falling in a study by Campbell et al. (1988). Nevitt et al. (1989) suggest that the risk attributed to arthritis may be the result of the pain, impaired joint motion, or reduced muscle strength that influences the afflicted individuals. Campbell et al. (1989) submit that arthritis of the lower limbs may increase risk of falling twofold: (1) through a decrease in stability which may accompany the arthritis, and (2) through muscle weakness which may stem from decreased activity in arthritic individuals.

Supporting evidence for increased risk of falling with urinary problems exists in prior falls research. For example, multivariate logistic analysis completed by Yasumura et al. (1994) demonstrated urinary or bowel incontinence in women, and urination at night for males and females to be significantly associated with an increased risk of falling. Further evidence stems from work undertaken by Nevitt et al. (1989) and Stewart et al. (1992). Yasmura et al. (1994) imply that problems with urination are indications of frailty or poor health, thus rendering the elderly vulnerable to falling. With respect to nocturia (night time urination), Stewart et al. (1992) suggest that it interferes with sleep, thus affecting their health status; however, they also suggest that accidents occurring during the nocturia events (i.e., interruptions of sleep, associated disease states, or medication side effects, or factors unknown) account for the risk of falling.

Impaired mobility, whether corrected by a mechanical device (i.e., cane) or not, was found to be associated with an increased risk of falling. Similar findings have been extensively substantiated within the literature. For example, Wickham et al. (1988) revealed through multivariate logistic regression modelling that seniors with impaired mobility were 2.0 times more likely to experience a fall. Other evidence of impaired mobility, as measured by impairments in balance and gait, were found to be associated with falls (see, for example, Campbell et al., 1981; Campbell et al., 1989; Craven & Bruno, 1986; Prudham & Evans, 1981), multiple falls (see, for example, Lord et al., 1994; Nevitt et al., 1989), serious injuries resulting from falling (see, for example, Tinetti et al., 1995A & B), and mortality associated with falls (see, for example, Wild et al., 1981). Given the influence that impaired mobility, balance and gait can have on the seniors (i.e., falls, injury, mortality), determining methods to improve these systems should be a priority in the prevention of falls.

4.3.2: Implications for Future Research

As with the findings from the SAI (Chapter 3.0), several of the risk factors from the NPHS analysis are similar to previous falls research with the elderly. For example, advanced age (see, for example, Sattin et al., 1990; Wild et al., 1981), being female (see, for example, Craven & Bruno, 1986; Prudham & Evans, 1981), certain medical conditions (see, for example, Blake et al., 1988; Stewart et al., 1992), medication use (see, for example, Cumming et al., 1991; Sorock & Shimkin, 1988), and impaired mobility (see, for example, Campbell et al., 1981; Wickham et al.,1988) have been associated with risk of falling in preceding studies. However, as previously suggested in Chapter 3.0, the completion of national longitudinal studies that have the ability to temporally relate individual characteristics to the fall event are needed in providing more definitive risk factors for falls. Thus, the continuation of the NPHS data collection in future waves will aid in this process. Given the significance of exposure to risk measures (i.e., presence of home repairs) in the models from the SAI (Chapter 3.0), inclusion of these types of measures in future NPHS cycles may be warranted.

CHAPTER 5: METHODOLOGY FOR DATA FROM THE GRAND RIVER HOSPITAL: FREEPORT HEALTH CENTRE, 1991-1994.

Although several risk factors for falls among the institutionalized elderly have been identified, little information is available concerning the risk factors that distinguish non-fallers or one-time fallers from multiple fallers. Further, the lack of vigorous statistical analyses based on institutional data warrants further investigation with more advanced statistical techniques to establish the risk factors for falls within institution settings. Longitudinal data from the Grand River Hospital: Freeport Health Centre will be analyzed with event history models to determine: (1) the risk factors for time-to-first-fall (distinguishing non-fallers from fallers) for institutionalized seniors and (2) the risk factors for time-to-second-fall (distinguishing non-fallers/one-time fallers from multiple fallers) among institutionalized seniors.

Data from Freeport Hospital's Program Needs Survey was used for this analysis. The survey, a seven year cohort sequential longitudinal study initiated in 1989, contains representative samples of the patient population. However, information pertaining to falls were collected beginning in 1991, so only information for 1991 until 1994 was utilized. Information from the Program Needs Survey was collected from four sources: interviews with primary care nurses, reviews of patient charts, information from existing electronic databases (e.g., incidence records), and information from time sheets (e.g., activities attended). All of the data for each of the years was collected during the time period of June to September for every given year. Although Freeport Health Centre provides services to adults 19 years of age and older, only individuals that were 65 years of age and older were included in this analysis.

4.1: Measures

The variables investigated in this analysis have been divided into socio-demographic variables, health practice measures, social support variables, measures of frailty, and balance and stability variables, and information pertaining to falls. Each of the variables within the categories will be described in turn.

4.1.1: Socio-Demographic Variables

Age and gender were the two socio-demographic measures utilized for this analysis.

Age

For this analysis, age was left as a continuous variable. Age was not coded into dummy variables, as in the other analyses within this thesis, because of the higher concentration of patients in the older age groups.

Gender

The gender variable was coded as a binary variable with the categories of males (0) and females (1). Males were used as the reference category.

4.1.2: Social Support Measures

For the social support measures, only marital status was available from the survey.

Marital Status

Responses to the question, "What is the patient's marital status?" were coded into single (1), widowed (2), or separated/divorced (3) as the dummy variables, and married (0) as the reference group.

4.1.3: Health Practice Measures

The sole health practice measure was medication use.

Medication Use

Medication use was collected from an administrative data set compiled by the Pharmacy Department at Freeport Health Centre for the years 1991 to 1994. This data set had medication information for tranquilizer/antidepressant and sedative/anxiolytic/hypnotic use. Both of these medications, which are classified as psychotherapeutic agents (Freeport Health Centre Formulary, 1994), were investigated since they have frequently been implicated as risk factors for falls among the institutionalized. Tranquilizers and antidepressants included the following medication classes: (1) antidepressants (for example, amitriptyline, amoxapine, desipramine, doxepine, imipramine, notriptyline, trimipramine, trazodone, clomipramine, fluoxetine, fluvoxamine), (2) tranquilizers (for example, chlorpromazine, perphenazine, thioridazine, loxapine, trifluoperazine, thiothixene, pimozide, pericyazine, pipotiazine palmitat, methotrimeprazine, prochlorperazine, fluphenazine decanoa). Throughout the remainder of this thesis the category of tranquilizers and antidepressants will be referred to as psychotherapeutics. The second category, sedatives/anxiolytics/hypnotics, included: (1) benzodiazepines (for example, oxazepam, diazepam, triazolam, lorazepam, alprazolam, clorazepate, flurazepam, temarzepam, nitrazepam, chlordiazepoxide), (2) barbituates (for example, tuinal, secobarbital, amobarbital), and (3) barbituate and benzodiazepine anticonvulsants (for example, phenobarbital, primidone, clonazepam). The latter category will be referred to as sedative use.

A baseline measure of drug use on June 1 in each year of the study was examined as a potential risk factor for falls within the next year. Variables based on use of psychotherapeutics and sedative use were each coded into non-use (0) or use of the medication (1) in question. Non-use was the reference category for the analysis of both sets of drugs. Further, breakdown of these categories into specific drug classes was not possible because of the small numbers involved.

4.1.4: Measures of Frailty

The variables classified as measures of frailty included presence or absence of a health change within the past six months, mental status, presence or absence of dementia, coronary heart disease, stroke, or diabetes.

Health Change within the Past Six Months

Each patient's primary care nurse was asked whether the patient experienced a health change (health decline) in the past six months. Responses were coded into did not experience a change (0) and experienced a change within the past six months (1). Not experiencing a change was utilized as the reference group.

Mental Status

For the measure of mental status, each of the patient's primary care nurses were asked to rate the patient's overall mental status. Specifically, the following question was posed, " What is the person's overall mental status? Consider the impression of characteristics like mental functioning, psychosocial abilities, freedom from impairments, and perceptual abilities". Each nurse was asked to rate the individual on a ten point scale, with a score of 0 being indicative of complete impairment, a score of five as moderate impairment, and a score of nine as no impairment. Responses were collapsed into the categories no impairment (score of 0)(0), mild to moderate impairment (score of 1 to 5)(1), and moderate to severe impairment (score of 6 to 9)(2). No impairment was utilized as the reference group, while the two remaining categories were dummy-coded.

Disease States (Dementia, Coronary Heart Disease, Stroke, Diabetes)

Primary care nurses were also asked whether or not each of the patients had dementia, coronary heart disease, stroke or diabetes. The category, coronary heart disease, included hypertension, myocardial infarction, atherosclerotic heart disease, and congestive heart disease, while stroke included cerebrovascular disease and transient ischemic attack. Responses for each of the conditions were coded as not having the disease (0) or having the disease (1). Not having the disease was the reference group.

4.1.5: Measures of Balance and Stability

The variables for measures of balance and stability included level of co-ordination, balance, mobility, and transferring ability.

Level of Co-ordination and Balance

For the question pertaining to co-ordination and balance, primary care nurses were asked in 1991, "Does the patient have a motor impairment in any of the following areas: (1) co-ordination, (2) balance (wheelchair patients balance in their seats)?" and in 1992 and 1993, "Rate the severity of the patient's motor impairment in the following areas: (1) coordination, (2) balance (wheelchair patients balance in their seats)?". Responses to the 1991 survey questions were yes or no, while responses for the 1992 and 1993 surveys were none, mild, moderate, or severe. For this analysis, answers were coded as having no impairment (0) and having an impairment (1), with having no impairment as the reference group. Having an impairment included the responses of yes for the 1991 survey, and the responses of mild, moderate and severe for the 1992 and 1993 surveys.

Level of Mobility

With respect to level of mobility, the primary care nurses were asked the following, "What is the patient's mobility on level surfaces: (1) walks independently, (2) walks with staff supervision, (3) walks with staff assistance, (4) walks with assistive device, (5) uses manual wheelchair, (6) uses power wheelchair, (7) uses "Geri" chair, and (8) uses a "Broda" chair, and (9) not applicable (non-ambulatory). Individuals were coded as non-ambulatory (response 9), wheelchair bound (included responses 5, 6, 7, 8) and walks independently or with some assistance (includes responses 1, 2, 3 and 4). For the analysis, non-ambulatory status was the reference group, while the remaining two categories were coded as dummy variables.

Level of Transferring Ability

For the measure on transferring ability primary care nurses were asked, "How does the patient transfer from bed to chair: (1) transfers self independently, (2) transfers self with staff supervision, (3) assisted by one person, (4) assisted by two or more people, and (5) assisted by mechanical lifter?". The responses were collapsed into three categories: needing the assistance of a mechanical lifter (0), needing assistance from staff (included responses 2, 3 and 4) (1), and transfers self independently (2). Needing a mechanical lifter was the reference group for the analysis, while the remaining two categories were coded as dummy variables.

4.1.6: Occurrence of Falls

Data from Freeport's incident databases were also collected. Information pertaining to fall incidents that occurred (e.g., date of the first instance, dates of further falls) from June first of the year in question until May thirty-first of the subsequent year were collected. For example, for the 1991 survey year fall data were collected from June 1, 1991 to May 31, 1992. To determine the risk factors for time-to-first-fall, falls were coded into the binary variable no falls (0) and one or more falls (1), with no falls as the reference group. For the determination of the risk factors for time-to-second-fall, falls were coded into no falls/first fall (0) and two or more falls (1), with the first category as the reference group.

4.1.7: Data Analysis

For the analyses, socio-demographic variables, health practice measures, social support variables, measures of frailty, and balance and stability variables were the independent measures within logistic regression and survival analysis models. The information pertaining to falls was used for the dependent variables. Survival analysis methods, namely the Proc Lifereg and Cox regression models, were used estimate the survivor function and to determine models of risk factors for time-to-first-(and second)fall, respectively.

For the survival models, baseline data for each of the independent variables were used to predict falls in the subsequent year. For example, baseline independent variables in 1991 were used to predict falls in 1992, while baseline independent variables in 1992 were used to predict falls in 1993. Only the independent variables found to be significant at the bivariate level were further analyzed in the final models. The final survival models were used to estimate the adjusted risk ratios for the main and interactive effects for the measures investigated. A description of the survival analysis techniques employed and the benefits of survival analysis follows.

4.1.7.1: Survival Analysis

4.1.7.1.1: Introductory Comments Concerning Longitudinal Data Analysis

Hirdes and Brown (1994) contend that there are four central issues that have resulted in an increased awareness of the importance of longitudinal data in aging research. The first point of interest is that in cross-sectional studies, the differences that are found between individuals in different age groups may be attributable to differences between cohorts, and not because of changes that can be attributed to processes involved with aging. Hirdes and Brown (1994) recommend that it would be more advantageous to follow individuals over a specified time period in order that age changes may be identified, thus, providing researchers with more useful and valid information about the processes involved with aging. Secondly, the simultaneous observation of variables, inherent within cross-sectional designs, do not allow for the establishment of temporal order between the independent and dependent variables. Therefore, only weak evidence for potential causal associations is available from cross-sectional studies. Hirdes' and Brown's (1994) third issue concerns the examination of static observations at one point in time. They assert that observing factors over time would provide researchers with more useful and interesting associations between variables, because of the changes that may occur in individual characteristics over time. The last issue deals with the processes that involve risks that vary with age. Specifically, Hirdes and Brown (1994) contend that the examination of patterns of change over time is more informative than the examination of static distributions at precise ages.

Unfortunately, longitudinal studies also possess several methodological and administrative liabilities. One of the major limitations in longitudinal research is the need for statistical models to examine complex data sets, given that multiple observations over time, for multiple individuals exist in these types of analyses. Therefore, the data set that is to be manipulated must consist of each individual's status at each interval period during the study. The method that is used to analyze the data should utilize each of the observation points collected, in order to examine the associations that exist between the variables (Hirdes & Brown, 1994). Additionally, attrition in longitudinal studies could potentially result in the loss of information for certain segments of the sample being studied. Normally, individuals that have dropped out of the study between two points in time would be excluded from simple longitudinal analysis, because the observations for the second time period in which data would be collected would be missing (Hirdes & Brown, 1994). Further, information on changes which occurred during the two points in time would also be lost; however, with recent statistical advances, the analysis of time-to-event data (survival analysis) are able to address some of the concerns with respect to subject loss. This is accomplished by using all of the information for all subjects in a data set, even those that have been lost to follow-up for reasons that are unrelated to the event of interest (termed censored cases).

4.1.7.1.2: Censoring

In longitudinal designs, information concerning the distribution of events among subjects can be lost for several reasons, including the following: (1) subjects being discharged from the study facility, (2) subjects that are absent at some of the assessment times and therefore data cannot be collected for these individuals, (3) deaths prior to the first fall, and (4) subjects, who at the end of the study, have not yet experienced the change or the event being studied (e.g., time-to-first-fall). The first three issues deal with attrition, and unfortunately, in these cases, it is unlikely that an appropriate event time can be assigned to the subjects to include them in simple longitudinal analysis procedures. All four types of cases which include events that are undetected are referred to as censored observations in time-to-event analysis. In each of these cases, the researcher may know that the particular event being studied (e.g., time-to-first-fall) has not occurred while the subject was participating in the study; however, the researcher can be less confident as to the status of the individual thereafter (Brown & Peterson, 1989; Hirdes & Brown, 1994).

These censored cases would represent serious concerns, should a researcher attempt to analyze this data with normal regression models, given that there was no event recorded for the subjects. Thus, the researcher would either have to assign missing values for each of the individuals that did not experience the event, or assign a duration for the event for each of the subjects with missing values (e.g., time of censoring for each subject). In the first case, the results would be biased towards individuals that had experienced an event (e.g., fall) during the study's duration. In the second case, the researcher has no rationale available to assign any value to the subjects, and thus the results would be biased as well (Hirdes & Brown, 1994). The most logical strategy for dealing with this issue, is to use the information that the event (e.g., fall) had not occurred up to the point where the individual had been censored. Fortunately, event history methods are able to complete this statistical procedure, and are able to use all complete or incomplete data obtained from subjects (Brown & Peterson, 1989; Hirdes & Brown, 1994).

4.1.7.1.3: Time-dependent Covariates

Through the use of longitudinal designs, researchers are able to collect information from individuals at several different points in time (Brown & Peterson, 1989; Hirdes & Brown, 1994). Some of the independent variables that are collected may be fixed (e.g., race, gender), while other variables may alter as time passes (e.g., health status, health practices). With variables that change with time in longitudinal designs, termed time-dependent covariates, problems may arise during analyses since it may be difficult to ascertain associations with the outcomes as the values change over time (Brown & Peterson, 1989; Hirdes & Brown, 1994). Hirdes and Brown (1994) suggest that some independent variables may be treated as fixed, particularly when change is infrequent with age (e.g., change in highest amount of education attained); however, with independent variables that are expected to alter (e.g., health status), adjusting for these time-dependent covariates would be beneficial for data analysis. Including time-dependent covariates, with all of the values for each of the measured time periods over the study period, may reveal important influences for the outcome variable of interest (Brown & Peterson, 1989).

4.1.7.1.4: Survival Analysis Models

Survival analysis methods permit the analysis of events and transitions in characteristics with age (e.g., health status), where subjects are considered to be "surviving" as long as the event or change has not yet occurred. Individuals are considered to have "failed" at the time the event transpires (Brown & Peterson, 1989; Hirdes & Brown, 1994). To explain the procedures involved in survival analysis, the event "time-to-first-fall" will be used to illustrate relevant points in the following section.

4.1.7.1.4.1: Definitions used within Survival Analysis

In order to develop the necessary notation for survival analysis, a random variable, **T** (e.g., time at which the participant first falls), must be defined. Two functions which are also central to survival analysis methodology, **S(t)**, which is the survival function at time **t**, is the probability that an individual has not fallen by time **t** (particular observation for a subject). This function can be explained by the following equation:

$$S(t) = Pr(T>t)$$

The hazard function at time t, which is denoted by **h(t)**, is the instantaneous fall rate at time t (e.g., probability that an individual who has still not fallen at time t, falls in the next small interval of time). Both of these functions are sufficient to describe **T**'s distribution. Further, each can be described in terms of each other (Brown & Peterson, 1989; Hirdes & Brown, 1994).

Time-to-event data modelling can be expressed in terms of methods frequently used to analyse binary end-point data (e.g., time-to-first-fall, mortality). Hirdes and Brown (1994), utilizing mortality as an endpoint, explain that statistical models for mortality data generally characterize the probability that a person will die during the study, based on a group of risk factors (e.g., self-rated health). Based on this set of risk factors, an individual in an at-risk group (e.g., those in poor health) is then compared with a reference group (e.g., those in good health). In essence, the ratio of probabilities of death for individuals in an at-risk group are compared with a reference group, termed the **relative risk of mortality**. Relative risks that are significantly greater or less than one, are indicative of variables that are associated with mortality. Other events (e.g., time-to-first-fall) can be modelled in the same fashion in order to obtain the risk ratios and their standard errors (Hirdes & Brown, 1994; Brown & Peterson, 1989). One such method that estimated relative risks of an event, while adjusting for other covariates is logistic regression models (see for example, Matthews & Farewell, 1988).

The time to the event (first fall) is described in these models in terms of the probability that a person who has not fallen at a specific time, will have fallen in the ensuing instant of time. Therefore, the difference between survival analysis and logistic regression techniques is that survival analysis concentrates on modelling falls at the time the event occurs.

while methods like logistic regression are primarily interested in any fall that occurs during the study, regardless of the time of fall. Also, logistic regression cannot be used to address the problem of censoring. The ratio of hazard functions (or instantaneous probability of a fall), can be used to approximate the relative risk of falling for individuals between groups (e.g., at-risk group vs reference group) in survival analysis models (Hirdes & Brown, 1994).

4.1.7.1.4.2: Regression Models in Survival Analysis

The estimation procedure for the "risk set" is important in understanding survival analysis. Survival models examine the event time (e.g., time to first fall) and compare the participants who have experienced the event (i.e., those who fell in the study interval) at that time, with all the other participants that have not experienced the event and further, have not been lost to follow-up at the same time. Therefore, for each fall time (t_f) there is a specific "risk set" representative of the set of subjects that have not fallen, and are able to fall just before the time (t_f). This time includes all individuals that fall at time (t_f), those that fall after time (t_f), and those that are censored at time or after time (t_f). All of this information is collected across all of the event times and the relative importance of risk factors that differentiate individuals that experience the event from those that did not experience the event are estimated (Brown & Peterson, 1989; Hirdes & Brown, 1994).

The Cox proportional hazards regression model is one of the more common models used for survival analysis (Cox, 1972). This is a semi-parametric model, in which the covariate effects are modelled parametrically, while the baseline hazard function (or distribution at time (t) describing the shape of the survival time distributions is left unspecified for n subjects. Thus, although the relative risk is modelled, the absolute risk is not, since the distribution of the hazard function remains unspecified. The model describes the event rate (e.g., time-to-first-fall) at time t in relation to a set of covariates:

$$h(t;X_1,X_2, ..., X_k) = h_o(t)\exp(B_1X_1 + B_2X_2 + ... + B_kX_k),$$

where $h(t;X_1,X_2, ..., X_k)$ is defined as the event rate (e.g., fall rate) at time t for an individual with the covariate values $X_1,X_2, ..., X_k$; $h_o(t)$ is the baseline event rate (e.g., fall rate) for an individuals with all of the covariates equal to zero; $B_1, B_2, ..., B_k$ are the unknown regression parameters that are to be estimated from the data; and exp is the base of the natural logarithm. It is important to note that the factor $\exp(B_1X_1 + B_2X_2 + ... + B_kX_k)$ is a multiplicative regression function which models the association of the covariates with the risk of the event (e.g., time-to-first-fall) at time t. Further, the estimate of $\exp(B_1)$ is an estimate of the relative risk per 1 unit of covariate X_1 when controlling for all of the other covariates. An important assumption of this model is that $\exp(B_1)$, the relative event rate (e.g., fall rate) per unit of X_1, is not dependent upon the follow-up at time t. Hence, that throughout the study, the relative risk (or ratio of hazard functions) for the "at risk" group compared to the reference group is constant. This primary assumption of the model, termed the proportional hazards assumption, is tested with interaction terms between the covariates and time (Brown & Peterson, 1989; Hirdes & Brown, 1994).

In summary, there are several attractive features of Cox regression models that need to be mentioned. They include: (1) the event rate (e.g., time-to-first-fall) is modelled directly; (2) the data from those lost to follow-up can be accommodated; (3) estimates of $B_1,B_2, ...,B_k$ can be obtained, while leaving the baseline hazard function $h_o(t)$ unspecified; and (4) variables that may be altered over time (e.g., health status) may be included in the model as time-dependent covariates (Brown & Peterson, 1989; Hirdes & Brown, 1994).

5.2: Results for Data from the Grand River Hospital: Freeport Health Centre

5.2.1: Univariate Distributions

The univariate distributions for the independent variables have been summarized into six tables. The first three tables provide the distributions for each cohort year and for the total sample of seniors. The remaining three univariate tables report the univariate distributions by gender, and for the combined sample for all of the independent measures. Tables 5.1 through 5.3 have been provided to enable the reader to examine each of the cohort years; however, no further explanation of these tables will be provided because bivariate analysis of cohort years showed no significant differences across years.

Table 5.4 provides results for the socio-demographic, social support and health measures for males and females separately, and for the combined sample. Females comprised 71.5% of the sample, while 28.5% were males. With respect to marital status, 56.7% and 28.2% of the sample were widowed and married, respectively; however, it is important to distinguish the differences in the distributions for males and females. A larger percentage of females were widowed (68.2%), while 50.0% of males were married. For the health measure of medication use, 41.6% and 46.3% of the total sample utilized psychotherapeutics and sedatives, respectively. When stratified by gender, a larger percentage of males used both medications.

The univariate distributions for the measures of frailty, including health change, mental status, and presence of dementia, cardiovascular disease, stroke or diabetes, have been summarized in Table 5.5. For the health change measure, 79.1% of the total sample were reported to not have experienced a change in health within the past six months. With respect to mental status, the largest percentage of individuals were classified as mild to moderately impaired (47.7%). The remainder of the sample, 11.2% and 41.0%, were categorized as having no impairment or being moderately to severely impaired, respectively. A larger percentage of women were found to have no impairment (12.3%) as compared to men (8.5%). In the total sample, 63.9% were reported as not having dementia. Further, 79.1% and 62.4% of the seniors did not have a diagnosis of coronary heart disease and stroke, respectively. Stratification by gender revealed that coronary heart disease and stroke were present in larger percentages within the male sample. Approximately 88% of the sample did not have a diagnosis of diabetes.

The last univariate table of independent variables summarizes the distributions for the balance and stability measures (Table 5.6). Examination of these measures revealed that the sample was generally impaired in terms of balance and stability. Approximately 84% and 82% of the total sample had impaired co-ordination and balance, respectively. Further, about 94% of patients were non-ambulatory or utilized wheelchairs for mobility purposes. With respect to transferring ability, the majority of the sample used mechanical lifters (60.3%) or assistance from staff (36.1%) to transfer from a bed to a chair.

Tables 5.7 through 5.10 summarize the distributions of the dependent variables used in survival analysis. The breakdown of non-fallers and fallers for each cohort year are presented in Tables 5.7 and 5.9. The percentage distributions for one-time and multiple fallers revealed that 13.0% (Table 5.8) and 4.8% (Table 5.10) of the overall sample, respectively, experienced falling one time or two or more times, respectively. When stratified by gender, a larger percentage of males experienced one-time falls (Table 5.8), whereas more females experienced multiple falls (Table 5.10).

5.2.2: Bivariate and Multivariate Associations

The main and interactive effects for variables that were found to be significant at the bivariate level were further analyzed in multivariate survival analysis models. Quadratic terms to test for curvilinearity in the models were not examined because all of the variables were categorized into dummy variables, with the exception of the continuous variable, age. Not all of the variables that were significant at the bivariate level remained significant in the final survival models. The results for the bivariate associations, the resulting final model, and the survival curves for each significant independent variable within the final models, will be discussed in turn for each of the outcome measures.

5.2.2.1: Bivariate and Multivariate Associations for Risk of Time-to-First-Fall

Bivariate results for the socio-demographic, social support, and health measures revealed that use of psychotherapeutics was the only variable associated with a significant increased risk of time-to-first-fall (Table 5.11). Conversely, a risk ratio of 0.54 indicated that being female was associated with a lower risk of time-to-first-fall. The remaining variables did not reach the 0.10 level of significance for the total sample, or when stratified by gender.

A change in health status and the presence of coronary heart disease was associated with a significant increased risk of time-to-first-fall for the total sample, as indicated by risk ratios of 2.67 and 2.07, respectively (Table 5.12). When stratified by gender, similar trends remained, but were only significant at the 0.10 level for females. Further, females that had diabetes were 2.55 times more likely to experience a fall; however, this relationship was not significant for males or for the total sample.

Results for the bivariate associations for the measures of balance and stability demonstrated that individuals that walked independently or used wheelchairs for mobility purposes were more likely to experience a fall. Further, needing assistance during transferring and transferring independently were also associated with an increased risk of a one-time fall. The mobility relationship and transferring independently relationship persisted for females upon gender stratification; however, walking and transferring independently were the only two variables that attained the 0.10 level of significance for males.

In the final survival analysis model for time-to-first-fall, the independent variables that remained significant were a health change, use of psychotherapeutics, presence of coronary heart disease, mobility, and transferring ability. No significant interaction terms were present within this model (Table 5.14).

Individuals that experienced a health change within the past six months were 2.39 times more likely to experience a fall. Use of psychotherapeutics and presence of coronary heart disease were also associated with an increased risk of experiencing a fall. Further, transferring independently, and the mobility categories of wheelchair use and walking independently was associated with an increased risk of falling.

The estimated survival curves for the five significant independent variables are shown been summarized in Figures 5.1 through 5.5. Figures 5.1 and 5.2 show that patients with a health change and those utilizing psychotherapeutics were consistently more likely to experience a first fall, as compared to individuals that did not experience a health change (X^2=8.99; p=0.003) or did not use psychotherapeutics (X^2=4.50; p=0.03). Further, individuals with coronary heart disease were more likely to experience a fall than individuals without coronary heart disease (X^2=3.75; p=0.05) (Figure 5.3). Figures 5.4 and 5.5 showed that the survival time among individuals that were non-ambulatory and used a mechanical lifter was greater than those that were independent or needed assistance for mobility (X^2=16.12; p=0.0003) and those transferring independently or requiring assistance (X^2=10.78; p=0.005).

5.2.2.2: Bivariate and Multivariate Associations for Risk of Time-to-Second-Fall

Only the bivariate results for the total sample have been presented for time-to-second-fall, since convergence was not attained for several of the bivariate models stratified by gender stratification. Table 5.15, which summarized the socio-demographics, social support, and health measures for risk of time-to-second-fall, shows that none of the measures were significant at the 0.10 level.

Experiencing a change of health in the past six months was associated with an increased risk of experiencing a second fall (Table 5.16). None of the other frailty measures (i.e., mental status, presence of dementia, coronary heart disease, stroke and diabetes) were significant at the bivariate level.

Bivariate results for measures of balance and stability indicated that mobility and transferring ability were the two measures significant at the 0.10 level (Table 5.17). Specifically, individuals that walked independently were 29.15 times more likely to experience a second fall; however, caution interpreting this result is warranted given the large confidence intervals. Further, needing assistance or transferring independently was also associated with an increased risk of falling twice.

The three variables significant at the bivariate level were the variables significant in the final survival model for time-to-second-fall (Table 5.18). Individuals that experienced a health change had a 3.12 times greater risk of a second fall, as compared to individuals that did not experience a change. Further, individuals that walked independently (R.R.=12.72) and transferred independently (R.R.=5.27) were also at an increased risk of falling twice. These results must be interpreted cautiously given the large confidence intervals for the independent measures within the final model. Since the estimated survival curves for the three significant variables in this model are similar to the figures previously shown for time-to-first-fall (Figures 5.1 to 5.5), the figures for time-to-second-fall will not be presented.

Table 5.1: Percentage (Frequency) Distributions for Socio-demographic, Social Support and Health Measures For Each Cohort Year, Program Needs Survey, 1991-1994

Measures	1991 Sample (n=87)	1992 Sample (n=118)	1993 Sample (n=125)	Combined Sample (n=330)
Gender				
male	27.6 (24)	28.0 (33)	29.6 (37)	28.5 (94)
female	72.4 (63)	72.0 (85)	70.4 (88)	71.5 (236)
Marital status				
married	27.6 (24)	30.5 (36)	26.4 (33)	28.2 (93)
single	11.5 (10)	10.2 (12)	7.2 (9)	9.4 (31)
widowed	58.6 (51)	52.5 (62)	59.2 (74)	56.7 (187)
separated	2.3 (2)	6.8 (8)	7.2 (9)	5.8 (19)
Use of Psychotherapeutics				
non-use	51.2 (42)	60.2 (68)	61.7 (74)	58.4 (184)
use	48.8 (40)	39.8 (45)	38.3 (46)	41.6 (131)
Use of Sedatives				
non-use	64.6 (53)	51.3 (58)	48.3 (58)	53.7 (169)
use	35.4 (29)	48.7 (55)	51.7 (62)	46.3 (146)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between the three cohort years for the independent variables

Note: Another socio-demographic variable utilized within this analysis was age; however, age was left continuous within the analysis and thus was not included within the univariate table

Table 5.2: Percentage (Frequency) Distributions for Measures of Frailty For Each Cohort Year, Program Needs Survey, 1991-1994

Measures	1991 Sample (n=87)	1992 Sample (n=118)	1993 Sample (n=125)	Combined Sample (n=330)
Health Change (***)				
no change	66.7 (58)	97.5 (115)	70.4 (88)	79.1 (261)
change	33.3 (29)	2.5 (3)	29.6 (37)	20.9 (69)
Mental Status				
no impairment	4.7 (4)	15.3 (18)	12.0 (15)	11.2 (37)
mild/moderate impairment	53.5 (46)	44.9 (53)	46.4 (58)	47.7 (157)
moderate/severe impairment	41.9 (36)	39.8 (47)	41.6 (52)	41.0 (135)
Dementia				
no dementia	62.1 (54)	66.9 (79)	62.4 (78)	63.9 (211)
have dementia	37.9 (33)	33.1 (39)	37.6 (47)	36.1 (119)
CHD				
no CHD	78.2 (68)	75.4 (89)	83.2 (104)	79.1 (261)
have CHD	21.8 (19)	24.6 (29)	16.8 (21)	20.9 (69)
Stroke				
no stroke	57.5 (50)	66.1 (78)	62.4 (78)	62.4 (206)
had stroke	42.5 (37)	33.9 (40)	37.6 (47)	37.6 (124)
Diabetes				
no diabetes	85.1 (74)	86.4 (102)	90.4 (113)	87.6 (289)
have diabetes	14.9 (13)	13.6 (16)	9.6 (12)	12.4 (41)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between the three cohort years for the independent variables

Table 5.3: Percentage (Frequency) Distributions for Balance and Stability Measures For Each Cohort Year, Program Needs Survey, 1991-1994

Measures	1991 Sample (n=87)	1992 Sample (n=118)	1993 Sample (n=125)	Combined Sample (n=330)
Co-ordination (***)				
no impairment	34.5 (30)	6.8 (8)	12.0 (15)	16.1 (53)
impairment	65.5 (57)	93.2 (110)	88.0 (110)	83.9 (277)
Balance (*)				
no impairment	28.7 (25)	13.6 (16)	16.0 (20)	18.5 (61)
impairment	71.3 (62)	86.4 (102)	84.0 (105)	81.5 (269)
Mobility (**)				
non-ambulatory	49.4 (43)	11.9 (14)	15.2 (19)	23.0 (76)
wheelchair	42.5 (37)	83.1 (98)	80.0 (100)	71.2 (235)
walks independently	8.0 (7)	5.1 (6)	4.8 (6)	5.8 (19)
Transferring Ability				
mechanical lifter	57.5 (50)	59 3 (70)	63.2 (79)	60.3 (199)
needs assistance	39.1 (34)	39.0 (46)	31.2 (39)	36.1 (119)
transfers independently	3.4 (3)	1.7 (2)	5.6 (7)	3.6 (12)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis for the three cohort years for the independent variables

Table 5.4: Percentage (Frequency) Distributions for Socio-demographic, Social Support and Health Measures, by Gender, Program Needs Survey, 1991-1994

Measures	Males	Females	Total
Gender			
male	100.0 (94)	not applicable	28.5 (94)
female	not applicable	100.0 (236)	71.5 (236)
Marital status (***)			
married	50.0 (47)	19.5 (46)	28.2 (93)
single	13.8 (13)	7.6 (18)	9.4 (31)
widowed	27.7 (26)	68.2 (161)	56.7 (187)
separated	8.5 (8)	4.7 (11)	5.8 (19)
Use of Psychotherapeutics (*)			
non-use	48.3 (42)	62.3 (142)	58.4 (184)
use	51.7 (45)	37.7 (86)	41.6 (131)
Use of Sedatives			
non-use	50.6 (44)	54.8 (125)	53.7 (169)
use	49.4 (43)	45.2 (103)	46.3 (146)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Note: Another socio-demographic variable utilized within this analysis was age; however, age (*) was left continuous within the analysis and thus was not included within the univariate table

Table 5.5: Percentage (Frequency) Distributions for Measures of Frailty, by Gender, Program Needs Survey, 1991-1994

Measures	Males	Females	Total
Health Change			
no change	77.7 (73)	79.7 (188)	79.1 (261)
change	22.3 (21)	20.3 (48)	20.9 (69)
Mental Status			
no impairment	8.5 (8)	12.3 (29)	11.2 (37)
mild/moderate impairment	51.1 (48)	46.4 (109)	47.7 (157)
moderate/severe impairment	40.4 (38)	41.3 (97)	41.0 (135)
Dementia			
no dementia	64.9 (61)	63.6 (150)	63.9 (211)
have dementia	35.1 (33)	36.4 (86)	36.1 (119)
CHD			
no CHD	76.6 (72)	80.1 (189)	79.1 (261)
have CHD	23.4 (22)	19.9 (47)	20.9 (69)
Stroke (***)			
no stroke	45.7 (43)	69.1 (163)	62.4 (206)
had stroke	54.3 (51)	30.9 (73)	37.6 (124)
Diabetes			
no diabetes	86.2 (81)	88.1 (208)	87.6 (289)
have diabetes	13.8 (13)	11.9 (28)	12.4 (41)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 5.6: Percentage (Frequency) Distributions for Balance and Stability Measures, by Gender, Program Needs Survey, 1991-1994

Measures	Males	Females	Total
Co-ordination			
no impairment	14.9 (14)	16.5 (39)	16.1 (53)
impairment	85.1 (80)	83.5 (197)	83.9 (277)
Balance			
no impairment	20.2 (19)	17.8 (42)	18.5 (61)
impairment	79.8 (75)	82.2 (194)	81.5 (269)
Mobility			
non-ambulatory	16.0 (15)	25.8 (61)	23.0 (76)
wheelchair	78.7 (74)	68.2 (161)	71.2 (235)
walks independently	5.3 (5)	5.9 (14)	5.8 (19)
Transferring Ability			
mechanical lifter	59.6 (56)	60.6 (143)	60.3 (199)
needs assistance	34.0 (32)	36.9 (87)	36.1 (119)
transfers independently	6.4 (6)	2.5 (6)	3.6 (12)

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Table 5.7: Percentage (Frequency) Distributions for Non-Fallers and Fallers For Each Cohort Year, Program Needs Survey, 1991-1994

Measure of fall status	1991 Sample (n=87)	1992 Sample (n=118)	1993 Sample (n=125)	Combined Sample (n=330)
Non-faller				
no falls	87.4 (76)	90.7 (107)	83.2 (104)	87.0 (287)
Faller				
1+ falls	12.6 (11)	9.3 (11)	16.8 (21)	13.0 (43)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between the three cohort years for the independent variables

Note: the independent variables were used to predict fall status within the subsequent year. For example, baseline measures for the 1991 sample were used to predict fall status in 1992, baseline measures for the 1992 sample were used to predict fall status in 1993, and baseline measures for the 1993 sample were used to predict fall status in 1994

Table 5.8: Percentage (Frequency) Distributions for Non-Fallers and Fallers, by Gender, Program Needs Survey, 1991-1994

Measure of fall status	Males	Females	Combined Sample
Non-faller			
no falls	81.9 (77)	89.0 (210)	87.0 (287)
Faller			
1+ falls	18.1 (17)	11.0 (26)	13.0 (43)

* p<0.05 ** p<0.01 *** p<0.001

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Note: Individuals that had not fallen by the end of the year, or had died before experiencing a fall, were coded as non-fallers (censored observations

Table 5.9: Percentage (Frequency) Distributions for Non-Fallers/One-Time Fallers and Multiple Fallers, for Each Cohort Year, Program Needs Survey, 1991-1994

Measure of fall status	1991 Sample (n=87)	1992 Sample (n=118)	1993 Sample (n=125)	Combined Sample (n=330)
Non-faller/One-Time Faller				
no falls or 1 fall	95.4 (83)	97.5 (115)	92.8 (116)	95.2 (314)
Multiple Faller				
2+ falls	4.6 (4)	2.5 (3)	7.2 (9)	4.8 (16)

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

Note: probability levels are indicative of the level of significance for Chi Square analysis between the three cohort years for the independent variables

Note: the independent variables were used to predict fall status within the subsequent year. For example, baseline measures for the 1991 sample were used to predict fall status in 1992, baseline measures for the 1992 sample were used to predict fall status in 1993, and baseline measures for the 1993 sample were used to predict fall status in 1994

Table 5.10: Percentage (Frequency) Distributions for Non-Fallers and Fallers, by Gender, Program Needs Survey, 1991-1994

Measure of fall status	Males	Females	Combined Sample
Non-faller/One-time Faller			
no falls or 1 fall	95.7 (90)	94.9 (224)	95.2 (314)
Multiple Faller			
2+ falls	4.3 (4)	5.1 (12)	4.8 (16)

* p<0.05   ** p<0.01   *** p<0.001

Note: probability levels are indicative of the level of significance for Chi Square analysis between males and females for the independent variables

Note: Individuals that had not fallen by the end of the year, or had died before experiencing a fall, were coded as non-fallers (censored observations)

Table 5.11: Unadjusted Risk Ratios (95% Confidence Intervals) for Risk of Time-to-First-Fall, by Socio-demographic, Social Support and Health Measures, Program Needs Survey, 1991-1994.

Measures	Males	Females	Total
Age	0.89 (0.46, 1.69)	1.19 (0.72, 1.99)	1.13 (0.76, 1.67)
Gender			
male	not applicable	not applicable	1.00
female			0.54 (0.29, 1.01) **
Marital status			
married	1.00	1.00	1.00
single	0.48 (0.06, 3.81)	3.04 (0.74,12.44)	1.38 (0.49, 3.93)
widowed	1.68 (0.61, 4.66)	1.23 (0.41, 3.70)	0.97 (0.48, 1.97)
separated	0.69 (0.09, 5.46)	1.16 (0.13,10.44)	0.83 (0.18, 3.74)
Use of Psychotherapeutics			
non-use	1.00	1.00	1.00
use	1.27 (0.49, 3.32)	1.85 (0.85, 4.07)	1.69 (0.92, 3.09) *
Use of Sedatives			
non-use	1.00	1.00	1.00
use	0.99 (0.38, 2.59)	1.15 (0.53, 2.52)	1.11 (0.61, 2.05)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.0001$

Table 5.12: Unadjusted Risk Ratios (95% Confidence Intervals) for Risk of Time-to-First-Fall, by Measures of Frailty, Program Needs Survey, 1991-1994.

Measures	Males	Females	Total
Health Change			
no change	1.00	1.00	1.00
change	1.64 (0.58, 4.61)	3.61 (1.64, 7.88) ***	2.67 (1.42, 4.99) **
Mental Status			
no impairment	1.00	1.00	1.00
mild/moderate impairment	0.58 (0.12, 2.74)	1.03 (0.29, 3.68)	0.90 (0.34, 2.41)
moderate/severe impairment	0.64 (0.13, 3.06)	0.89 (0.24, 3.30)	0.85 (0.31, 2.32)
Dementia			
no dementia	1.00	1.00	1.00
have dementia	1.38 (0.53, 3.60)	0.87 (0.37, 2.02)	1.04 (0.56, 1.95)
CHD			
no CHD	1.00	1.00	1.00
have CHD	1.34 (0.48, 3.81)	2.57 (1.12, 5.83) **	2.07 (1.09, 3.96) **
Stroke			
no stroke	1.00	1.00	1.00
had stroke	1.00 (0.38, 2.61)	1.55 (0.70, 3.47)	1.44 (0.78, 2.63)
Diabetes			
no diabetes	1.00	1.00	1.00
have diabetes	0.34 (0.05, 2.56)	2.55 (1.02, 6.43) **	1.45 (0.64, 3.30)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.0001$

Table 5.13: Unadjusted Risk Ratios (95% Confidence Intervals) for Risk of Time-to-First-Fall, by Measures of Balance and Stability, Program Needs Survey, 1991-1994.

Measures	Males	Females	Total
Co-ordination			
no impairment	1.00	1.00	1.00
impairment	0.55 (0.18, 1.68)	0.53 (0.22, 1.27)	0.54 (0.27, 1.08)
Balance			
no impairment	1.00	1.00	1.00
impairment	0.86 (0.28, 2.63)	1.24 (0.42, 3.63)	1.02 (0.47, 2.23)
Mobility			
non-ambulatory	1.00	1.00	1.00
wheelchair	1.34 (0.30, 5.93)	7.85 (1.04,59.07) **	3.65 (1.11,12.13) **
walks independently	6.52 (1.08,39.77) **	23.10 (2.62,203.49) ***	12.56 (3.31,47.60) ¥
Transferring Ability			
mechanical lifter	1.00	1.00	1.00
needs assistance	1.87 (0.66, 5.31)	1.81 (0.79, 4.11)	1.81 (0.94, 3.44) *
transfers independently	6.74 (1.71,26.63) **	5.51 (1.22,25.01) **	6.33 (2.34,17.28) ¥

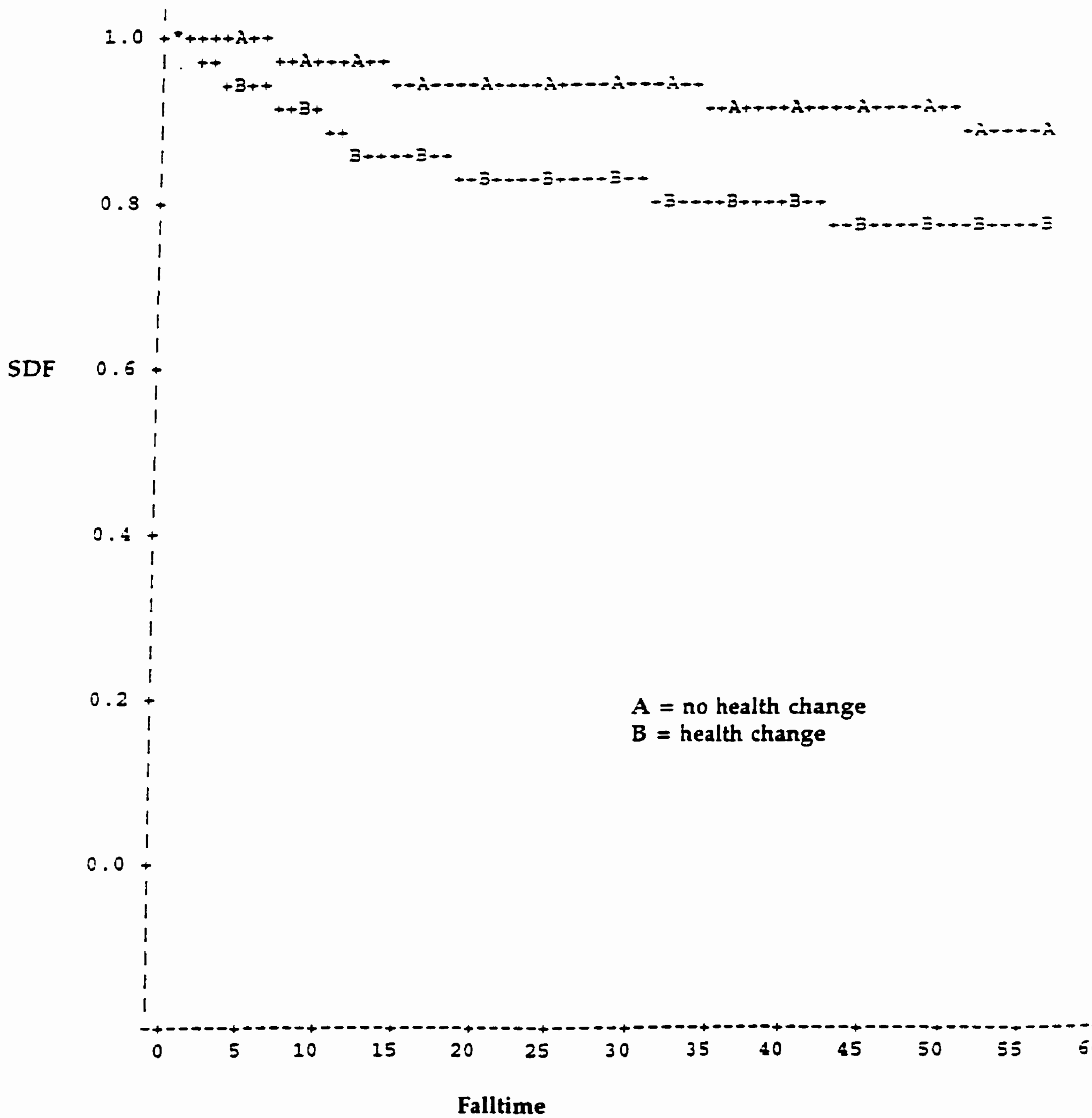
* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.0001$

Table 5.14: Survival Analysis Model for Time-To-First-Fall for Seniors within an Institutional Setting, Program Needs Survey, 1991-1994.

Independent Measures	Parameter Estimate	Standard Error	Relative Risk	95% Confidence Intervals
Health Change				
no change	0.00		1.00	
change	0.87 ***	0.32	2.39	1.27, 4.47
Use of Psychotherapeutics				
no use	0.00		1.00	
use	0.73 **	0.33	2.07	1.09, 3.96
CHD				
no CHD	0.00		1.00	
CHD	0.66 **	0.34	1.93	0.99, 3.77
Mobility				
nonambulatory	0.00		1.00	
wheelchair	1.34 **	0.61	3.81	1.16,12.62
walks independently	2.13 ***	0.75	8.40	1.93,36.60
Transferring Ability				
mechanical lift	0.00		1.00	
needs assistance	0.39	0.34	1.47	0.76, 2.88
transfers independently	1.07 *	0.59	2.90	0.92, 9.27

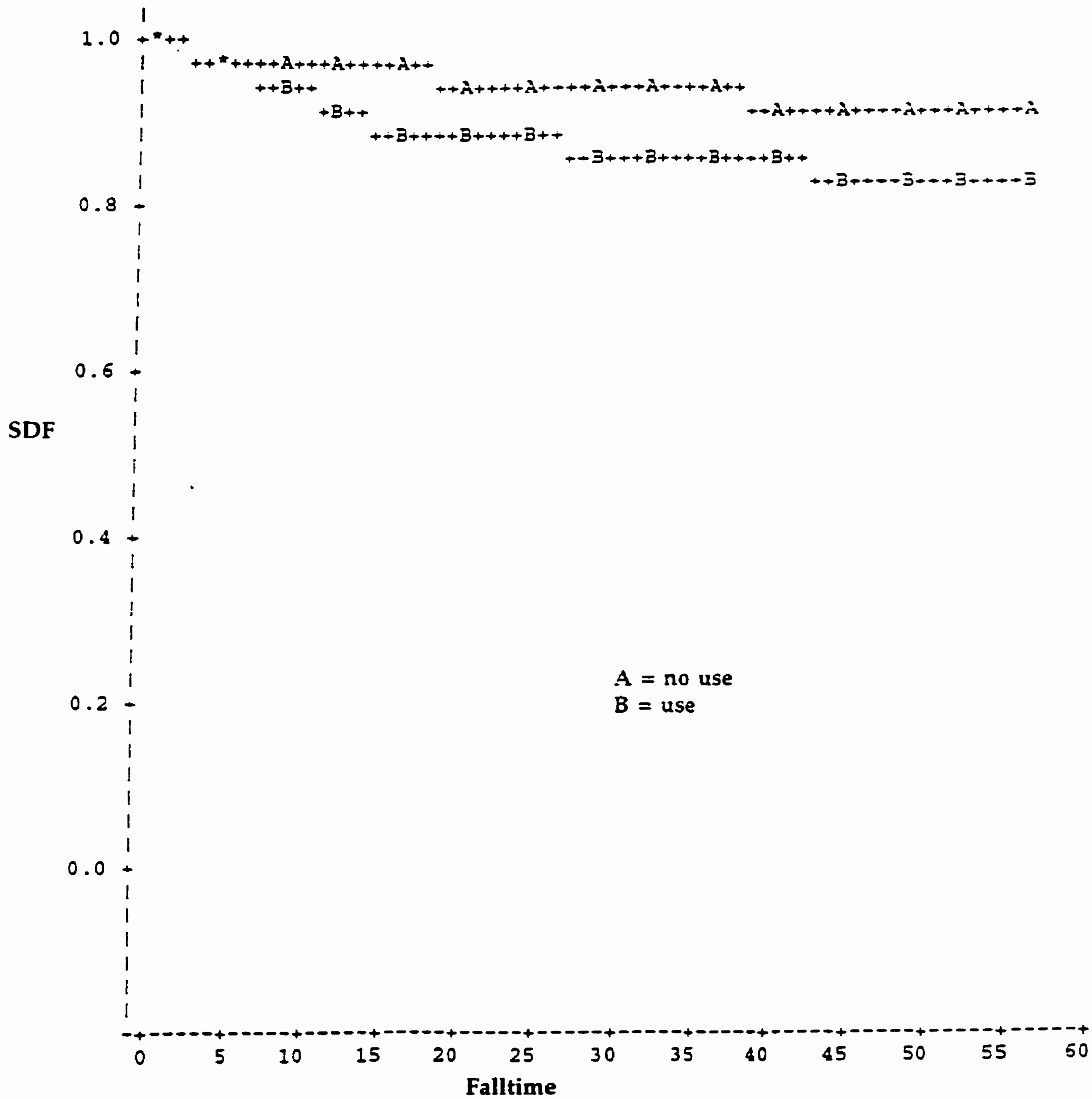
* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

Figure 5.1: Survival Function Estimates for Time-to-First-Fall, by Health Change Status



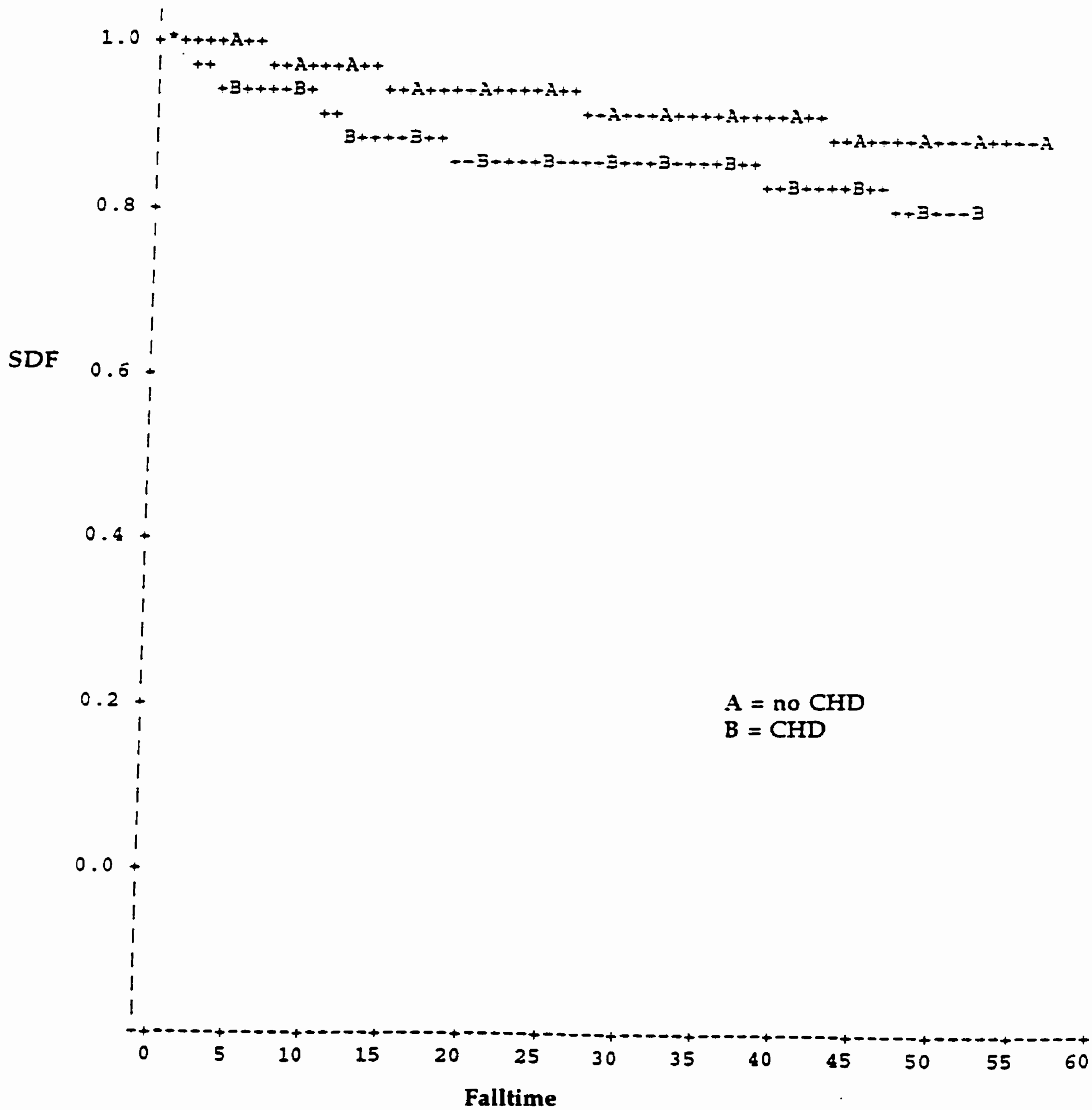
(Note: SDF = Survival Distribution Function)

Figure 5.2: **Survival Function Estimates for Time-to-First-Fall, by Psychotherapeutic Use Status**



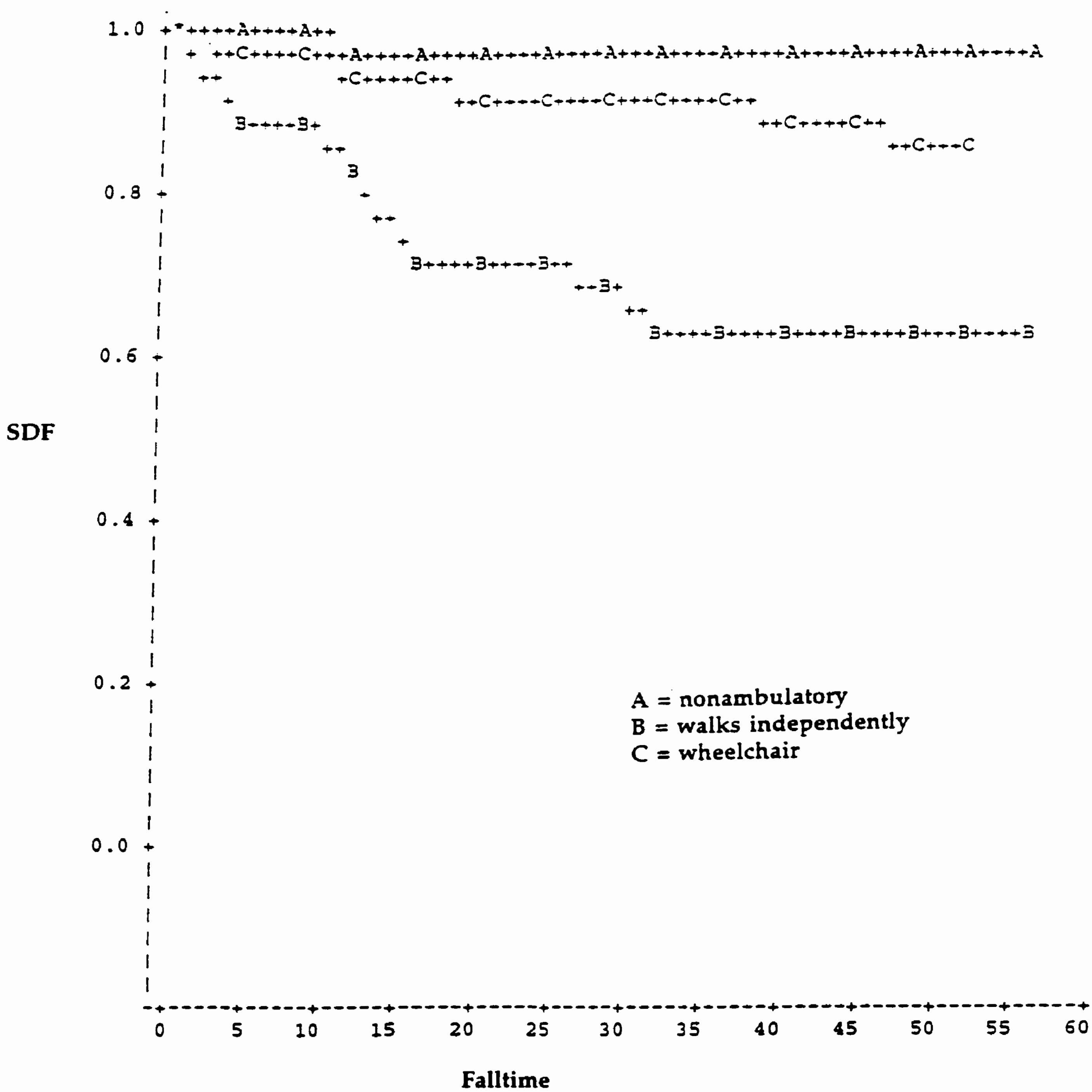
(Note: SDF = Survival Distribution Function)

Figure 5.3: **Survival Function Estimates for Time-to-First-Fall, by CHD Status**



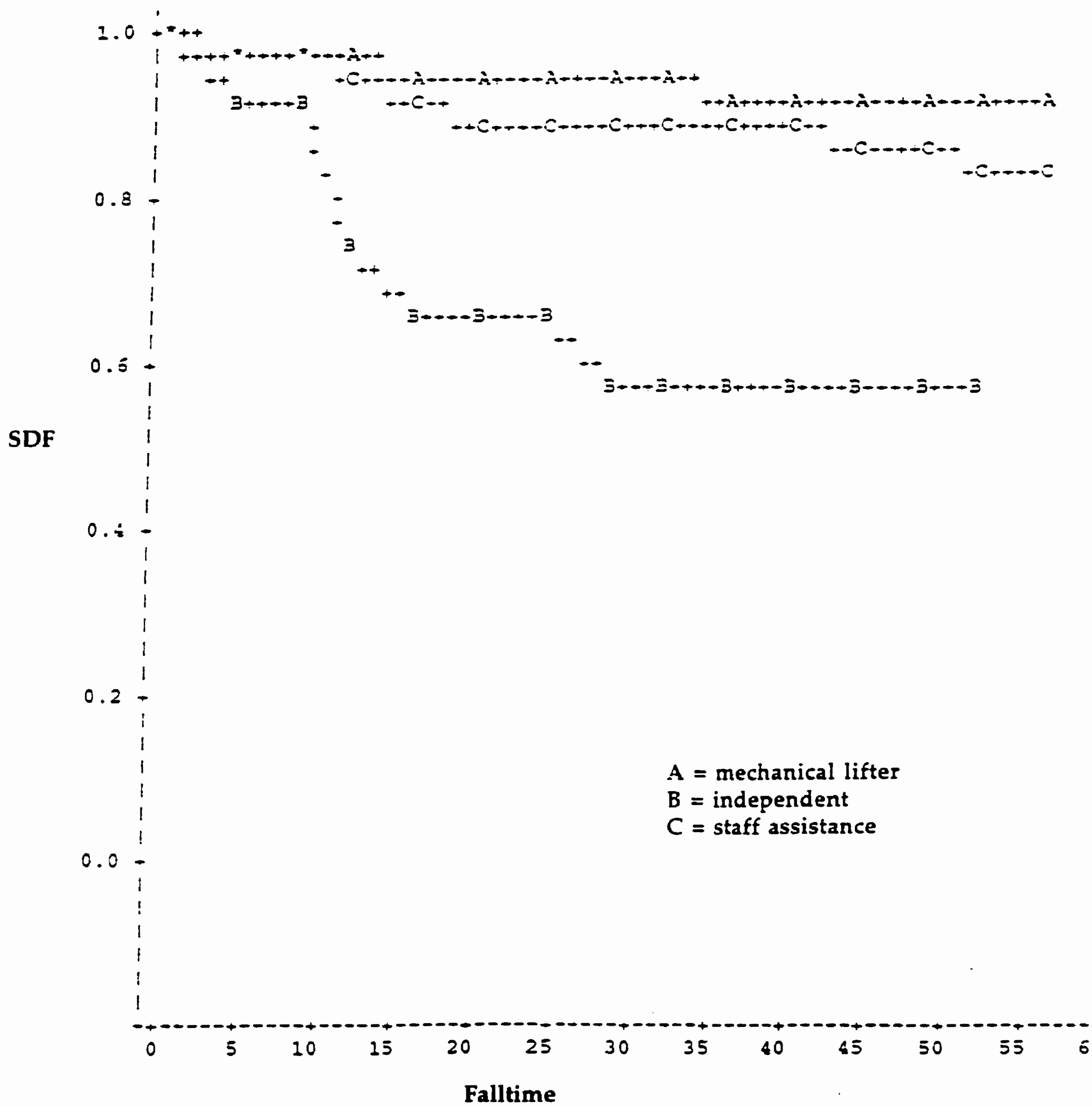
(Note: SDF = Survival Distribution Function)

Figure 5.4: **Survival Function Estimates for Time-to-First-Fall, by Mobility Status**



(Note: SDF = Survival Distribution Function)

Figure 5.5: Survival Function Estimates for Time-to-First-Fall, by Transfer Ability Status



(Note: SDF = Survival Distribution Function)

Table 5.15: Unadjusted Risk Ratios (95% Confidence Intervals) for Risk of Time-to-Second-Fall, by Socio-demographic, Social Support and Health Measures, Program Needs Survey, 1991-1994.

Measures	Total Sample
Age	1.20 (0.65, 2.26)
Gender	
male	1.00
female	1.16 (0.37, 3.62)
Marital status	
married	1.00
single	1.59 (0.29, 8.80)
widowed	1.12 (0.34, 3.62)
separated	1.20 (0.13,10.75)
Use of Psychotherapeutics	
non-use	1.00
use	1.21 (0.45, 3.22)
Use of Sedatives	
non-use	1.00
use	1.24 (0.47, 3.32)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.0001$

Table 5.16: Unadjusted Risk Ratios (95% Confidence Intervals) for Risk of Time-to-Second-Fall, by Measures of Frailty, Program Needs Survey, 1991-1994.

Measures	Total
Health Change	
no change	1.00
change	4.00 (1.51,10.70) ***
Mental Status	
no impairment	1.00
mild/moderate impairment	1.83 (0.23,14.55)
moderate/severe impairment	1.88 (0.23,15.29)
Dementia	
no dementia	1.00
have dementia	1.40 (0.53, 3.74)
CHD	
no CHD	1.00
have CHD	1.80 (0.63, 5.20)
Stroke	
no stroke	1.00
had stroke	1.66 (0.62, 4.39)
Diabetes	
no diabetes	1.00
have diabetes	0.47 (0.06, 3.52)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.0001$

Table 5.17: Unadjusted Risk Ratios (95% Confidence Intervals) for Risk of Time-to-Second-Fall, by Measures of Balance and Stability, Program Needs Survey, 1991-1994.

Measures	Total
Co-ordination	
no impairment	1.00
impairment	0.55 (0.18, 1.73)
Balance	
no impairment	1.00
impairment	0.50 (0.17, 1.43)
Mobility	
non-ambulatory	1.00
wheelchair	3.05 (0.39,24.00)
walks independently	29.15 (3.50,241.48) ***
Transferring Ability	
mechanical lifter	1.00
needs assistance	3.44 (1.05,11.42) *
transfers independently	20.66 (5.15,83.42) ¥

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.0001$

Table 5.18: Survival Analysis Model for Time-To-Second-Fall for Seniors within an Institutional Setting, Program Needs Survey, 1991-1994.

Independent Measures	Parameter Estimate	Standard Error	Relative Risk	95% Confidence Intervals
Health Change				
no change	0.00		1.00	
change	1.14 **	0.52	3.12	1.13, 8.66
Mobility				
nonambulatory	0.00		1.00	
wheelchair	1.10	1.06	3.00	0.38, 23.99
walks independently	2.54 **	1.16	12.72	1.31,123.17
Transferring Ability				
mechanical lift	0.00		1.00	
needs assistance	0.87	0.64	2.39	0.68, 8.37
transfers independently	1.66 *	0.88	5.27	0.94,29.51

* p<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

5.3: Summary Discussion for Data from the Grand River Hospital: Freeport Health Centre

5.3.1: Interpretation of Results

The two final survival analysis models for time-to-first-fall and time-to-second-fall reveal that several parallels exist, regardless of the outcome variable. Results and similar propensities that endure across the models will be emphasized within the following section.

Experiencing a change in health was associated with risk of falling in both of the final models. This change referred to a decline in the health status of the patient. Evidence has shown that poor health (as measured by activity limitations, presence of medical conditions) (see, for example, Gross et al., 1990; Kalchthaler et al., 1978; Myers et al., 1991) has been implicated as a risk factor for falling within elderly populations. Further, Brody et al. (1984) reported that women with Alzheimer's Disease that experienced declines in "physical vigor" were at greatest risk of falling, as compared to those with stable levels of vigor.

The use of psychotherapeutics was associated with an increased risk of falling in the final survival model for time-to-first fall. Psychotherapeutics (anti-depressants and tranquilizers), may have a number of unintended effects, including blurred vision, and sedative or hypotensive effects that increase the risk of falling (Campbell et al., 1991; Granek et al., 1987; Ray et al., 1990; Sorock, 1988). The use of these drugs may represent underlying disease (i.e., depression) which in and of itself increases risk (Sorock, 1988). These effects, combined with the changes that are associated with aging (i.e., increased ratio of body fat to lean tissue, decreased baroreceptor sensitivity) which affect the body's response to drugs, may further increase fall risk. A study by Granek et al. (1987) revealed that the odds of being a faller were increased for individuals taking antidepressants (O.R.=2.9; p=0.002) or tranquilizers (O.R.=1.8; p=0.45). Other medications (i.e., sedatives, hypnotics, vasodilators) were also found to be associated with risk of falling, in addition to medication combinations (two plus medications) and various medical diagnoses (Granek et al., 1987), although not confirmed within the present study. Further, through multivariate analysis Ruthazer and Lipsitz (1993) found that the risk of falling was increased for women that had a history of falling and were taking antidepressants; however, use of benzodiazepines and antipsychotics were not found to be significant predictors of fall risk for women, while none of the medications were significant risk factors for males. For future endeavours, the risk attributed to other medications (i.e., diuretics, cardiac medications) and synergistic medications, and the effects that various medical conditions have on medications and falls, warrants further investigation, given the limited evidence that is available for institutional settings.

Risk of one-time falls was associated with the presence of coronary heart disease, which included hypertension, myocardial infarction, atherosclerotic heart disease, and congestive heart disease. Gross et al. (1990) and Sobel and McCart (1983) note that higher percentages of fallers within their studies were diagnosed with some form of coronary heart disease; however, vigorous statistical analyses were lacking in these results. In a case-control study exploring the associations between falls, drugs and diagnoses in seniors in long-term care facilities, Granek et al. (1987) reported that congestive heart failure, arteriosclerotic cardiovascular disease, and hypertension were not associated at the 0.10 level with an increased risk of falling. However, they contend that their results suggest that falling is generally associated more with specific drugs, rather than the diagnoses for which the medications have been prescribed. Therefore, although coronary heart disease in and of itself may increase risk of falling, examination of cardiac medications, which may be attributable to risk of falling, is warranted.

The results for mobility status reveal that individuals that used wheelchairs or were able to walk independently were at risk of experiencing falls as compared to nonambulatory seniors. Wheelchair use was significantly associated with risk of one-time falls, while independent mobility was significantly associated with risk of one-time and multiple falls. Gross et al. (1990) found that of the forty falls that occurred, a wheelchair was being used as an assistive device in 70% of the cases. Wheelchair-bound individuals were not involved in any of the repeated falls in this study. Similar findings from Kalchthaler et al. (1978) support the contention that wheelchair-bound individuals face the greatest risk of falling, while individuals with assistive devices (i.e., walkers, canes, crutches) experienced fewer falls. Assistive devices may be able to stabilize gait disorders in seniors, by increasing proprioception and co-ordination, and improving unstable gait through weight redistribution (Kalchthaler et al., 1978). Unfortunately, multivariate analysis was not completed on either data set, and thus failed to account for other factors involved with falling. Conversely, Myers et al. (1991) reported that ambulatory (walk independently or with assistance) seniors were 3.5 times more likely to fall than nonambulatory (bed or wheelchair-bound) seniors. Similarly, Friedman et al. (1995) found that ambulatory or wheelchair-mobile seniors had a significant risk of falling; however, this study was designed to examine the change in fall rates after relocation of seniors from one facility to another and may not be applicable to this type of setting. Thus, it would appear that in all of these cases that being mobile increased exposure to risk for fall events.

Independent transfers were also associated with an increased risk of falling one time or multiple times. Pablo (1977) suggested that seniors may want to assert their independence, and thus increase their exposure to various hazards (i.e., falls) by completing certain activities on their own; however, given the lack of multivariate analyses within the literature concerning risk of falling and transfers, further work is required.

The recurrent theme of mobility and transferring ability within the models for one-time fallers and multiple fallers necessitates further discussion. Low risk of falling for nonambulatory seniors and individuals requiring assistance during transfers may actually be indicative of higher levels of impairment, and potentially a lower quality of life. Conversely, ambulatory seniors and those that complete transfers on their own, may be more independent, and more able to participate in life (i.e., social activities) at the facility. The question then arises is whether quality of life or risk of falling is more important? For example, if a facility deemed that the risk of falling for "ambulatory seniors" would be reduced through the use of restraints (i.e., chair restraints), quality of life may be compromised in the process. Thus, future work should determine the precise association between these factors in order to balance the relationship between risk of falling and quality of life for the institutionalized.

5.3.2: Implications for Future Research

The majority of the risk factors for one-time fallers and multiple fallers identified here coincide with past research for institutionalized seniors. Use of psychotherapeutics (see for example, Granek et al., 1987; Ruthazer & Lipsitz, 1993), coronary heart disease (Granek et al., 1987; Gross et al., 1990; Sobel & McCart, 1983), and ambulatory or seniors within wheelchairs (Myers et al., 1991; Friedman et al., 1995) were implicated as risk factors in research previous completed. However, the use of longitudinal studies that include multidisciplinary frameworks, involving thorough medication information is needed. Identifying specific medications and medication classes may be one of the modifiable risk factors in managing falls among the institutionalized. Implementing a more comprehensive assessment tool such as the Minimum Data Set or MDS (see, for example, Hawes et al., 1995; Morris et al.,, 1995) which has been mandated for use in chronic care hospitals within Ontario (Hirdes et al., 1996), would aid in the collection of data longitudinally and at different sites to allow for comparison between facilities. Additionally, the completion of balance tests, rather than nurses proxies of balance control, may aid in better understanding of falls among seniors. Also the inclusion of more facilities, and the resulting increase in the number of patients utilized for analysis purposes, would improve the confidence in the results and the generalizability to other settings.

6.0 METHODOLOGY FOR THE DEVELOPMENT AND TESTING OF DIFFERENT FALL PREVENTION PROGRAMS: PILOT STUDY, 1995-1996.

Hornbrook et al. (1994) note that despite expectations that falls can be prevented, by targeting identified risk factors, few fall prevention studies have been conducted to date. The research that has been published generally shows less than favourable results (see, for example, Craven & Bruno, 1986; Reinsch et al., 1992), perhaps because of inadequate evaluations, or interventions that approach the problem of falls from only one perspective. Given that falls is a multifactorial problem, an intervention program must approach prevention from many angles. Thus, the objectives of this research study were twofold: to develop and test prevention programs for falls that include different components (e.g., balance, education); and (2) to identify the main risk factors for falls in a sample of frail seniors, so that the prevention programs could be modified to fit their need.

6.1 Explanation of Falls Intervention Program

With the understanding that fall prevention must be approached through a multidimensional approach, a falls education program (see Appendix 4) and two exercise programs (see Appendix 5), were developed for evaluation in a pilot study. The falls education component, designed to educate seniors about the importance of falls within elderly populations, specifically focussed on the risk factors for falls and modification of common environmental hazards. This segment was devised with the intent of group participation and group discussion.

Neuromuscular functioning, gait and balance control deteriorate with age, and are further compromised by inactivity. These changes are among the main contributors to falls and instability with elderly populations (Kane et al., 1989; Sharrattt et al., 1992). Therefore, the primary focus of the exercise classes was to counteract the effects of the aging body by increasing balance control; however, strength and flexibility components were also included in the exercise regimens. Given that balance and instability is such a crucial component to this intervention, an explanation of the systems controlling balance and stability is provided in Appendix 6. The first exercise program was conducted within a gymnasium-like setting, while the second required the use of an aquatic pool. Although the programs were based on the same premise, it was expected that conducting classes in the water may decrease the occurrence of falls or other injuries during exercise participation. However, the sample size available here is too small to compare the gymnasium and pool samples.

Three groups were formed for the intervention program, namely, (1) a control group that participated in the falls education program, and also received a general health education program (included information on nutrition, medication, stress and the importance of health), (2) an experimental group that received the falls education program and participated in the balance control exercise program within the gymnasium, and (3) a second experimental group that received the falls education program and participated in the balance control exercise program within the water. The falls education program was conducted on-site at each facility for two 1 1/2 hour classes. The balance control exercise classes were conducted independently and on-site two times per week for approximately 45 minutes per class session. The two hour general health program was conducted by Living Younger, a seniors organization that provides wellness programs for elderly within the Kitchener-Waterloo Region.

6.2: Subject Recruitment and Selection

Community-based individuals over the age of 65 living in retirement homes in the Kitchener-Waterloo were targeted for this intervention. Five retirement homes were selected to participate in the program, with the intent of implementing all programs in-house. Four of the retirement homes were selected from the homes within the K-W area; however, one of the homes was specifically selected, as it was the only facility with a pool on-site. Therefore, the sample used for this pilot study is one of convenience, and cannot be considered a random sample. With the remaining four groups, two were assigned to the experimental group that completed exercise classes within the gymnasium, while the remaining two groups were assigned to the control group. Subject recruitment and program implementation was undertaken with the assistance of the retirement home activity directors. In order to introduce the program to the seniors, introductory presentations were conducted at each of the sites. Sign-up sheets were also posted on the information boards within the retirement homes. Prior to participation within the intervention program, signed consent forms from every participant (see Appendix 7) and medical recommendation from physicians (see Appendix 8) for participants in the exercise programs were completed.

6.3: Measures

The information that was collected (see Appendix 9) for the intervention program was divided into the categories: (1) socio-demographics; (2) health practice variables, (3) social relationship measures, (4) variables associated with frailty, (5) exposure to risk variables, (6) measures with respect to balance and stability/ measures of physical strength, and (7) information pertaining to falls. The wording of the majority of these inquiries were based on questions posed by the Canada Fitness Survey, the National Alcohol and Drug Survey, and the Survey on Ageing and Independence, all of which are national surveys designed by Statistics Canada. Each of these categories of variables will be addressed in turn.

6.3.1: Socio-Demographic Variables

Age, gender, educational attainment, and lifetime occupation were the socio-demographic variables collected.

Age

Participants were asked to provide their date of birth, and age was subsequently calculated based on this information. In order to be consistent with analyses of the SAI, the following ranges: 65 to 70, 70 to 74; 75 to 79, and 80 and over. Dummy variables were used, with the lowest category (65 to 69) utilized as the reference group.

Gender

Gender was coded into the binary variable males (0) and females (1), with males used as the reference category during statistical analysis.

Education

Responses to the question, "What is the highest level of education that you have attained: elementary or less, some secondary schooling, a secondary diploma, some post-secondary education, community college, or one or more university degrees?", was subsequently recoded utilizing dummy-coding. The resulting categories included (1) an elementary education or less/some secondary schooling, (2) a secondary diploma or some post-secondary education, and (3) a community college degree or one or more university degrees. For data analysis purposes, the lowest educational attainment category was used as the reference group.

Life-time Occupation

Participants were asked to report their life-time occupations, naming up to three occupations if applicable. Lifetime occupation was subsequently classified into the following categories: professional (e.g., librarian, teacher, occupational therapist), managerial (e.g., marketing, head of financial department, store manager), service industry (e.g., secretary hairdresser, clerk waitress), trade (e.g., mechanic), homemaker, never worked, armed services, unskilled labourer (e.g., cleaning lady, housekeeper), and other. Upon analysis of the lifetime occupation information, the data were recoded into: (1) professionals/managerial positions; (2) homemakers; (3) service providers/unskilled labourers. The first category, professionals/managerial positions, was used as the reference group.

6.3.2: Health Practice Variables

The health practice variables consisted of information pertaining to alcohol consumption patterns, smoking status, rest and sleep patterns, and medication use.

Alcohol Consumption

For the question, "Which of the following describes your experience with alcohol (beer or wine or liquor) the best: I never drink alcohol, I drink alcohol less than once a week, I drink ____ servings of alcohol per day, or I drink ____ servings of alcohol per week?", the following dummy variables were formed: (1) never drink, (2) drink less than once a week, and (3) drink ____ servings of alcohol per day/week. The first category was used as the reference group during analysis.

Smoking Status

For smoking status, individuals were posed, "Which of the following describes your experience with tobacco: I have never smoked, I stopped smoking cigarettes/cigars ____ months/years ago, I smoke cigarettes/cigars occasionally, or I smoke _____ cigarettes/cigars per day?". Responses were dummy-coded to form the categories non-smoker, former smoker, and current smoker, with non-smokers as the reference group.

Rest and Sleep Patterns

Individuals were posed the following questions pertaining to sleep, "How long do you usually spend sleeping each night?", "Do you regularly have trouble going to sleep?", and "Do you regularly have trouble staying asleep?". For data analysis, responses to the first question were left continuous, with responses from questions two and three each coded into the binary variable "no trouble" (0) and "trouble" (1) going or staying asleep, respectively. "No trouble" was used as the reference variable.

Medication Use

To obtain information pertaining to medication use, the following question was posed, "Are you currently taking any of the following medications: aspirin or similar pain relievers, tranquilizers, diet pills or stimulants, anti-depressants, codeine/demoral/morphine, medications for the heart or blood pressure, cough or cold remedies, penicillin or similar antibiotics, allergy medicine, insulin or similar diabetic medicine, sleeping pills, diuretics, or vitamins?". Each of the specific medications was coded into the binary variable "used medication" (0) or "did not use medication" (1), with non-use coded as the reference category. Further, a count of psychotropic medications (analgesics, anticonvulsants, tranquilizers, sleeping pills, antidepressants, and antimanic medications) and a count of total medication use taken were derived from the medication information, and left as continuous variables during analysis.

6.3.3: Social Support

For measures of social support, information was collected pertaining to marital status, support of family and support of friends.

Marital Status

Responses to the question, "What is your marital status?", were classified into the categories married (0), widowed (1), divorced/separated (2), and single (3). Being married was used as the reference group for a dummy variable on marital status.

Family Support

With respect to family support, responses to the question, "Do you have any family members that you feel close to, and that you can talk about any private issues, or that you can call if you are in need of assistance?", were coded into the binary variable "no support" (0) and "support" (1). The reference variable for this measure was "no support" of family.

Friend Support

As with family support the question, "Do you have any friends that you feel close to, and that you can talk about any private issues, or that you can call if you are in need of assistance?", was used. The responses were coded into the binary variable "no support" (0) and "support" (1). The reference variable for this measure was "no support" of friends.

6.3.4: Measures of Frailty

Information pertaining to frailty consisted of perceived health, a previous history of falls, a history of injuries in or away from the home, a measure of affect (SHARP), medical diagnosis, adequate vision, and nocturia.

Perceived Health

Individuals were asked to report whether they perceived their general state of health to be excellent, good, fair, or poor. Responses to the question were collapsed into excellent/good health (0) and fair/poor health (1), with excellent/good health used as the reference group.

History of Falls

Responses to the question, "How often would you say you have fallen within the past year?", were coded into the categories no falls (0), and fell one or more times (1). Not falling was used as the reference variable.

Internal Injuries

Responses to the question, "In the past 12 months, were you injured in an accident around your home?", were coded into the binary variable did not experience an injury (0) and did experience an injury (1). Not experiencing an injury was used as the reference variable.

External Injuries

Similarly, responses to the question, "In the past 12 months, were you injured in an accident away from your home?", were also coded into the binary variable did not experience an injury (0) and did experience an injury (1). The reference variable used was that of not experiencing an injury.

Short Happiness and Affect Research Protocol (SHARP)

The SHARP questionnaire (Short Happiness and Affect Research Protocol) (Appendix 10) is a shortened version of the Memorial University of Newfoundland Scale of Happiness (MUNSH) (Kozma & Stones, 1980). Kozma et al. (1985) developed the 24-item MUNSH scale to measure mental health among seniors with a full continuum from happiness to (subclinical) depression; however, this measure was also found to be a valid measure of affect. The SHARP was subsequently developed, and tested for validity and reliability on a number of sample subjects. This newly developed scale is comprised of 12 items from the MUNSH and has similar psychometric properties as the MUNSH. Specifically, this measure has the same balance between positive and negative, short-term and long-term affect items as the MUNSH. The SHARP was chosen over the MUNSH because of its brevity, and its validity and reliability. The SHARP consists of a 12 point scale, with higher scores indicative of higher levels of happiness (Stones et al., 1996). For the purpose of this analysis, the SHARP was entered as a continuous variable.

Medical Diagnosis

Participants were asked whether or not they had been diagnosed with the following conditions in the last six months: osteoporosis, asthma, persistent back pain, arthritis or rheumatism, high blood pressure, circulation problems, heart disease, diabetes, urinary or kidney problems, digestive problems, goiter or thyroid problems, or eye problems (i.e., cataracts, glaucoma). For each of the medical conditions, responses were coded into absence of the condition (0) or presence of the condition (1). Individuals were also asked whether or not they had another other conditions not mentioned. These conditions were coded in a similar manner where applicable. Further, a count of the total number of medical conditions participants reported was calculated, and entered into the analysis as a continuous variable.

Vision Adequacy

Participants were asked whether they were able to see well enough with glasses or contact lenses (if needed) to recognize a friend on the other side of the street. Responses were dichotomized to form the binary responses "cannot see well enough" (0) and "can see well enough" (1), with the first category as the reference group.

Nocturia

Responses to the question, "How many times a night do you get up to go to the bathroom?" were coded to form the categories: 0 times (0), 1 time (1), 2 to 4 times (2), 5 or more times (3)?". The response "0 times" was used as the reference group dummy variable within the analysis.

6.3.5: Exposure to Risk

Activity level compared to other individuals of the same age was the only exposure to risk variable used for this analysis.

Activity Level Compared to Others

Responses to the question, "Compared to other people your age, would you say that you are physically more active, as active, or less active?", were dummy-coded into three categories, with more active as the reference group.

6.3.6: Balance and Stability

Two measures of balance and a measure of balance confidence were the balance and stability measures used.

Balance Measure: Tinetti's Functional Mobility Assessment

The first measure of balance was Tinetti's Functional Mobility Assessment (1986) (Appendix 11). Three prospective studies have found that poor performance in this index predicts increased risk of future falls among seniors (Robbins et al., 1989; Tinetti et al, 1986; Tinetti et al., 1988). Tinetti and Ginter (1988) found an association between neuromuscular findings and the ability to perform specific mobility maneuvers. They further contended that several of the standard neuromuscular tests were not able to indicate dysfunctions in tasks of daily mobility, given that the examinations were developed to identify pathological lesions, and not functional capacity. Further, they purported that their measure was more applicable in measuring balance, since the ability to change position, balance and walk is not merely the sum of individual muscular components, but rather the integration of multiple neuromuscular components and the accumulated effects of compensatory mechanisms, habits and psychological factors. Additionally, environmental factors (e.g., chair height, floor surface, footwear) also influence performance in mobility and have not been standard components of a neuromuscular examination (Tinetti & Ginter, 1988).

This 13-item scale contains maneuvers which are sometimes graded dichotomously (can or cannot perform), while other items are scored 0, 1, or 2 to denote the quality of performance (Tinetti, 1986). The total score ranges from 0 to 24 points, with higher scores indicative of higher levels of balance. Inter-rater reliability was found to be between 85% and 90% for a nurse and physician. (Tinetti et al., 1986). This measure of balance was chosen as it required little equipment, could be easily administered to seniors, was found to be a reliable measure, and reflected the changes in positions and various gait maneuvers that have been associated with normal activities of daily living (Tinetti, 1986). For the purposes of this analysis, the Tinetti measure of balance was left as a continuous variable.

Balance Measure: Podsiadlo and Richardson's timed "UP & GO" Test

The second balance measure that was employed was Podsiadlo and Richardson's (1991) timed "UP & GO" Test. For this test, subjects are observed and timed while performing the following: rising from an arm chair, walking 3 metres, turning around, and walking back to the chair and sitting down. Prior research indicated that the timed score was (1) reliable (inter-rater and intra-rater); (2) correlated well with the log-transformed scores on the following mobility measures: (a) Berg Balance Scale (r=-0.81), gait speed (r=-0.61), and Barthel Index of ADL (r=-0.78); and (3) appeared to predict the patient's ability to go outside alone safely (Podsiadlo & Richardson, 1991). This test was also chosen because it has been found to be a reliable and valid test for quantifying functional mobility. Further, Podsiadlo & Richardson (1991) have contended that it is useful in following clinical change over time, and does not require special equipment or training. Scores for the Up & Go test were left continuous for this analysis.

Powell and Myers' Activities-specific Balance Confidence Scale

The Activities-specific Balance Confidence (ABC) Scale (see Appendix 12) (Powell & Myers, 1995) was used to assess the balance confidence of the seniors. This 16 item scale can be self-administered, administered over the telephone, or in person. The instrument was developed to classify individuals as possessing high or low mobility confidence according to their perceived need for a walking aid and personal assistance to ambulate outdoors. Respondents are asked to rate items using whole numbers (from 0 to 100). To obtain each subject's ABC score, the ratings for the items are totalled (possible range = 0 to 1600) and then divided by 16. The ABC scale has been shown to be internally consistent and has demonstrated good test-retest reliability, convergent and criterion validity.

6.3.7: Muscular Strength Measure

Hand strength was the only measure of muscular strength assessed for this analysis.

Hand Strength

Hand grip strength has been found to correlate well with general muscle strength (Blake et al., 1988), and is believed to reflect the ability to maintain stability and balance of the body. Although not the measure of choice, this measure of muscular strength was chosen because assessment did not require complicated equipment (use of a hand dynamometer) and the test itself was easy to administer. Scores for hand strength were left continuous for the analysis.

6.3.8: Information Pertaining to Falls

Information on falls was collected in the form of a weekly diary (Appendix 13) that subjects completed with the assistance of the activity director and/or an undergraduate student that was working for the author. The information that was collected included whether a fall had occurred that week, the circumstances around the fall situation (i.e., day of fall, time fall occurred, location of fall), and whether or not an injury was sustained during the fall. Further, other information collected consisted of perceived health during the week, whether or not the individual was happy or unhappy, and the participant's ability to remember things during the week. The latter information was collected in order to determine whether or not the individual's falls may have been the result of poor health (from question 1: for example, bout of illness during the week in question), depression or unhappiness (from question 2), or absent-mindedness (from question 3). All participants were asked to submit their diaries at the conclusion of each diary week. The activity director and undergraduate student aided in diary collection, so that all of the diaries were handed in within a few days after each completed diary week. All falls that occurred were cross-checked with the incident reports at the retirement homes, and with staff, spouses and/or friends of the person in question.

Given that the issue of defining a fall is a major point of contention within the falls literature, a substantial portion of this literature was reviewed before determining the definition to be used for this study. The definition that was decided upon was the following, as adapted from the ongoing research work of Edwards et al. (unpublished paper) from the University of Ottawa: "a fall is an event which results in a person coming to rest inadvertently on the ground, or other lower level, or hitting an object like a chair or stair and is not a consequence of the following: sustaining a violent blow, or sudden onset of paralysis or seizure". This definition coincides with the definition proposed by the Kellogg International Work Group (1987) and the FICSIT Group (Ory et al., 1993; Tinetti et al., 1993C), two of the more notable working groups in the area of falls. The rationale behind the selection of this definition is that falls that are the result of impairments in balance control, and not attributable to one specific medical condition, (e.g., seizure, paralysis) are being targeted by this intervention program. Since the exercises in this intervention focus on the improvement of balance and stability, falls that are the result of medical complications, will more than likely not be affected by this program, and will be excluded from the study.

6.4: Data Collection Time Points and Time Line for Intervention Program

During the second last week of September 1995 baseline data (Time 1 Data), which consisted of all of the variables mentioned (with the exclusion of the falls diary), were collected for subjects in the control and experimental groups. Seniors also received diaries for the first month of the study at the end of this assessment. Each month new diaries were administered to the participants, and all participants were asked whether or not they were having trouble completing the diaries. At the end of the exercise intervention program (week 11), the following information was collected on all participants within the exercise and control groups (Time 2): Tinetti's measure of balance, timed UP & Go test, ABC test, hand strength, information on sleep (i.e., hours of sleep each night, trouble going or staying asleep), perceived health, and medications that were being taken at the time of the testing. The information that was collected at Time 2 was also collected at the end of the follow-up period during the second week of March 1996 (Time 3). All participants continued to complete their weekly diaries during the follow-up period. Therefore, weekly diary information was collected from Time 1 until Time 3, which consisted of approximately 26 weeks.

The exercise intervention programs were conducted for a ten week period, beginning the last week in September and ending in December. The falls education classes were conducted during the first three weeks in October, at each of the five sites. At the conclusion of the exercise classes and falls education classes, no further intervention was given to the experimental group. During the last two weeks in January the control group received the general health program from the Living Younger staff.

6.5: Statistical Analyses

Descriptive statistics were used to report falls information and baseline data collected for the sample. Additionally, survival analysis methods, t-tests, and multivariate linear regression models were used to examine the data in greater detail. Specifically, the risk factors for time-to-first-fall and time-to-second-fall (multiple falls) were determined utilizing survival analysis models, with fall status as the dependent variable and all other baseline measures as the predictor variables. Additionally, using the Proc Lifetest procedure in the survival analysis techniques, survival curves were plotted for fall status by group. T-tests were used to examine the differences between the number of falls between the experimental and control groups during the study. Further, other t-tests were computed to determine whether or not there were differences between change scores for selected variables (hours of sleep, hand strength, Tinetti's balance score, timed Up & Go score, and ABC score) in the following scenarios: (1) Time 2 scores - Time 1 scores, and (2) Time 3 scores - Time 1 scores. Plots of means for each of the Time 1, 2 and 3 scores for Tinetti's balance score, timed Up & Go score, and ABC score, and the confidence intervals for each of these scores, were completed in order to visualize the differences between the groups on these measures throughout the study time periods. Lastly, linear regression modelling was used to determine the factors that predicted balance (Tinetti and Up & Go measures) and balance confidence (ABC measure) at Times 1 (baseline), 2 (after intervention) and 3 (follow-up). Thus, nine separate models were completed utilizing linear regression. For the survival and linear models, only the independent variables found to be significant at the bivariate level were examined in the multivariate models. Interaction and quadratic terms were also examined in both of the modelling techniques to test for the presence of curvilinearity with the continuous variables.

Multiple linear regression, which allows for the inclusion of more than one independent variable into the modelling equation, provides: (1) a greater explanation of the dependent variable, and (2) enhances the effect of a single variable, by removing the distortions from other independent variables. The dependent variable is a linear function of one or more independent variables, in the general multiple regression equation:

$$Y = a_o + b_1X_1 + b_2X_2 + B_3X_3 \ldots + B_kX_k + e$$

where Y is the dependent variable, the X's are the independent or predictor variables, a is the intercept or constant (indicates the point where the regression line intercepts the Y-axis), the b's are the slopes for the independent variables (e.g., the slope estimate indicates the average change in Y associated with a unit change in X), and e represents the error term of the model. The subscripts identify the independent variables. The equation suggests that Y is determined by the X variables and an error term (Lewis-Beck, 1980).

6.6: Results from the Development and Testing of Different Fall Prevention Programs: Pilot Study, 1995-1996.

6.6.1: Univariate Distributions for the Falls Intervention Study, 1995-1996

The distributions for the percentages of males and females at each of the five retirement home sites have been summarized in Tables 6.1A, 6.1B and 6.1C. The control group, which consisted of pooled subjects from two retirement homes (n=32), was comprised of 29 females and 3 males (Table 6.1A). An even number of subjects (n=16) were from each of the retirement homes. For the experimental group, three retirement home samples were combined for total of 27 females and 4 males (Table 6.1B). The contribution of seniors from each of the sites for the experimental group were not balanced, since 54.8%, 19.4% and 25.8% were from retirement homes 1, 2 and 3, respectively. The total sample was comprised of 50.8% control subjects and 49.2% experimental subjects.

Tables 6.2 through to 6.10 summarize the independent variables utilized for the survival analysis models. The univariate distributions for the socio-demographic variables have been summarized in Table 6.2. Females constituted 87.1% of the sample, while men accounted for 11.1% of the sample. With respect to educational attainment, 58.7% of the sample had an elementary education of less, while 15.9% and 25.4% had acquired a high school/some post-secondary or diploma/university education, respectively; however, when stratified by group, the control group consisted of individuals that were less educated than the experimental group. Lifetime occupation revealed that the majority of the sample had worked as service providers or labourers. The remainder of the sample were professionals/managers (23.8%) or homemakers (28.6%). When stratified by group, a larger percentage of the experimental group (35.5%) were categorized as professionals/managers, as compared to control subjects (12.5%).

The univariate distributions for the health practice variables have been summarized in Tables 6.3 to 6.5. Table 6.3 contains the health practice measures of alcohol consumption, smoking status, and sleep patterns. For alcohol consumption, 49.2% and 44.4% reported that they were non-drinkers or drank less than 1/week, respectively. Approximately, 6.3% of the sample drank daily or weekly. The majority of the sample did not smoke (76.2%), while 20.6% and 3.2% were classified as former-smokers and current smokers. With respect to sleep patterns, 61.9% and 81.0% claimed to have trouble going to sleep and staying asleep (after initially going to sleep).

The remaining two health practice tables summarized the univariate distributions for medication use. With respect to heart medication, the majority of the sample reported using one (34.9%) or more (17.5%) heart medications. The majority of the sample used vitamins (58.7%), but did not use insulin (90.5%), thyroid medication (92.1%), ventolin (92.1), or gastrointestinal medication (73.0%). Approximately, 56% of the sample reported not using diuretics; however, when stratified by group more experimental subjects (71.0%) reported non-use than controls (40.6%) (Table 6.4). Approximately, 62% of the sample reported using analgesics. Once again more individuals within the experimental group (48.4%) reported not using analgesics as compared to the control sample (28.1%). For tranquilizers, antidepressants, and antimanic medications, 88.9%, 90.5%, and 95.2% of the sample, respectively, did not use the medications. For sedative use, 58.7% of the total sample were not receiving sedatives; however, a larger percentage of the experimental group were not using sedatives.

Marital status and family/friend support have been summarized in Table 6.6. The majority of the sample reported being widowed (73.0%) and single (19.0%). When stratified by group, no controls were married, while 9.7% of experimental subjects were married. With respect to support, 95.2% and 76.2% reported having family and friend support, respectively.

Tables 6.7 through 6.9 report distributions of the measures of frailty. The majority of the sample reported being in good health (68.3%), and experiencing no internal (60.3%) or external injuries (74.6%). With respect to history of falls, 50.8% of the sample reported falling within the past year. Tables 6.8 and 6.9, which summarized several of medical conditions, revealed that the majority of the sample reported not having problems with osteoporosis, asthma, backpain, circulation, heart conditions, diabetes, urinary, digestion, goiter/thyroid, and inadequate vision. Alternatively, 60.3%, 41.3%, and 47.6% of the sample were affected by arthritis, high blood pressure, and eye problems, respectively. Further, 30.2% and 44.4% of the sample reported nocturia one or more times a night, respectively.

Only one exposure to risk variable, activity compared to others of the same age, was collected for this study. Table 6.10 revealed that the majority of the sample reported being more active (34.9%), while 33.3% and 31.7% were classified as active or less active as individuals of the same age, respectively.

The distributions for the dependent variables used for the survival analysis models have been summarized in Tables 6.11A and 6.12A. With respect to fall status, 31.7% and 11.0% were classified as fallers (one or more falls) (Table 6.11A) and multiple fallers (Table 6.12B). The number of falls experienced by the control versus experimental group did not differ significantly for fallers (one or more falls) based on t-test analysis; however, results from t-tests performed for fall status between control and experimental subjects revealed that a significantly greater number of control seniors fell two or more times (t-test Value = -2.01; $p<0.05$). The control group experienced two deaths, two hospitalizations, and two hip fractures as compared to none in the experimental group. Further, three individuals in the control group were too ill to finish the study. Only one male from the experimental group could not complete the remaining month of follow-up since he moved away.

Chi Square Analysis between the independent variables and the two groups was not performed. Since 50% of the cells in the chi square procedures had expected counts less than 5, chi square may not be a valid test for this data set (SAS program).

6.6.2: Bivariate Associations and Survival Analysis Models for the Falls Intervention Study, 1995-1996

The main and interactive effects for all of the variables that were found to be significant at the bivariate level for the total sample were further analyzed in multivariate survival analysis models. Quadratic terms were examined for all variables that had been left continuous. Not all of the variables that had been found to be significant at the bivariate level continued to maintain significance in the final survival models. The results for the bivariate associations, the final survival models, and the survival curves for each of the independent variables significant within the final models have been summarized in the following section.

6.6.2.1: Bivariate and Multivariate Survival Models for Risk of Time-To-First-Fall for the Falls Intervention Study, 1995-1996

The bivariate associations for the socio-demographic variables revealed that females were less likely to be at risk for time-to-first-fall as indicated by a risk ratio of 0.37 compared with men (Table 6.13). The remaining socio-demographic variables, age, education, and lifetime occupation, were not significant at the 0.10 level of significance.

Hours of sleep was the only health practice variable that was associated with time-to-first-fall (Table 6.14). The bivariate results revealed that as the number of hours increased, risk of falling also increased (R.R.= 1.60). None of the other measures of health, which included alcohol consumption, smoking status, other measures of sleep, and medication use (Tables 6.14-6.16), were significantly associated with time-to-first-fall at the bivariate level.

The only social support independent variables associated with time-to-first-fall was family support (continuous variable) (Table 6.17). A risk ratio of 1.24 indicated that risk of falling increased as the number of supportive family members increased. Marital status and a dichotomized family support measure did not reach convergence at the bivariate level.

Experiencing internal injuries or external injuries, having a history of falls, and having a heart condition were the three frailty variables significantly associated with time-to-first-fall (Tables 6.18-6.20). Individuals that had experienced an internal or external injury at baseline were 4.30 times and 2.49 times more likely to experience a subsequent fall. Individuals that reported having a heart condition were also more likely to fall, as indicated by a risk ratio of 2.35. All other medical conditions were not significantly associated with falling at the bivariate level.

The measure of exposure to risk, activity level compared to others, was not significantly associated with risk of falling at the bivariate level (Table 6.21). The measures of balance/stability and strength have been summarized in Table 6.22. These bivariate associations revealed that all of the measures of balance were associated with risk of falling. Results from Tinetti's measure of balance and the ABC measure of balance confidence, showed that individuals that possessed higher scores for balance (indicative of better balance) and balance confidence (indicative of more confidence in balance) were less likely to fall (R.R.=0.92 & 0.98 respectively). The results for the Timed Up & Go test revealed that individuals with higher scores (indicative of lower balance scores) were more likely to fall, as indicated by a risk ratio of 1.06. Correlations between the three measures of balance revealed that they were significantly associated with each other (not shown). Thus, the balance variables were not entered into the same final multivariate models because of potential problems with collinearity. Hand strength was not associated with time-to-first-fall.

In order to accommodate the significantly correlated balance measures, three separate models for time-to-first-fall were reported, with one of the balance measures in each of the survival models. Each of the final survival models incorporated the same covariates, namely, gender, family support and history of falls, in addition to one of the measures of balance (Tables 6.23-6.25). No interaction terms or quadratics were significant in the final models. In each of the models, females were less likely to experience a fall, as indicated by risk ratios below 1.00. Family support and a history of falling were both associated with an increased risk of time-to-first-fall in all of the final models. As expected, better balance and balance confidence scores, as measured by Tinetti's measure (R.R.=0.88) and the ABC measure (R.R.=0.97), were related to a decreased risk of falling, while a lower level of balance (Timed Up & Go) (R.R.=1.06) was associated with an increased risk of falling. Since most of the independent variables significant within the final model were continuous, and survival curves cannot be produced for such variables.

6.2.2.2: *Bivariate and Multivariate Survival Models for Risk of Time-To-Second Fall (Multiple Falls) for the Falls Intervention Study, 1995-1996*

The bivariate associations for the socio-demographic variables and social support measures revealed that none of the measures were significantly associated with time-to-second-fall (Table 6.26 and Table 6.30). Conversely, Tables 6.27 through to 6.29 indicated that hours of sleep and gastrointestinal medications were significantly associated with falling. A risk ratio of 1.75 revealed that as hours of sleep increased, risk of falling increased. With respect to gastrointestinal medication, individuals taking these medications were 1.06 times more likely to fall. Several of the health practice variables did not reach convergence at the bivariate level.

Experiencing an internal or external injury, and having a heart condition were also significantly related to time-to-second-fall (Tables 6.31 to 6.33). As with the results for time-to-first-fall, an internal or external injury was associated with an increased risk of falling, as indicated by risk ratios of 10.44 and 8.39, respectively. Individuals that had heart conditions were also more likely to experience two or more falls. The risk ratio for heart condition was 7.02. The bivariate model for activity level compared to others did not reach convergence (Table 6.34).

The balance/stability measures and the strength measure have been summarized in Table 6.35. The three balance measures were all found to be significantly associated with risk of falling two or more times. Higher balance and balance confidence scores, as measured by Tinetti and ABC assessments, appeared to have a protective effect against fall risk, while the Timed Up & Go measure was associated with an increased risk of falling two or more times. Higher scores for the latter test are indicative of poor balance.

Three final models were formed for Time-To-Second-Fall, since the balance measures could not be incorporated into the same models because of collinearity. For the models with Tinetti's measure of balance and the Timed Up & Go test, the only two other variables that remained in the models were hours of sleep and experiencing external injuries (Table 6.36 & 6.38). The final survival model with the ABC measure, contained heart condition and external injuries (Table 6.37). In models 1 and 3 (Tables 6.36 and 6.38), sleeping a greater number of hours was associated with an increased risk of falling two or more times. All three models revealed that individuals that reported experiencing an external injury, were more likely to fall. Tinetti's measure of balance (R.R.=0.83) and the ABC measure of balance confidence (R.R.=0.94) were both associated with a decreased risk of injury, while the Timed Up & Go test (R.R. = 1.07) was associated with an increased risk of falling. No interaction terms or quadratics reached significance in the final three models. A survival curve for the fall status between the control and experimental group (Figure 6.1) was produced, which revealed that individuals in the experimental group were less likely to experience multiple falls, as compared to the controls. Unlike the survival curve for time-to-first-fall, this survival distribution for fall status between the groups was significantly different (X^2=4.49; p=0.03).

6.6.3: Change Score Results for Balance and Balance Confidence Measures, by Group, Falls Intervention Study 1995-1996

The next section describes work completed with respect to the balance measure scores at Times 1, 2 and 3. First, two T-tests were computed to determine the differences in a change in balance between the control group and the experimental group for different points in time: (1) balance score at Time 2 - balance score at Time 1, and (2) balance score at Time 3 - balance score at Time 1. The results of these tests reveal whether the balance in one group significantly improved from baseline as compared to the other group. These T-tests were computed for each of the balance measures. Additionally, figures illustrating the mean scores for each of the balance measures at Times 1, 2 and 3 were completed. The mean scores for the control group are represented by white bars, while the experimental group are represented by gray bars. Confidence intervals that overlap between the control and experimental groups for a specific point in time (e.g., at Time 1) for the same balance measure (e.g., Tinetti's Balance Measure) indicate that there is no significant difference in that particular balance measure for the two groups; however, in cases where the confidence intervals do not overlap between the control and experimental groups for a specific measure, a significant difference in the mean balance score exists. It is important to remember while reviewing this section that the T-tests compare the mean changes in balance (Time 2 - Time 1; Time 3 - Time 1), while the figures represent the mean scores for each of the balance measures at Times 1, 2 and 3.

6.6.3.1: Change Score Results for Tinetti's Balance Measure, by Group

Table 6.39 and 6.40 show that the experimental group significantly improved their balance scores at Time 2 and Time 3, as measured by Tinetti's measure of balance. With this measure, higher scores are indicative of better balance. Figure 6.3 graphically represents differences between the scores at all three points in time. It is important to note that at Time 1 the control group had significantly lower scores for balance than the experimental group; however, after the intervention, the balance scores for the experimental group improved far more significantly than the control group. In fact, at Time 3 the mean score for the control group decreased from Time 2.

6.6.3.2: Change Score Results for the Timed Up & Go Test, by Group

The experimental group significantly lowered the scores for the Timed Up & Go Test, as indicated by Table 6.41. However, the scores between the two groups were not significantly different for the change in score between Time 3 and 1. The scores at baseline did overlap for the two groups, and were thus not significantly different from each other at Time 1. A graphic representation of these results has been provided (Figure 6.4).

6.6.3.3: Change Score Results for the Measure of Balance Confidence (ABC), by Group

The results for the change scores for the measure of balance confidence reveal the most improvement for the experimental group after the onset of the intervention. At baseline, the two groups do not differ significantly; however, the change scores between Time 2 and 1, and between Time 3 and 1, are significantly different as indicated by Table 6.43 and 6.44, respectively. Further, Figure 6.5 shows that at Times 2 and 3 the experimental group's ABC scores improve, while the control group's ABC scores decline.

6.6.4: Linear Regression Models for Balance and Balance Confidence Measures, Intervention Study 1995-1996

Only the final models for the linear regression analysis have been shown, since the predictors of balance and balance confidence are not the prime outcomes of interest of this study; however, models have been provided for the interesting finding of the importance of previous balance/balance confidence scores in the prediction of future balance/balance confidence. Further, quadratic results have not been shown, since this was not the point of interest in these findings.

6.6.4.1: Linear Regression Models for Tinetti's Measure of Balance, by Time

Tables 6.45 to 6.47 summarize the results of the linear regression models for Tinetti's measure of balance at Times 1, 2 and 3. The variables significant for each of the outcomes are as follows: (1) Time 1: age, quadratic of age, group, activity level compared to other individuals, and the use of gastrointestinal medications (Table 6.45); (2) Time 2: Tinetti's balance score at Time 1, group, fall status prior to start of study (Table 6.46); and (3) Time 3: Tinetti's balance score at Time 2, psychotropic drug use (Table 6.47). The amount of variance explained was 57.0%, 82.0%, and 86.0% for Times 1, 2 and 3. These results would generally suggest that the most important predictor of balance is an individual's previous balance score (see Table 6.46 & 6.47). In both these models, fewer variables were significant within the final models, and more variance was explained as compared to the model for Time 1. At baseline, no previous measure of balance was available, and would thus seem to account for the greater number of variables within this final model, and for a lesser amount of variance explained.

6.6.4.2: Linear Regression Models for Timed Up & Go Scores, by Time

The variables significant for the Timed Up & Go Scores at the three points in time have been summarized in Tables 6.49, 6.50, and 6.51. Age, the quadratic of age, educational attainment, tranquilizer use, and gastrointestinal drug use were the significant predictors of scores for the Timed Up & Go at Time 1 (Table 6.49). Conversely, Up & Go scores at Time 1, group and trouble going to sleep predicted Time 2 scores (Table 6.50), while Up & Go scores at Time 2 and group predicted Time 3 scores (Table 6.51). As with the findings from the Tinetti models, a greater amount of variance was explained in the two models with measures of balance (Tables 6.50 & 6.51). Further, fewer predictor variables were present within these models, as compared to the model for Time 1 Up & Go Scores.

6.6.4.3: Linear Regression Models for ABC (Balance Confidence) Scores, by Time

Age, hours of sleep, marital status, alcohol consumption, gastrointestinal drug use, and activity level compared to others of the same age were predictive of ABC Scores at Time 1 (Table 6.51). For ABC scores at Time 2, ABC at Time 1, group, family support, and fall status within the study were the significant predictors, while age, ABC at Time 2 (Table 6.52), and group predicted Time 3 scores (Table 6.53). These findings parallel those from the results of the linear models for the measures of balance.

Table 6.1A: Percentage (Frequency) of Subjects in Control Group, by Retirement Home, Falls Intervention Study, 1995-1996.

Retirement Home	Males	Females	Total
Retirement Home 1	100.0 (3)	44.8 (13)	50.0 (16)
Retirement Home 2	0	55.2 (16)	50.0 (16)

Table 6.1B: Percentage (Frequency) of Subjects in Experimental Group, by Retirement Home, Falls Intervention Study, 1995-1996.

Retirement Home	Males	Females	Total
Retirement Home 3	50.0 (2)	55.6 (15)	54.8 (17)
Retirement Home 4	0	22.2 (6)	19.4 (6)
Retirement Home 5	50.0 (2)	22.2 (6)	25.8 (8)

Table 6.1C: Percentage (Frequency) of Subjects, by Group, Falls Intervention Study, 1995-1996.

Group	Males	Females	Total
Control Group	42.9 (3)	51.8 (29)	50.8 (32)
Experimental Group	57.1 (4)	48.2 (27)	49.2 (31)

Table 6.2: Percentage (Frequency) Distributions for Socio-demographic Variables, by Group, Falls Intervention Study, 1995-1996.

Variables	Control Group	Experimental Group	Total
Gender			
male	9.4 (3)	12.9 (4)	11.1 (7)
female	90.6 (29)	87.1 (27)	88.9 (56)
Education			
elementary/some secondary	81.3 (26)	35.5 (11)	58.7 (37)
high school/some post sec	6.3 (2)	25.8 (8)	15.9 (10)
diploma/university	12.5 (4)	38.7 (12)	25.4 (16)
Lifetime Occupation			
professional/managerial	12.5 (4)	35.5 (11)	23.8 (15)
homemaker	31.3 (10)	25.8 (8)	28.6 (18)
service provider/labourer	56.3 (18)	38.7 (12)	47.6 (30)

Note: age was left continuous within the model (Mean Age = 80.3; Range = 60.9 to 96.15).

Table 6.3: Percentage (Frequency) Distributions for Health Practice Variables, by Group, Falls Intervention Study, 1995-1996.

Variables	Control Group	Experimental Group	Total
Alcohol Consumption			
non-drinker	56.3 (18)	41.9 (13)	49.2 (31)
less than 1/week	37.5 (12)	51.6 (16)	44.4 (28)
drinks daily or weekly	6.3 (2)	6.5 (2)	6.3 (4)
Smoking Status			
non-smoker	75.0 (24)	77.4 (24)	76.2 (48)
former-smoker	18.8 (6)	22.6 (7)	20.6 (13)
current smoker	6.3 (2)	0 (0)	3.2 (2)
Going to Sleep			
no trouble	59.4 (19)	64.5 (20)	61.9 (39)
trouble	40.6 (13)	35.5 (11)	38.1 (24)
Staying Asleep			
no trouble	15.6 (5)	22.6 (7)	19.0 (12)
trouble	84.4 (27)	77.4 (24)	81.0 (51)

Note: another health practice variable used within this analysis was **hours of sleep** (Mean = 8.1; Range = 5 to 12 hours per night); however, hours of sleep was left as a continuous variable and was not included within the univariate table

Table 6.4: Percentage (Frequency) Distributions for Health Practice Variables, by Group, Falls Intervention Study, 1995-1996.

Variables	Control Group	Experimental Group	Total
Heart Medications			
non-use	43.8 (14)	51.6 (16)	47.6 (30)
one heart med	37.5 (12)	32.3 (10)	34.9 (22)
two heart meds	18.8 (6)	16.1 (5)	17.5 (11)
Vitamins			
non-use	46.9 (15)	35.5 (11)	41.3 (26)
use	53.1 (17)	64.5 (20)	58.7 (37)
Insulin			
non-use	87.5 (28)	93.5 (29)	90.5 (57)
use	12.5 (4)	6.5 (2)	9.5 (6)
Thyroid			
Medications	90.6 (29)	93.5 (29)	92.1 (58)
non-use	9.4 (3)	6.5 (2)	7.9 (5)
use			
Ventolin			
non-use	93.8 (30)	90.3 (28)	92.1 (58)
use	6.3 (2)	9.7 (3)	7.9 (5)
Gastrointestinal Medications			
non-use	62.5 (20)	83.9 (26)	73.0 (46)
use	37.5 (12)	16.1 (5)	27.0 (17)
Diuretics			
non-use	40.6 (13)	71.0 (22)	55.6 (35)
use	59.4 (19)	29.0 (9)	44.4 (28)

Table 6.5: Percentage (Frequency) Distributions for Health Practice Variables, by Group, Falls Intervention Study, 1995-1996.

Variables	Control Group	Experimental Group	Total
Analgesics			
non-use	28.1 (9)	48.4 (15)	38.1 (24)
use	71.9 (23)	51.6 (16)	61.9 (39)
Tranquilizers			
non-use	87.5 (28)	90.3 (28)	88.9 (56)
use	12.5 (4)	9.7 (3)	11.1 (7)
Sedatives			
non-use	40.6 (13)	77.4 (24)	58.7 (37)
use	59.4 (19)	22.6 (7)	41.3 (26)
Antidepressants			
non-use	87.5 (28)	93.5 (29)	90.5 (57)
use	12.5 (4)	6.5 (2)	9.5 (6)
Antimanic			
non-use	100 (32)	90.3 (28)	95.2 (60)
use	0	9.7 (3)	4.8 (3)

Note: two other health practice variables used within this analysis were **psychotropic drug use** (Mean Use = 1.3; Range = 0 to 3 psychotropic meds) and **total number of medications** (Mean Number = 4.1; Range = 0 to 11 meds); however, psychotropic drug use and total number of medications were left as continuous variables and were not included within the univariate table.

Table 6.6: Percentage (Frequency) Distributions for Social Support Variables, by Group, Falls Intervention Study, 1995-1996.

Variables	Control Group	Experimental Group	Total
Marital Status			
married	0	9.7 (3)	4.8 (3)
widowed	78.1 (25)	67.7 (21)	73.0 (46)
divorced/separated	3.1 (1)	3.2 (1)	3.2 (2)
single	18.8 (6)	19.4 (6)	19.0 (12)
Family Support			
no support	3.1 (1)	6.5 (2)	4.8 (3)
support	96.9 (31)	93.5 (29)	95.2 (60)
Friend Support			
no support	28.1 (9)	19.4 (6)	23.8 (15)
support	71.9 (23)	80.6 (25)	76.2 (48)

Note: family support was also left as a continuous variable within bivariate analysis since many individuals reported having the support of several family members (Mean = 2.5; Range = 0 to 6); however, with friend support responses consisted of no friend support or one friend for support.

Table 6.7: Percentage (Frequency) Distributions for Measures of Frailty, by Group, Falls Intervention Group, 1995-1996.

Variables	Control Group	Experimental Group	Total
Perceived Health			
good	62.5 (20)	74.2 (23)	68.3 (43)
poor	37.5 (12)	25.8 (8)	31.7 (20)
History of Falls			
no history of falls	43.8 (14)	54.8 (17)	49.2 (31)
history of falls	56.2 (18)	45.2 (14)	50.8 (32)
Internal Injuries			
no injuries	53.1 (17)	67.7 (21)	60.3 (38)
injuries	46.9 (15)	32.3 (10)	39.7 (25)
External Injuries			
no injuries	71.9 (23)	77.4 (24)	74.6 (47)
injuries	28.1 (9)	22.6 (7)	25.4 (16)

Note: another measure of frailty used within this analysis was the **SHARP** (Mean = 9.2; Range = 2 to 12); however, the **SHARP** was left as a continuous variable and was not included within the univariate table.

Table 6.8: Percentage (Frequency) Distributions for Measures of Frailty, by Group, Falls Intervention Group, 1995-1996.

Variables	Control Group	Experimental Group	Total
Osteoporosis			
no osteoporosis	90.6 (29)	83.9 (26)	87.3 (55)
osteoporosis	9.4 (3)	16.1 (5)	12.7 (8)
Asthma			
no asthma	93.8 (30)	90.3 (28)	92.1 (58)
asthma	6.3 (2)	9.7 (3)	7.9 (5)
Backpain			
no backpain	87.5 (28)	87.1 (27)	87.3 (55)
backpain	12.5 (4)	12.9 (4)	12.7 (8)
Arthritis			
no arthritis	40.6 (13)	38.7 (12)	39.7 (25)
arthritis	59.4 (19)	61.3 (19)	60.3 (38)
High Blood Pressure			
no high blood pressure	62.5 (20)	54.8 (17)	58.7 (37)
high blood pressure	37.5 (12)	45.2 (14)	41.3 (26)
Circulatory Problems			
no circulatory problems	84.4 (27)	64.5 (20)	74.6 (47)
circulatory problems	15.6 (5)	35.5 (11)	25.4 (16)
Heart Condition			
no heart condition	65.6 (21)	77.4 (24)	71.4 (45)
heart condition	34.4 (11)	22.6 (7)	28.6 (18)
Diabetes			
no diabetes	78.1 (25)	90.3 (28)	84.1 (53)
diabetes	21.9 (7)	9.7 (3)	15.9 (10)

Table 6.9: Percentage (Frequency) Distributions for Measures of Frailty, by Group, Falls Intervention Study, 1995-1996.

Variables	Control Group	Experimental Group	Total
Urinary Problems			
no problem	84.4 (27)	74.2 (23)	79.4 (50)
problem	15.6 (5)	25.8 (8)	20.6 (13)
Digestive Problems			
no problem	81.3 (26)	83.9 (26)	82.5 (52)
problem	18.8 (6)	16.1 (5)	17.5 (11)
Goiter/Thyroid			
no goiter/thyroid	81.3 (26)	93.5 (29)	87.3 (55)
goiter/thyroid	18.8 (6)	6.5 (2)	12.7 (8)
Eye Problems (i.e., Cataracts)			
no problem	50.0 (16)	54.8 (17)	52.4 (33)
problem	50.0 (16)	45.2 (14)	47.6 (30)
Adequate Vision			
not adequate	21.9 (7)	22.6 (7)	22.2 (14)
adequate	78.1 (25)	77.4 (24)	77.8 (49)
Nocturia			
no	21.9 (7)	29.0 (9)	25.4 (16)
one time	25.0 (8)	35.5 (11)	30.2 (19)
two or more times	53.1 (17)	35.5 (11)	44.4 (28)

Note: another measure of frailty used within this analysis was a **count of medical conditions** (Mean = 3.9; Range = 0 to 12 conditions); however, the count of medical conditions was left continuous within the analysis and thus was not included within the univariate table.

Table 6.10: Percentage (Frequency) Distributions for Exposure to Risk Variables, by Group, Falls Intervention Program, 1995-1996.

Variables	Control Group	Experimental Group	Total
Activity Compared to Others			
more	31.3 (10)	38.7 (12)	34.9 (22)
as	31.3 (10)	35.5 (11)	33.3 (21)
less	37.5 (12)	25.8 (8)	31.7 (20)

Note: for measures of balance and strength the following variables were used within the analysis: **Tinetti's measure of balance** (Mean = 14.9; Range = 2 to 24), **timed Up & Go test** (Mean = 17.7; Range = 8.8 to 47.3), **ABC scale** (Mean = 63.6; Range = 15.6 to 98.1); however, all of these measures were left as continuous variables within the analysis and thus were not included within the univariate table. For measures of muscular strength, **hand dynamometer strength** (Mean = 11.4; Range = 2.5 to 33.0) was used; however, this measure was left as a continuous variable within the analysis and thus was not included within the univariate table.

Table 6.11A: Percentage (Frequency) Distributions for Non-Fallers and Fallers, by Group, Falls Intervention Study, 1995-1996.

Measure of Fall Status	Control Group	Experimental Group	Total Sample
Non-faller			
no falls	59.4 (19)	77.4 (24)	68.3 (43)
Faller			
1+ falls	40.6 (13)	22.6 (7)	31.7 (20)

Note: individuals that had not fallen by the end of the year, or had died before experiencing a fall, were coded as non-fallers (censored observations)

Table 6.11B: T-Test Results for Fall Status (Non-Faller vs Faller) by Group, Falls Intervention Study, 1995-1996.

Intervention Groups	Mean (Standard Deviation)	T-Test Results	Number of Fallers
Control (n=32)	0.41 (0.50)	-1.54	13
Experimental (n=31)	0.23 (0.43)		7

* 0<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Table 6.12A: Percentage (Frequency) Distributions for Non-Fallers/One-Time Fallers and Multiple Fallers, by Group, Falls Intervention Study, 1995-1996.

Measure of Fall Status	Control Group	Experimental Group	Total Sample
Non-faller/One Time Faller			
no falls or 1 fall	82.0 (26)	97.0 (30)	89.0 (56)
Multiple Faller			
2+ falls	18.0 (6)	3.0 (1)	11.0 (7)

Note: individuals that had not fallen by the end of the year, or had died before experiencing a fall, were coded as non-fallers (censored observations)

Table 6.12B: T-Test Results for Fall Status (Non-Faller/One-Time Faller vs Multiple Faller) by Group, Falls Intervention Study, 1995-1996.

Intervention Groups	Mean (Standard Deviation)	T-Test Results	Number of Multiple Fallers
Control (n=32)	0.19 (0.40)	-2.01 **	6
Experimental (n=31)	0.03 (0.18)		1

* 0<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Table 6.13: Unadjusted Risk Ratios (95% Confidence Intervals) for Risk of Time-To-First Fall for Socio-demographic Variables, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Age	1.03 (0.97, 1.09)
Gender	
male	1.00
female	0.37 (0.12, 1.10) *
Education	
elementary/some secondary	1.00
high school/some post sec	0.50 (0.11, 2.22)
diploma/university	0.61 (0.20, 1.85)
Lifetime Occupation	
professional/managerial	1.00
homemaker	1.08 (0.33, 3.58)
service provider/labourer	0.80 (0.26, 2.45)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

Note: group (experimental as reference group) was not significant at the bivariate level (R.R.=1.92; 95% C.I. = 0.75-4.91)

Table 6.14: Unadjusted Risk Ratios (95% Confidence Intervals) for Risk of Time-To-First-Fall for Health Practice Variables, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Alcohol Consumption	
non-drinker	1.00
less than 1/week	0.61 (0.24, 1.57)
drinks daily or weekly	0.68 (0.09, 5.25)
Smoking Status	
non-smoker	
former-smoker	♪ no convergence
current smoker	
Hours of Sleep	1.60 (1.06, 2.41) **
Going to Sleep	
no trouble	1.00
trouble	0.91 (0.36, 2.34)
Staying Asleep	
no trouble	1.00
trouble	2.32 (0.53,10.07)

* p<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

♪ convergence was not attained at the bivariate level for the variable smoking status

Table 6.15: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-First-Fall for Health Practice Variables, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Heart Meds	
non-use	1.00
one heart med	1.11 (0.42, 2.97)
two heart meds	0.98 (0.26, 3.61)
Vitamins	
non-use	1.00
use	0.57 (0.23, 1.42)
Insulin	
non-use	1.00
use	1.99 (0.58, 6.85)
Thyroid Meds	
non-use	1.00
use	1.42 (0.33, 6.17)
Ventolin	
non-use	1.00
use	0.56 (0.07, 4.22)
Gastrointestinal Meds	
non-use	1.00
use	1.45 (0.55, 3.78)
Diuretics	
non-use	1.00
use	0.97 (0.39, 2.37)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

Table 6.16: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-First-Fall for Health Practice Variables, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Analgesics	
non-use	1.00
use	0.91 (0.36, 2.27)
Tranquilizers	
non-use	1.00
use	0.97 (0.22, 4.22)
Sedatives	
non-use	1.00
use	1.59 (0.64, 3.90)
Antidepressants	
non-use	1.00
use	0.47 (0.06, 3.56)
Antimanic	
non-use	♪ no convergence
use	
Psychotropic Count	1.54 (0.61, 3.86)
Medication Count	1.02 (0.84, 1.24)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

♪ convergence was not attained at the bivariate level for the variable antimanic medications

Table 6.17: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-to-First-Fall for Social Support Variables, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Marital Status	
married	
widowed	♪ no convergence
divorced/separated	
single	
Family Support	1.24 (0.97, 1.61) *
(continuous)	
Family Support	
no support	♪ no convergence
support	
Friend Support	
no support	1.00
support	0.57 (0.22, 1.48)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

♪ convergence was not attained at the bivariate level for the variables marital status and family support (dichotomized)

Table 6.18: Unadjusted Odds Ratios (95% Confidence Intervals) for Time-To-First-Fall for Measures of Frailty, Falls Intervention Group, 1995-1996.

Variables	Total Sample
Perceived Health	
good	1.00
poor	1.39 (0.54, 3.56)
History of Falls	
no history of falls	1.00
history of falls	6.36 (1.85,21.86) ***
Internal Injuries	
no injuries	1.00
injuries	4.30 (1.62,11.47) ***
External Injuries	
no injuries	1.00
injuries	2.49 (1.01, 6.12) **
SHARP	0.95 (0.82, 1.08)

* p<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Table 6.19: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-First-Fall for Measures of Frailty, Falls Intervention Group, 1995-1996.

Variables	Total Sample
Osteoporosis	
no osteoporosis	1.00
osteoporosis	0.35 (0.05, 2.61)
Asthma	
no asthma	1.00
asthma	0.56 (0.07, 4.22)
Backpain	
no backpain	1.00
backpain	0.34 (0.05, 2.56)
Arthritis	
no arthritis	1.00
arthritis	0.89 (0.36, 2.18)
High Blood Pressure	
no high blood pressure	1.00
high blood pressure	0.84 (0.33, 2.16)
Circulatory Problems	
no circulatory problems	1.00
circulatory problems	0.51 (0.14, 1.74)
Heart Condition	
no heart condition	1.00
heart condition	2.35 (0.93, 5.88) *
Diabetes	
no diabetes	1.00
diabetes	1.59 (0.53, 4.75)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

Table 6.20: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-First-Fall (95% Confidence Intervals) for Measures of Frailty, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Urinary Problems	
no problem	1.00
problem	1.54 (0.55, 4.26)
Digestive Problems	
no problem	1.00
problem	0.88 (0.26, 3.02)
Goiter/Thyroid	
no goiter/thyroid	1.00
goiter/thyroid	0.71 (0.16, 3.06)
Eye Problems (i.e., Cataracts)	
no problem	1.00
problem	0.76 (0.31, 1.86)
Adequate Vision	
not adequate	1.00
adequate	1.64 (0.47, 5.61)
Nocturia	
no	1.00
one time	1.77 (0.44, 7.11)
two or more times	2.21 (0.60, 8.03)
Medical Condition Count	0.97 (0.81, 1.15)

* p<0.10   ** p<0.05   *** p<0.01   ¥ p<0.001

Table 6.21: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-First-Fall for Exposure to Risk Variables, Falls Intervention Program, 1995-1996.

Variables	Total Sample
Activity Compared to Others	
more	1.00
as	0.36 (0.09, 1.35)
less	1.26 (0.47, 3.35)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

Table 6.22: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-First-Fall for Balance/Stability Measures and Measures of Strength, Falls Intervention Program, 1995-1996.

Variables	Total Sample
Tinetti's Measure of Balance	0.92 (0.84, 1.02) *
Timed Up & Go	1.06 (1.01, 1.09) ***
ABC	0.98 (0.96, 0.99) *
Hand Dynamometer	0.98 (0.91, 1.06)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

Table 6.23: Survival Analysis Model for Time-To-First-Fall for Intervention Participants, Falls Intervention Study, 1995-1996 (Final Model 1).

Independent Measures	Parameter Estimate	Stand. Error	Relative Risk	95% Confidence Intervals
Gender				
males	0.00		1.00	
females	-1.41 **	0.61	0.24	0.12, 0.81
Family Support	0.48 ***	0.17	1.62	1.16, 2.26
History of Falls				
no history of falls	0.00		1.00	
history of falls	1.62 ***	0.65	5.04	1.41,18.07
Tinetti	-0.13 ***	0.05	0.88	0.80, 0.97

* p<0.10   ** p<0.05   *** p<0.01   ¥ p<0.001

Table 6.24: Survival Analysis Model for Time-To-First-Fall for Intervention Participants, Falls Intervention Study, 1995-1996 (Final Model 2).

Independent Measures	Parameter Estimate	Stand. Error	Relative Risk	95% Confidence Intervals
Gender				
males	0.00		1.00	
females	-1.56 ***	0.63	0.21	0.06, 0.72
Family Support	0.44 ***	0.16	1.55	1.13, 2.12
History of Falls				
no history of falls	0.00		1.00	
history of falls	1.51 **	0.66	4.54	1.24,16.50
Timed Up & Go	0.06 ***	0.02	1.06	1.02, 1.10

* p<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Table 6.25: Survival Analysis Model for Time-To-First-Fall for Intervention Participants, Falls Intervention Study, 1995-1996 (Final Model 3).

Independent Measures	Parameter Estimate	Stand. Error	Relative Risk	95% Confidence Intervals
Gender				
males	0.00		1.00	
females	-1.47 **	0.62	0.23	0.07, 0.78
Family Support	0.55 ***	0.19	0.17	1.19, 2.52
History of Falls				
no history of falls	0.00		1.00	
history of falls	1.71 ***	0.64	5.53	1.58,19.38
ABC	-0.03 ***	0.01	0.97	0.95, 0.99

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

Table 6.26: Unadjusted Risk Ratios (95% Confidence Intervals) for Risk of Time-To-Second Fall for Socio-demographic Variables, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Age	0.96 (0.89, 1.04)
Gender	
male	1.00
female	0.28 (0.05, 1.47)
Education	
elementary/some secondary	♪ no convergence
high school/some post sec	
diploma/university	
Lifetime Occupation	
professional/managerial	1.00
homemaker	1.64 (0.15,17.84)
service provider/labourer	1.97 (0.22,17.73)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

♪ convergence was not attained at the bivariate level with the variable education

Table 6.27: Unadjusted Risk Ratios (95% Confidence Intervals) for Risk of Time-To-Second-Fall for Health Practice Variables, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Alcohol Consumption	
non-drinker	♪ no convergence
less than 1/week	
drinks daily or weekly	
Smoking Status	
non-smoker	♪ no convergence
former-smoker	
current smoker	
Hours of Sleep	1.75 (1.03, 2.97) **
Going to Sleep	
no trouble	1.00
trouble	1.19 (0.27, 5.26)
Staying Asleep	
no trouble	♪ no convergence
trouble	

* p<0.10   ** p<0.05   *** p<0.01   ¥ p<0.001

♪ convergence was not attained at the bivariate level for the variables alcohol consumption, smoking status and trouble staying asleep at night.

Table 6.28: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-Second-Fall for Health Practice Variables, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Heart Meds	
non-use	1.00
one heart med	0.92 (0.15, 5.44)
two heart meds	2.07 (0.35,12.35)
Vitamins	
non-use	1.00
use	0.52 (0.12, 2.32)
Insulin	
non-use	1.00
use	1.50(0.18,12.39)
Thyroid Meds	
non-use	1.00
use	2.17 (0.26,18.12)
Ventolin	
non-use	♪ no convergence
use	
Gastrointestinal Meds	
non-use	1.00
use	1.06 (0.91,17.99) *
Diuretics	
non-use	1.00
use	1.76 (0.40, 7.84)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

♪ convergence was not attained at the bivariate level for the variable ventolin

Table 6.29: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-Second-Fall for Health Practice Variables, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Analgesics	
non-use	♪ no convergence
use	
Tranquilizers	
non-use	1.00
use	1.39 (0.17,11.55)
Sedatives	
non-use	1.00
use	0.57 (0.11, 2.93)
Antidepressants	
non-use	♪ no convergence
use	
Antimanic	
non-use	♪ no convergence
use	
Psychotropic Count	1.36 (0.31, 6.05)
Medication Count	1.26 (0.94, 1.69)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

♪ convergence was not attained at the bivariate level for the variables analgesics, antidepressants, and antimanic medications

Table 6.30: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-to-Second-Fall for Social Support Variables, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Marital Status	
married	
widowed	♪ no convergence
divorced/separated	
single	
Family Support	
(continuous)	1.38 (0.89, 2.12)
Family Support	
no support	♪ no convergence
support	
Friend Support	
no support	1.00
support	0.73 (0.14, 3.77)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

♪ convergence was not attained at the bivariate level for the variables marital status and family support (dichotomized)

Table 6.31: Unadjusted Odds Ratios (95% Confidence Intervals) for Time-To-Second-Fall for Measures of Frailty, Falls Intervention Group, 1995-1996.

Variables	Total Sample
Perceived Health	
good	1.00
poor	1.61 (0.36, 7.10)
History of Falls	
no history of falls	♪ no convergence
history of falls	
Internal Injuries	
no injuries	1.00
injuries	10.44 (1.26,87.08) **
External Injuries	
no injuries	1.00
injuries	8.39 (1.62,43.66) ***
SHARP	0.92 (0.75, 1.11)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

♪ convergence was not attained at the bivariate level with the variable history of falls

Table 6.32: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-Second-Fall for Measures of Frailty, Falls Intervention Group, 1995-1996.

Variables	Total Sample
Osteoporosis	
no osteoporosis	1.00
osteoporosis	1.11 (0.13, 9.18)
Asthma	
no asthma	♪ no convergence
asthma	
Backpain	
no backpain	1.00
backpain	1.16 (0.14, 9.65)
Arthritis	
no arthritis	1.00
arthritis	1.61 (0.31, 8.38)
High Blood Pressure	
no high blood pressure	1.00
high blood pressure	1.07 (0.24, 4.71)
Circulatory Problems	
no circulatory problems	1.00
circulatory problems	0.48 (0.06, 3.96)
Heart Condition	
no heart condition	1.00
heart condition	7.02 (1.35,36.47) **
Diabetes	
no diabetes	1.00
diabetes	2.08 (0.40,10.77)

* p<0.10   ** p<0.05   *** p<0.01   ¥ p<0.001

♪ convergence was not attained at the bivariate level with the variable asthma.

Table 6.33: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-Second-Fall for Measures of Frailty, Falls Intervention Study, 1995-1996.

Variables	Total Sample
Urinary Problems	
no problem	1.00
problem	0.60 (0.07, 4.99)
Digestive Problems	
no problem	1.00
problem	1.88 (0.36, 9.74)
Goiter/Thyroid	
no goiter/thyroid	♪ no convergence
goiter/thyroid	
Eye Problems (i.e., Cataracts)	
no problem	1.00
problem	0.78 (0.18, 3.45)
Adequate Vision	
not adequate	1.00
adequate	1.73 (0.21,14.39)
Nocturia	
no	♪ no convergence
one time	
two or more times	
Medical Condition Count	1.06 (0.81, 1.40)

* p<0.10   ** p<0.05   *** p<0.01   ¥ p<0.001

♪ convergence was not attained at the bivariate level for the variables goiter/thyroid problems and nocturia.

Table 6.34: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-Second-Fall for Exposure to Risk Variables, Falls Intervention Program, 1995-1996.

Variables	Total Sample
Activity Compared to Others	
more	♪ no convergence
as	
less	

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

♪ convergence was not attained at the bivariate level for the variable activity level compared to others

Table 6.35: Unadjusted Risk Ratios (95% Confidence Intervals) for Time-To-Second-Fall for Balance/Stability Measures and Measures of Strength, Falls Intervention Program, 1995-1996.

Variables	Total Sample
Tinetti's Measure of Balance	0.79 (0.66, 0.94) ***
Timed Up & Go	1.09 (1.02, 1.15) ***
ABC	0.95 (0.91, 0.99) ***
Hand Dynamometer	0.99 (0.85, 1.12)

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

Table 6.36: Survival Analysis Model for Time-To-Second-Fall for Intervention Participants, Falls Intervention Study, 1995-1996 (Final Model 1).

Independent Measures	Parameter Estimate	Stand. Error	Relative Risk	95% Confidence Intervals
Hours of Sleep	1.05 **	0.51	2.86	1.05, 7.76
External Injuries				
no injuries	0.00		1.00	
injuries	2.11 **	0.9	8.28	1.41, 48.13
Tinetti	-0.18 **	0.08	0.83	0.71, 0.98

* p<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Table 6.37: Survival Analysis Model for Time-To-Second-Fall for Intervention Participants, Falls Intervention Study, 1995-1996 (Final Model 2).

Independent Measures	Parameter Estimate	Stand. Error	Relative Risk	95% Confidence Intervals
Hours of Sleep	1.26 **	0.55	3.51	1.20, 10.36
External Injuries				
no injuries	0.00		1.00	
injuries	2.04**	0.9	7.72	1.32, 44.88
Timed Up & Go	0.07 **	0.03	1.07	1.01, 1.14

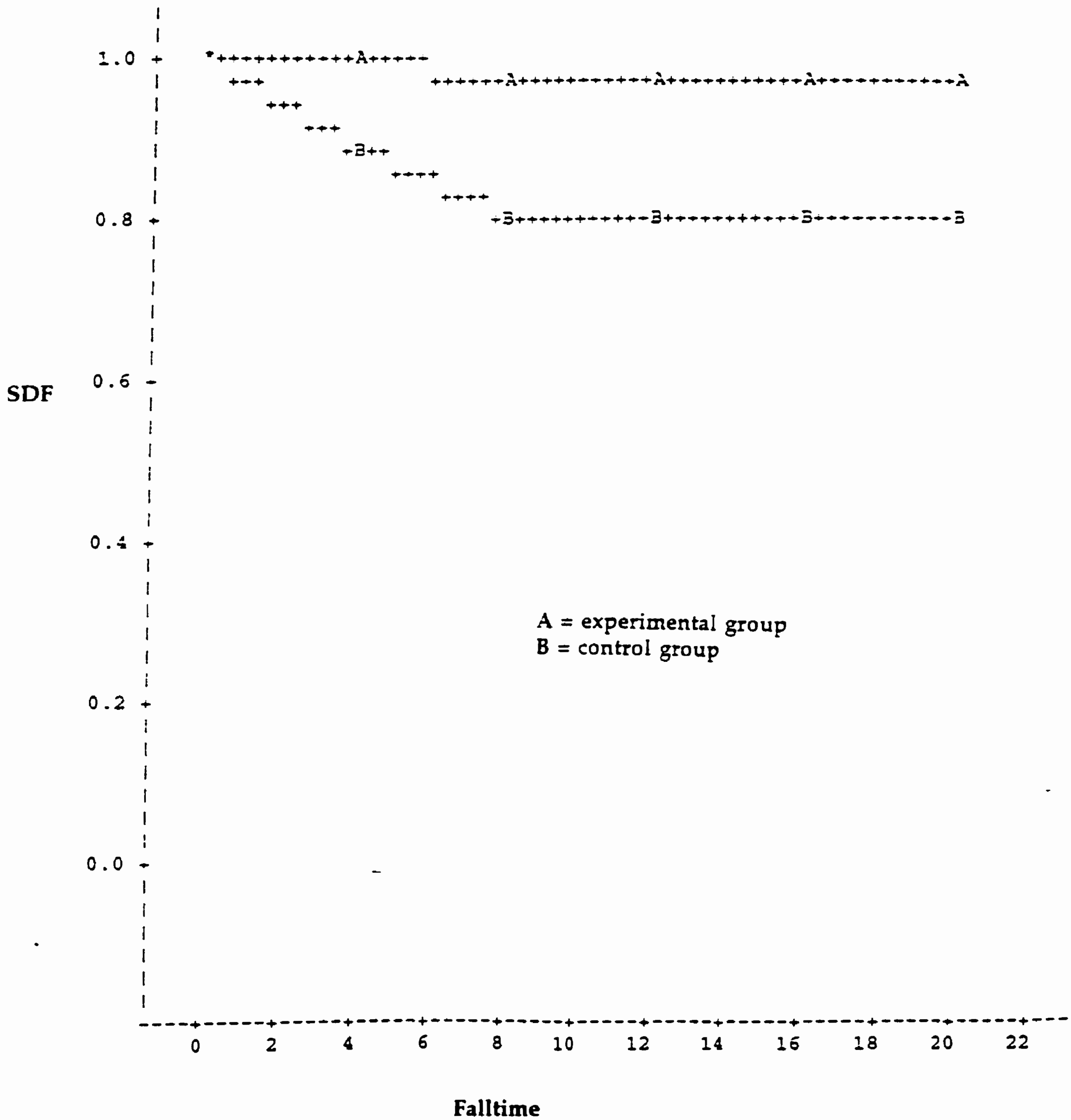
* p<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Table 6.38: Survival Analysis Model for Time-To-Second-Fall for Intervention Participants, Falls Intervention Study, 1995-1996 (Final Model 3).

Independent Measures	Parameter Estimate	Stand. Error	Relative Risk	95% Confidence Intervals
Heart Condition				
no heart condition	0.00		1.00	
heart condition	1.59 *	0.90	4.88	0.84, 28.62
External Injuries				
no injuries	0.00		1.00	
injuries	2.58 ***	0.93	13.25	2.13, 81.68
ABC	-0.06 ***	0.02	0.94	0.91, 0.98

* $p<0.10$ ** $p<0.05$ *** $p<0.01$ ¥ $p<0.001$

Figure 6.1: Survival Distribution Function for Time-to-Second/Multiple-Falls, by Group



(Note: SDF=Survival Distribution Function)

Table 6.39: T-Test Results for Change Score for Tinetti's Measure of Balance (Time 2 - Time 1) by Group, Falls Intervention Study, 1995-1996

Intervention Groups	Mean (Standard Deviation)	T-Test Results
Control	1.60 (3.25)	2.52 ***
Experimental	3.66 (2.73)	

* 0<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Table 6.42: T-Test Results for Change Score for Tinetti's Measure of Balance (Time 3 - Time 1) by Group, Falls Intervention Study, 1995-1996

Intervention Groups	Mean (Standard Deviation)	T-Test Results
Control	0.87 (4.36)	2.82 ***
Experimental	3.86 (3.18)	

* 0<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Figure 6.3 : Mean (95%CL) Tinetti Scores for Balance in Experimental (Gray) and Control (White) Groups, Time 1 to Time 3

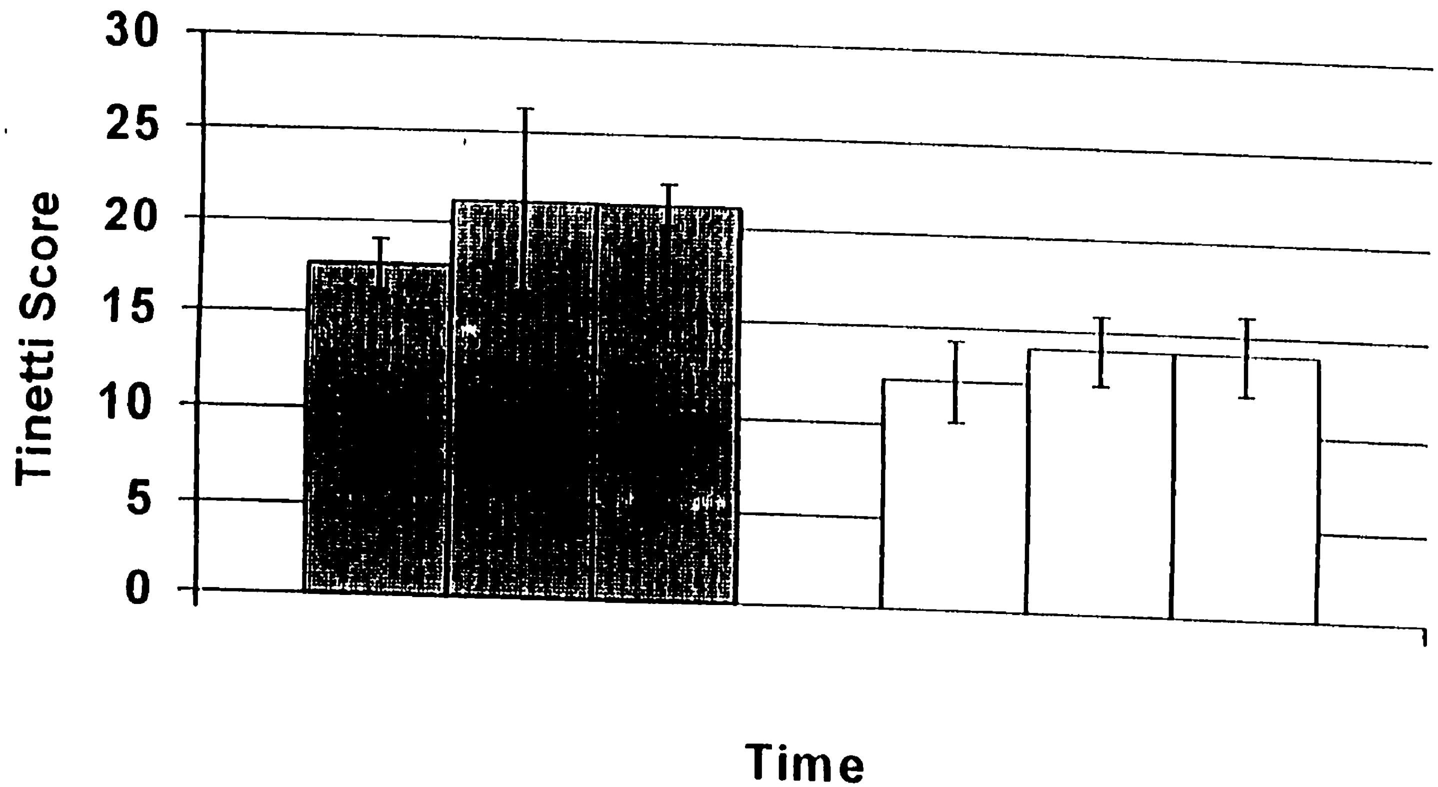


Table 6.41: T-Test Results for Change Score for Timed Up & Go Test (Time 2 - Time 1) by Group, Falls Intervention Study, 1995-1996

Intervention Groups	Mean (Standard Deviation)	T-Test Results
Control	-0.89 (5.33)	-0.46 ***
Experimental	-1.47 (4.04)	

* 0<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Table 6.42: T-Test Results for Change Score for Timed Up & Go Test (Time 3 - Time 1) by Group, Falls Intervention Study, 1995-1996

Intervention Groups	Mean (Standard Deviation)	T-Test Results
Control	-0.39 (3.98)	-1.17
Experimental	-1.99 (5.46)	

* 0<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Figure 6.4 : Mean (95%CL) Up & Go Scores for Balance in Experimental (Gray) and Control (White) Groups, Time 1 to Time 3

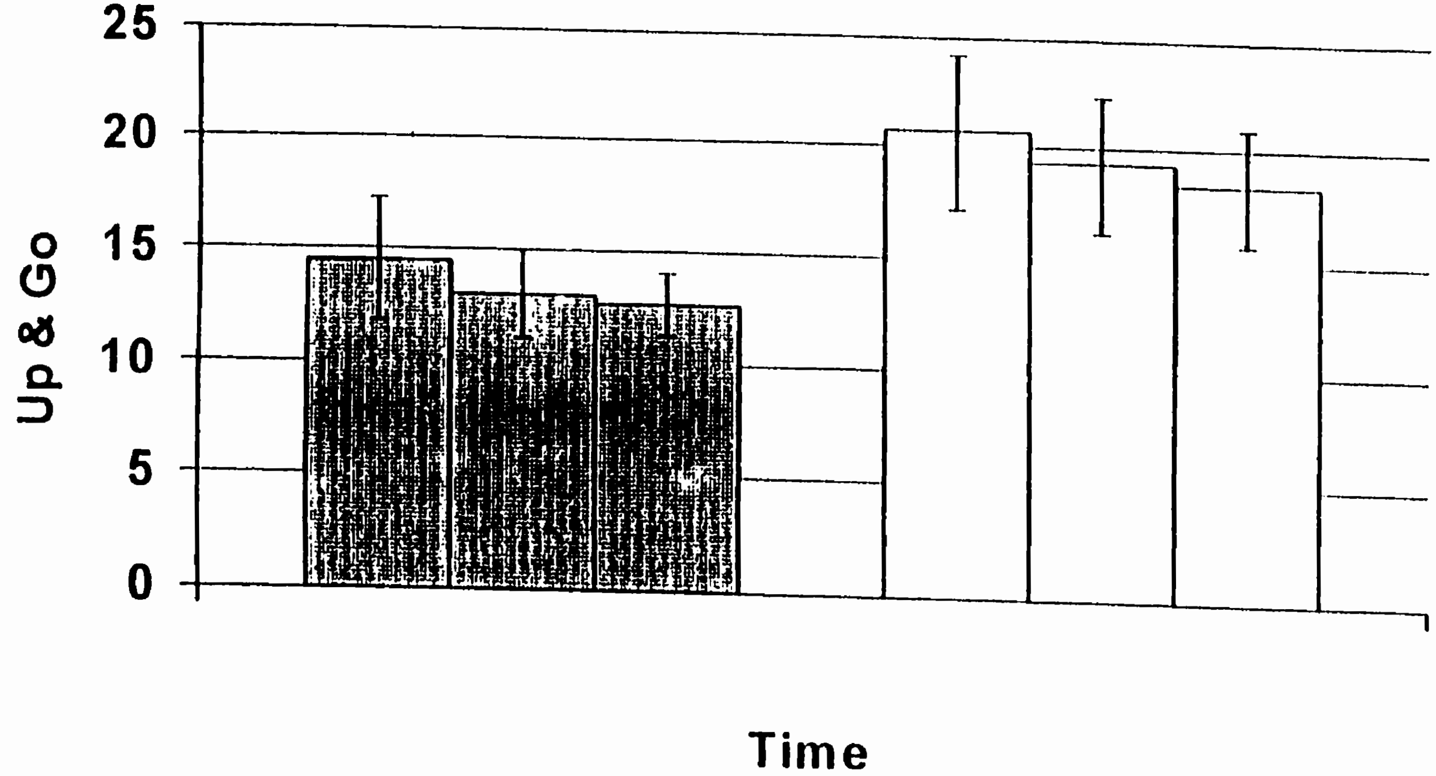


Table 6.43: T-Test Results for Change Score for ABC Measure of Balance Confidence (Time 2 - Time 1) by Group, Falls Intervention Study, 1995-1996

Intervention Groups	Mean (Standard Deviation)	T-Test Results
Control	-3.32 (16.02)	2.07 **
Experimental	4.17 (10.28)	

* 0<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Table 6.44: T-Test Results for Change Score for ABC Measure of Balance Confidence(Time 3 - Time 1) by Group, Falls Intervention Study, 1995-1996

Intervention Groups	Mean (Standard Deviation)	T-Test Results
Control	-12.59 (21.80)	3.48 ***
Experimental	5.25 (13.15)	

* 0<0.10 ** p<0.05 *** p<0.01 ¥ p<0.001

Figure 6.5 : Mean (95%CL) ABC Scores for Balance Confidence in Experimental (Gray) and Control (White) Groups, Time 1 to Time 3

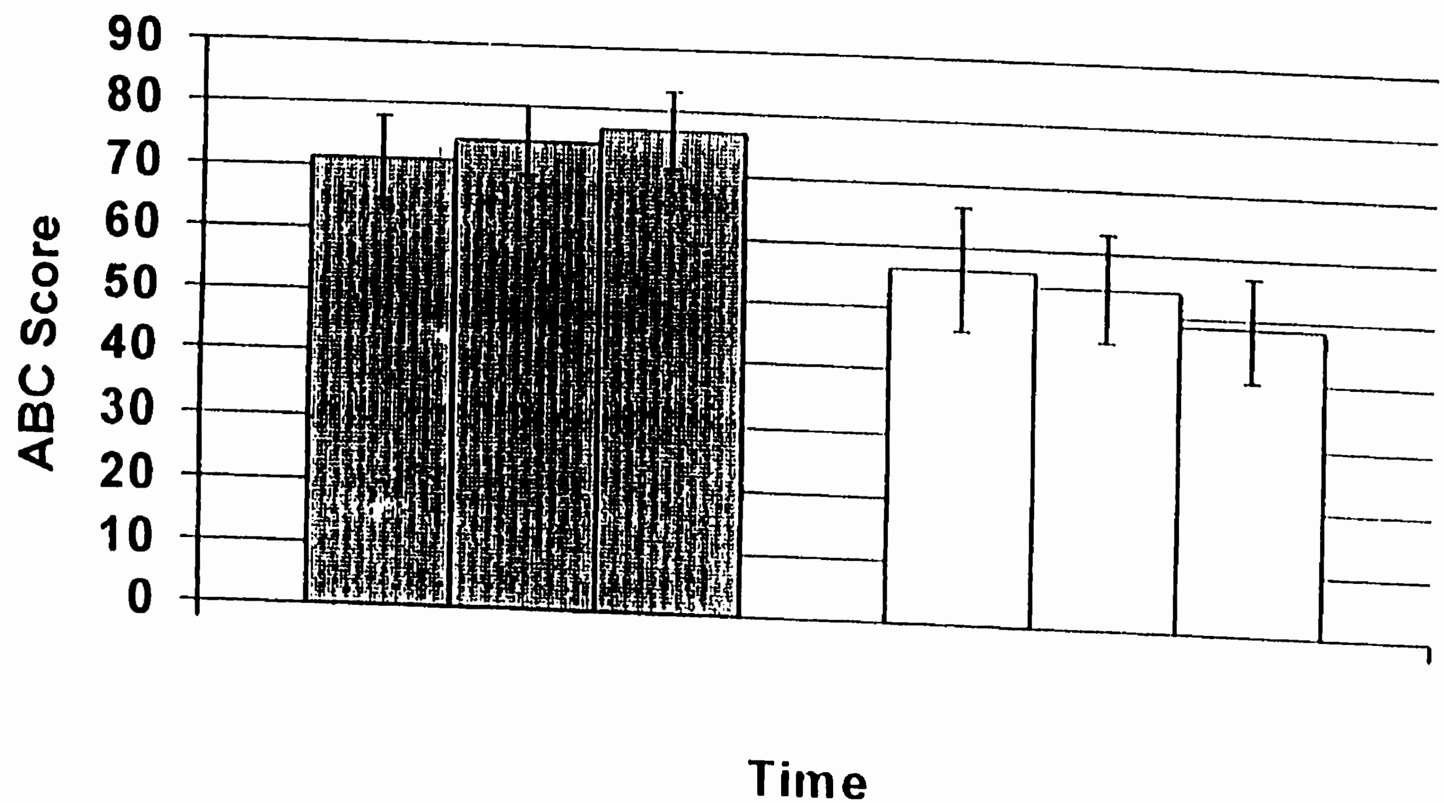


Table 6.45: Final Multiple Linear Regression Model for Tinetti Balance Scores at Time 1, Falls Intervention Study 1995-1996.

Variables	Parameter Estimate	Standard Error	p-Value
Age	1.98	0.94	0.04
Age Squared	-0.01	0.01	0.02
Group			
Experimental	0.00		
Control	-3.03	1.06	0.01
Gastrointestinal Medication			
non-use	0.00		
use	-4.05	1.24	0.002
Activity Level			
more	0.00		
as	-1.24	1.29	0.34
less	-2.92	1.33	0.03
R-Square	**F-Value**	**degrees of freedom**	**Prob>F**
0.57	11.29	6	0.0001

Table 6.46: Final Multiple Linear Regression Model for Tinetti Balance Scores at Time 2, Falls Intervention Study 1995-1996.

Variables	Parameter Estimate	Standard Error	p-Value
Tinetti Balance Score at Time 1	0.58	0.07	0.0001
Group			
experimental	0.00		
control	-4.30	0.72	0.0001
Fall Status			
0 falls	0.00		
1 fall	-1.23	0.62	0.05
R-Square	**F-Value**	**degrees of freedom**	**Prob>F**
0.82	74.31	3	0.0001

Table 6.47: Final Multiple Linear Regression Model for Tinetti Balance Scores at Time 3, Falls Intervention Study 1995-1996.

Variables	Parameter Estimate	Standard Error	p-Value
Tinetti Balance Score at Time 2	0.96	0.06	0.0001
Psychotropic Use			
non-use	0.00		
use	-1.13	0.32	0.001
R-Square	**F-Value**	**degrees of freedom**	**Prob>F**
0.86	144.16	2	0.0001

Table 6.48: Final Multiple Linear Regression Model for Timed Up & Go Scores at Time 1, Falls Intervention Study 1995-1996.

Variables	Parameter Estimate	Standard Error	p-Value
Age	-4.35	1.72	0.01
Age Squared	0.03	0.01	0.01
Education			
elem/some secondary	0.00		
high school/some post-sec	-4.62	2.52	0.07
diploma/university	-5.02	2.16	0.02
Gastrointestinal Medication			
non-use	0.00		
use	5.49	2.09	0.01
Psychotropic Use			
non-use	0.00		
use	4.67	2.88	0.01
R-Square	**F-Value**	**degrees of freedom**	**Prob>F**
0.46	7.56	6	0.0001

Table 6.49: Final Multiple Linear Regression Model for Timed Up & Go Scores at Time 2, Falls Intervention Study 1995-1996.

Variables	Parameter Estimate	Standard Error	p-Value
Up & Go at Time 1	0.62	0.06	0.0001
Group			
experimental	0.00		
control	2.51	1.00	0.02
Trouble Going to Sleep	2.62	0.98	0.01
R-Square	**F-Value**	**degrees of freedom**	**Prob>F**
0.77	56.29	3	0.0001

Table 6.50: Final Multiple Linear Regression Model for Timed Up & Go Scores at Time 3, Falls Intervention Study 1995-1996.

Variables	Parameter Estimate	Standard Error	p-Value
Up & Go at Time 2	0.78	0.05	0.0001
Group			
experimental	0.00		
control	1.16	0.64	0.08
R-Square	**F-Value**	**degrees of freedom**	**Prob>F**
0.87	157.99	2	0.0001

Table 6.51: Final Multiple Linear Regression Model for ABC (Balance Confidence) Scores at Time 1, Falls Intervention Study 1995-1996.

Variables	Parameter Estimate	Standard Error	p-Value
Age	- 0.93	0.32	0.01
Sleep	- 4.26	2.01	0.04
Marital Status			
married	0.00		
widowed	-17.91	11.96	0.14
divorced/separated	-62.25	17.91	0.001
single	-25.64	12.44	0.04
Alcohol Consumption			
non-drinker	0.00		
less than 1/week	11.33	5.20	0.03
daily or weekly	10.42	10.73	0.34
Gastrointestinal Medication			
non-use	0.00		
use	-14.89	5.96	0.02
Activity Level			
more	0.00		
as	-6.24	6.56	0.34
less	-15.68	6.72	0.20
R-Square	**F-Value**	**degrees of freedom**	**Prob>F**
0.53	5.75	10	0.0001

Table 6.52: Final Multiple Linear Regression Model for ABC (Balance Confidence) Scores at Time 2, Falls Intervention Study 1995-1996.

Variables	Parameter Estimate	Standard Error	p-Value
ABC Score at Time 1	0.61	0.06	0.0001
Group			
experimental	0.00		
control	-12.48	2.88	0.002
Family Support	2.00	0.84	0.02
Fall Status in Study			
fell	1.00		
did not fall	-6.75	3.31	0.05
R-Square	**F-Value**	**degrees of freedom**	**Prob>F**
0.77	43.45	4	0.0001

Table 6.53: Final Multiple Linear Regression Model for ABC (Balance Confidence) Scores at Time 3, Falls Intervention Study 1995-1996.

Variables	Parameter Estimate	Standard Error	p-Value
Age	-0.50	0.19	0.01
ABC at Time 2	0.84	0.09	0.0001
Group			
experimental	0.00		
control	-11.26	3.38	0.002
R-Square	**F-Value**	**degrees of freedom**	**Prob>F**
0.79	55.51	3	0.0001

6.3: Summary Discussion for the Intervention Study, 1995-1996

While interpreting the findings from the intervention study, the following caveats must be taken into account. This intervention was a pilot study to test the effectiveness of balance control and education in the prevention of falls. Although prevention should be approached through a multidisciplinary focus (see, for example, Tinetti et al., 1994), limited resources and financial constraints of the author did not permit this type of focus. The approach utilized attempted to test the feasibility of two strategies that have been under-developed in the area of falls prevention to date. For example, specifically using balance control exercises in the prevention of falls is not that common within the literature. Most of the exercise intervention programs used for fall prevention have consisted of other types of exercises, and have not had a complete focus on balance control. Further, the use of a balance control program within the water has not been tested as of yet, and offers a promising new approach for fall prevention, particularly since the chance of incurring an injury (e.g., fall) within the water is unlikely. Additionally, the space (e.g., room size, pool size) available for the classes at the retirement homes was limited and could not accommodate large groups of individuals for participation. The classes were therefore restricted in size and number, which in effect resulted in rather small sample sizes, specifically for the group that participated within the rehabilitation pool. Hence, separate analysis of the two experimental groups (e.g., pool group, gymnasium group) and the control group was not possible because of the small numbers within the pool. However, despite these limitations the findings from this pilot study have the potential to contribute to the prevention of falls for seniors, particularly the significant importance of the use of balance control exercises in improving balance and decreasing falls.

6.3.1: Interpretation of the Results

Three models were obtained for time-to-first-fall and for time-to-second-fall (multiple falls) for the participants within the study, since the balance measures (e.g., Tinetti's measure of balance, Up & Go, ABC) were significantly correlated with each other. It is important to note that the risk factors for the models with the same outcomes are generally the same. Conversely, the risk factors for time-to first-fall (Tables 6.23-6.25) compared to time-to-second-fall (Tables 6.36-6.38) are different, with the exception of the measure of balance or balance confidence, which remains significant in all six models.

Gender was significant within the models for time-to-first-fall; however, unlike the findings from the SAI (Chapter 3) and NPHS (Chapter 4), males were more likely to experience a fall as compared to females (Tables 6.23-6.25). The finding that males were more likely to experience a fall may be called into question since there were only seven men within the study, four of which experienced one fall; however, three of these men that experienced a fall used an assistive device for mobility purposes (2 used walkers and 1 used a cane). It is thus possible that their mobility limitations, rather than gender per se, and their greater frailty increased their risk. Given that most of the literature has found females to be more susceptible to falls (see, for example, Campbell et al., 1981; Prudham & Evans, 1981; Wild et al., 1981), the findings from this study would have to be replicated.

For the survival analysis models for time-to-first-fall, family support increased seniors' risk of falling (Table 6.23-6.25). These findings reflect those in the analysis of the SAI (Chapter 3) and NPHS (Chapter 4); however, the question specifically parallels the question from the SAI regarding support of family and friends. It is possible that having more support of family/friends could potentially be a surrogate measure of frailty (Chapter 4), but it is unlikely the case in this study. The precise relationship between increased family/friend support and risk of falling needs to be examined in further detail, in order to determine the exact mechanism involved with increased support increasing fall risk. It is possible that individuals that have more support, have more opportunity to expose themselves to a variety of different situations (e.g., are able to leave the retirement homes), which may be unfamiliar to them, and thus places them at an increased risk. Nine of the falls that did occur during the study period occurred outside of the retirement homes. However, until further work has been completed, no firm conclusions regarding this matter will be provided.

A past history of falls was also significantly related to time-to first-fall (Tables 6.23-6.25). In the community-based literature, several studies have found previous falls to be significantly related to risk of future falls (see, for example, Prudham & Evans, 1981; Teno et al., 1990). Nevitt et al. (1989) and Nickens (1985) have suggested that a history of falls (particularly multiple falls) may be indicative of an intrinsic problem responsible for the fall risk (e.g., chronic disease; physiological disability). Nevitt et al. (1989) report that certain chronic diseases may actually increase risk of falling (e.g., arthritis and parkinson's disease), and be the result of the pain, impaired joint motion, or reduced muscle strength around the affected joints (e.g., arthritis) or problems with postural control (e.g., parkinson's disease).

Increased hours of sleep was associated with an increased risk of falling for time-to-second-fall (Table 6.36 & 6.37). The analysis of the SAI (chapter 3) found that obtaining adequate rest appeared to have a protective effect against the risk of experiencing an injury. It was suggested that inadequate rest may not be a direct risk factor for falling, but may be indicative of overall health status and disease states for individuals that are at risk of falling. In the findings from the intervention study, higher levels of rest were associated with higher fall risk. The same analogy from the SAI can be applied to the present results. Elderly persons that slept for longer periods of time were frailer, and needed more rest than the healthier elderly. It is also possible that individuals that were frailer and needed assistance going to bed from the retirement home staff were put down for the night at earlier times, and thus resulted in the increased hours of sleep.

Experiencing an injury that occurred outside of the home within the past year was also significantly related to an increased risk of falling (Tables 6.36-6.38); however, the large confidence intervals for this measure suggest the use of caution when interpreting the results. It is important to note that the occurrence of external injuries also included falls. In fact, all of the external injuries that occurred were falls that occurred outside of their location of residence. Thus, the unfamiliarity of the surroundings or encounter with environmental hazards may have played a role in their risk for falling (see, for example, Wild et al., 1981). Further, the suggestions proposed by Nevitt et al. (1991) concerning fall risk and some intrinsic problem related to past falls (e.g., chronic disease), may also be responsible for the falls (or external injuries) that occurred.

Individuals that reported a heart condition were significantly more likely to be at risk for time-to-second-fall, but only for the model with ABC scores (Table 6.38). Once again, the large confidence intervals surrounding the relative risk should be interpreted with caution. This finding has been substantiated within the literature (see, for example, Lipsitz, 1991; Prudham & Evans, 1981), although Lipsitz (1991) notes that little research has been conducted in this area. Lipsitz (1991) contends that although cardiovascular risk factors often are exhibited in the form of syncope (result of transient hypotension, inadequate oxygen delivery to brain), cerebral hypoperfusion may also present resulting symptoms of postural instability, near syncope, dizziness, and resultant falls. Further, many physiological changes associated with aging (e.g., decreased cerebral blood flow, impaired extracelluar volume regulations, decreased baroreflex sensitivity) can impair blood pressure homeostasis, resulting in a predisposition for falling. In addition, several cardiovascular diseases (e.g., valvular heart disease, cardiac arrhythmias, hypotensive syndromes) can lead to falling or fainting for the elderly. Lipsitz (1991) asserts that the combination of the multiple pathological or physiological changes associated with age can predispose the elderly for fall risk or syncopal episode, particularly during ordinary activities of daily living.

Balance and balance confidence scores were significantly related to falls for all the models for time-to-first-fall (Table 6.23-6.25) and time-to-second-fall (Tables 6.36-38). Odds ratios below 1.00 for Tinetti's tool of balance assessment (Tables 6.23 & 6.36) and the ABC (balance confidence) (Tables 6.25 & 6.38) revealed protective effects of better balance and balance confidence. Conversely, for the timed Up-&-Go test, where higher scores are indicative of poorer balance, odds ratios of greater than 1.00 were shown. Support for these findings is evident within the literature. For example, using a sample of 1103 community-dwelling seniors, risk factors associated with experiencing a serious fall injury included cognitive impairments, two or more chronic conditions, impaired balance and gait, and a low body mass index score (Tinetti et al., 1995A). Specifically, the odds ratio of impaired balance and gait was 1.8 (95% C.I.=1.3-2.7). Further, Robbins et al. (1989) identified hip weakness, poor balance, and number of medications prescribed, as significant predictors of falling through the use of logistic regression analysis. In addition to these findings, other support for the relationship between impaired balance and risk of falling has been substantiated within the literature (see, for example, Craven & Bruno, 1986; Overstall et al., 1977; Wild et al., 1981A). According to the Kellogg International Work Group (1987) balance is not a unitary function, but rather a system which utilizes a number of functions, which subsequently utilize several anatomical structures (e.g., visual, vestibular, proprioceptive system). Kane et al. (1989) report that changes in postural control and gait play a substantial role in falling, particularly because of the age-related factors that contribute to instability (see Table 1.3 in Chapter 1). Additionally, Sattin (1992) contends that gait and balance abnormalities that contribute to falling may also be the result of medication use or the presence of disease, in addition to the age-related changes. Hence, it is not surprising that seniors are at risk of falling, given these age-related changes in balance, and the increase in use of medications and in disease affliction with advancing age.

With respect to the effects of the intervention, it would appear that the balance control classes were beneficial to the participants in the experimental group. Although the seniors in the control group may have had lower levels of balance and balance confidence at baseline (not significantly different for ABC and Up-&-Go tests), the experimental group improved their balance confidence and balance scores. Conversely, the control group maintained or decreased their balance confidence and Up-&-Go scores, indicative of no improvement in either measure. The scores for the measure of balance by Tinetti, did however, increase at Time 2 and then was maintained at Time 3. In addition the control group experienced significantly more falls than the experimental group, and experienced two deaths, two hip fractures (and subsequent hospitalizations), and three disabling illnesses that did not enable these individuals to be tested at Times 2 and 3. At this point it cannot be concluded whether the intervention did have an affect on the fall rates and hip fractures of the control group, since it is possible that other factors may be responsible for the differences between the two groups (e.g., medication use, illness).

The significant improvements in the balance measures yield important results towards the prevention effort. Past research utilizing exercise/and or balance programs have generally failed to elicit improvements in balance in the elderly (see, for example, MacRae et al., 1994; McMurdo & Johnstone, 1995; Reinsch et al., 1992), with the exception of the FICSIT interventions (see, for example, Tinetti et al., 1994; Province et al., 1995). Use of exercises (described in Appendix 5) may be a useful tool in the future development of exercise classes, specifically exercises designed to improve balance control, in the prevention of falls for the elderly. Unfortunately, it was not possible to test the differences between the programs in the gymnasium and in the pool, because of the small numbers within the pool.

The use of the falls education segment as a tool in the prevention of falls was not adequately assessed by this pilot study. It was hoped that a "real" control group, meaning a group with neither the falls education or exercises classes, could have been used within this study. However, retirement home recruitment was a difficult task, and not enough facilities were willing to participate, in order to test the control condition. Further, the limited budget for this project may not have been able to support the addition of other retirement homes. Thus, the applicability of this tool to the prevention of falls will be assessed in future prevention programs for falls.

The results for the linear regression models generate interesting findings. For each of the models at Time 1, various measures of health status (e.g., medication use, medical conditions), age, group and activity level, were predictive of balance and/or balance confidence (Table, 6.45,6.48, 6.51). There was no measure of any balance assessment for Time 1. Conversely, for the models at Times 2 and 3, only the balance/balance confidence measure at Times 1 or 2, and one or two other risk factors (e.g., group, fall status, medication use, trouble going to sleep, age, family support) (Table 6.46, 6.47, 6.49, 6.50, 6.52, 6.53) were predictive of balance/balance confidence at Times 2 and 3, respectively. Thus, it would appear that not only does balance affect future balance levels (see, linear regression results), but also plays a significant role in the risk of falling (see, survival analysis results). Overstall et al. (1977) contend that balance is the first of the four human capabilities (namely, balance, flexibility, strength, endurance) to display a performance decrement, which may then result in deficits in the other three measures, primarily because of disuse of these systems (Kellogg International Work Group, 1987). This being the case, decrements in balance control could invoke a spiralling decline in other body systems that render the elderly at risk of falling.

6.3.2: Implications For Future Research

Future research should focus on several issues regarding the risk factors and prevention aspects of this pilot study. One of the first issues relates to replication of the present pilot study, improving for several of the issues below (e.g., sample size, longer intervention, longer follow-up), and the assessment of the education program in the prevention of falls. For example, conducting studies with longer follow-up periods would enable the study of the association between seasonal change and risk of falling. With respect to the exercise program, lengthening the time period for the exercise classes may result in more substantial improvements in balance and balance confidence, which may affect the fall rate between the groups. Increasing the sample size would allow for a more detailed analysis of the different interventions, and provide more confidence with the existing findings. Also, the pool based intervention was feasible in terms of implementation, and thus warrants more detailed study. Use of the tool for fall collection (diary method) was successful and should be tested further in future studies. Lastly, testing areas other than balance control and education (e.g., nutrition, medical interventions, strengthening exercises) may be more beneficial in reducing falls attributable to different causes.

CHAPTER 7: SUMMARY DISCUSSION

The occurrence of falls appears to affect approximately one third of individuals over the age of sixty-five, and accounts for substantial morbidity, mortality, and disability among seniors. Further, despite the low percentage of falls resulting in fractures, the absolute number of seniors that endure fractures taxes the health care system considerably (Kellogg International Work Group, 1987). Additionally, falls that do not result in serious injury, hospitalization, or death have the potential to affect seniors' socially and psychologically (e.g., loss of confidence, restriction of mobility, fear of falling) {see, for example, Kane et al., 1989; Tideiksaar, 1989}. Thus, the provision of accurate information about the risk factors and preventive strategies for falls among the elderly formed the rationale behind the present analyses. The purpose of this final section is twofold: (1) to consolidate the information obtained from the analyses of the four data sets, namely, the Survey on Ageing and Independence, the National Population Health Survey, the Program Needs Survey at Freeport Hospital, and the intervention program for falls, and (2) to provide recommendations for future research and policy implications for falls.

7.1: Consolidation of Information

Table 7.1 was constructed to provide a synopsis of the fall risk factors identified within this research. This table provides a summary of the variables found to be significant within one or more of the final models. Although several of the risk factors recurrently appear in the final models, it is important to remember that not all of the potential risk factors were available in each of the data sets, thereby limiting comparisons across the models. For example, medication information was not included in the Survey on Ageing and Independence, and information pertaining to home maintenance was not a part of the National Population Heath Survey. Thus, shaded areas in the table indicate variables that were not included within the survey. Further, Lilley et al. (1995) note that findings of studies from institutional settings are likely to differ from community settings, since residents of institutions are typically older, frailer, more likely to be taking medications and using assistive devices, and are subject to stricter building and fire hazard regulations.

It is also important to remember that the majority of these analyses were completed on cross-sectional data, and thus may have obscured the directionality or causal pathways of the results obtained. For example, it is possible that greater social support does not increase risk of (or cause) falling, but rather the likelihood of falling affects the level of support one receives. In order to confirm the temporal order of pathways that exist between the predictor variables and falls, longitudinal data are required.

Despite these issues, the use of multiple sources afforded several strengths to the present study. For example, similar conclusions derived from different sources or with dissimilar populations, yields greater confidence in the findings. Within these analyses, several variables were recurrently identified as risk factors for falls in the different data sources (e.g., the female gender, irregular rest and sleep patterns, use of medications, support, diagnosis, balance/mobility problems). Further, the use of nationally representative data sets enables the findings to be extrapolated to a larger population because of the reduction of selection bias inherent in the survey design. Additionally, these analyses have provided detailed information about the risk factors for one-time and multiple fallers (i.e., time-to-first-fall and time-to-second-fall) through the use of survival analyses, although the results generally revealed similar results for the different types of fall statuses. The examination of effect modification revealed the existence of interaction terms (e.g., age by gender, age by activity limitation, gender by home maintenance), but only within the models based on the Survey on Ageing and Independence data. These findings reveal the varying levels of risk with interacting variables, and support the continued examination of these interactions in future research work pertaining to falls. Several issues have also been generated from the compilation of the findings from these models, which deserve further attention. Namely, the roles of age, gender, and balance/mobility in relation to fall risk will be addressed in greater detail.

7.1.1: Is Falling Part of Normal Aging?

The Kellogg International Work Group (1987) suggest that the notion of some older people, their families, and healthcare professionals that falling is a consequence of old age must be refuted. Falling is not a part of the normal aging process, but can be attributed to the interactions between underlying disease, medication use and environmental hazards (see, for example, Nelson & Amin, 1990; Tideiksaar, 1989). Further support for this contention lies in the fact that people of all ages experience falls, and not just the elderly (Hornbrook et al., 1991), and that not all elderly people experience falls. Thus, if falling were synonymous with aging, then all aging individuals would experience higher probability of falls with increasing frequency over time. However, only two of the final models in the present analyses contained the age variable. Nelson and Amin (1991) believe that falling is a symptom of some underlying problem, and that it is not a diagnosis eligible for inclusion in the Medical Diagnostic Indices or the International Classification of Diseases. Tideiksaar (1989) contends that as aging occurs the causative factors that rest in falls differ for the interaction of intrinsic factors (e.g., multiple "normal" physiological aging changes, disease, medication use) and extrinsic factors (e.g., environmental hazards). For example, the young-old (75 years of age and younger) are most likely to fall because of normal aging changes (e.g., postural balance), and their interaction with the environment (e.g., throw rugs), while the old-old (75 years of age and older) generally fall because of an underlying health problem (e.g., cardiac disease) and use of medications. Thus, it would appear that falling is not a part of the aging process, but rather that chronological age may be a surrogate measure of certain conditions (e.g., disease, medication use) that accompany advanced age.

7.1.2: Why Are Females More Likely to Fall?

Being female was associated with an increased risk of falling independent of a number of confounding factors in the models for the two national data sets (the Survey on Ageing and Independence and the National Population Health Survey) and in the majority of the falls literature (see, for example, Kellogg International Work Group, 1987). Rationale has already been provided as to the findings of males being at risk within the intervention study. Several considerations could potentially account for the increased frequency of fall incidence among the female gender, after controlling for other factors. Females may be more willing to report the occurrence of a fall episode, and variability in reporting may therefore account for the gender bias. However, this is not supported by recent findings from a prospective study of incidence rates for fall-related hospitalizations among benzodiazepine users and non-users (Maxwell et al., in press; Neutel et al., 1996). These results revealed that females using sedatives and tranquilizers were more likely to be hospitalized as a result of falls as compared to males, providing evidence against the hypothesis that females may actually report more falls than males. Differential mortality may also account for these findings between males and females. Specifically, frail or unhealthy males may have been "selected out" (died), thus leaving a greater proportion of healthy males within the population, that were not susceptible to experiencing a fall (see Hirdes & Forbes (1993) for an additional discussion on differential mortality).

An alternative possibility for the gender differences is that the use of imprecise measures, and the exclusion of some other factor(s) lead to incomplete coverage of all mechanisms linking gender and falls. For instance, do women have certain medical conditions or use particular medications that make them more susceptible to falling? and have all diseases and/or medications been measured? or are the numbers too small to be statistically significant within the analyses, An example of a medical condition that may contribute to the gender differences is osteoporosis which occurs more frequently among women than men (Myers et al., 1991; Sattin, 1992). Osteoporosis, which is characterized by abnormal rarefaction of bone, occurs most frequently in postmenopausal women (Glanze et al., 1990), primarily because of the differences in bone density between the genders (Birge et al., 1994; Tinetti et al., 1995A), which may in part be attributed to the lower levels of estrogen that accompanies menopause (Grisso & Attie, 1989; Riggs & Melton, 1992). This is one type of condition associated with being female, that may increase the probability of fall-related fractures. Although the development of bone densitometry can be used as a potential screening tool to identify persons at high risk of hip fracture (Sattin, 1992), the only practical means of prevention is the screening of those at risk, primarily normal women at or about the time of menopause and then provide subsequent treatment (Nordin et al., 1994). It is thus possible, that women that experienced hip fractures or falls in studies were not aware of the presence of osteoporosis, and that the female gender became the surrogate of this measure. Future work should concentrate on determining whether there are specific medical conditions and medications associated with women that increase their risk of falls and fractures. Should evidence arise to support this contention, it may justify the completion of separate analyses for risk factors and prevention programs for falls for males and females, or should be controlled for through the use of interaction terms within any analyses undertaken.

7.1.3: Importance of Balance and Mobility In Relation to the Fall Event

A measure of balance control (e.g., mobility, transferring ability, balance confidence) was one of the common factors within all of the final models, with the exclusion of the Survey on Ageing and Independence, which failed to include balance in the survey. The results generally revealed that an impairment in balance control was one of the main predictors of falling. The importance of balance control in the prevention of falls was further strengthened by: (1) the linear regression findings that future balance is best estimated by balance in the past (see Chapter 6), and (2) the intervention results which showed that the experimental group not only improved their balance and balance confidence, but also experienced significantly less multiple falls, fractures, and hospitalizations than the control group.

Satariano et al. (1996) report that despite the importance and growing recognition of the relevance of imbalance as a public health issue for seniors, few imbalance studies have been conducted, and little is known about the etiology of imbalance. According to Berg (1989), balance or postural control involves the interaction of sensory information from three sources: (1) the vestibular (provides input about head position in relation to gravity, and motion through linear and angular acceleration of the head), (2) somatosensory (provides information about the movement of body segments with respect to each other), and (3) visual systems (information concerning the body's position with reference to the environment). Under normal conditions the postural control system keeps the body's centre of gravity over the body's base of support (Berg, 1989). However, alterations in the ability to balance may alter the proper functioning of the balance control system to prevent falls upon displacement. This system can be impaired by diseases (vestibular disorders, arthritis, cerebrovascular accidents) and/or age-related changes (e.g., losses in visual acuity, losses in depth perception) that affect any of the structures involved in balance control, by medications that decrease efficient functions of the structures of balance control (e.g., reduction of mental alertness and speed of transmission in the central nervous system), and by environmental factors (e.g., environmental hazards) {Kellogg International Work Group, 1987}. Vandervoort et al. (1992) suggest that it is doubtful that one of systems that slow with age is solely accountable for the increased number of falls in the elderly, since other systems would compensate for these deficient functions. It is further suggested that as all systems become compromised it may be more difficult to correct an unstable body position, resulting in a failure of the postural control system and a fall (Patla et al., 1992; Vandervoort et al., 1990).

Further, Satariano et al. (1996) suggest a number of questions that should be addressed with respect to the relationship between imbalance and other health conditions:

> (1) "is imbalance only part of the sequelae of specific diagnosed conditions, such as a stroke or diabetes, or does imbalance also occur independently of those conditions", (2) "if imbalance does occur independently of specific chronic conditions", does this suggest "that there are different types or forms of imbalance with different, as yet unknown, etiologies?", and (3) given that there is little information concerning the independent effects of cognitive impairment, musculoskeletal problems, health behaviours, use of medications, and amount of physical activity, how are these factors related to the development of imbalance?.

In an attempt to address some of these concerns, Satariano et al. (1996) conducted a study to identify the demographic, behavioral, and health factors associated with the presence of imbalance with individuals over the age of 55. They found that imbalance was greater among females, those of advanced age (85 years of age and older), and individuals with low levels of education. Further, specific chronic conditions (e.g., hypertension, stroke, cataracts) were significantly associated with imbalance. Additionally, after adjusting for all of these conditions, imbalance was related to reduced lower-body strength, short-term memory, hip pain, vision problems, current cigarette smoking, and refraining from the use of alcohol.

These results suggest that there may be various forms of imbalance, and as a result the effectiveness of existing interventions (e.g., exercise interventions, balance control interventions) may vary depending upon the type of imbalance in question. Thus, Satariano et al., (1996) suggested that, in order for the improvement of balance to occur, future work should examine the etiology of different forms of imbalance (e.g., early versus late onset imbalance; imbalance that is the result of chronic conditions) in the development of future interventions. Whether or not the type of imbalance effects the incidence or type of falling among seniors remains to be seen, but should be considered within future research.

7.1.4: Prevention of Falls Among the Elderly

The prevention component of this dissertation showed that a balance control exercise program has the potential to increase balance confidence and balance, and aid in the prevention of falls with community-based elderly. The effectiveness of the education program is in need of further evaluation, before conclusions can be drawn about its utility in the prevention of falls (e.g., medication use, reduction of environmental hazards). This dissertation does not suggest that the balance control element be used as the sole strategy for reduction of falls, given that there are a number of potentially modifiable risk factors for falling that were not addressed by this intervention (e.g., behavioral recommendations for postural hypotension, training in transfer skills), primarily because of lack of resources (e.g., involvement of physicians and physical therapists). However, the results from the intervention study do warrant the further examination of balance control programs within a gymnasium or pool setting, in conjunction with a multifactorial risk abatement intervention (Tinetti et al., 1994) as described previously.

Future directions for intervention programs for falls must approach prevention from a multidisciplinary perspective, as suggested by the evidence on the various risk factors for falls from different domains. Examining these risk factors in detail (Table 7.1), showed the reoccurance of several variables, namely, the female gender, irregular rest/sleep patterns, use of medications, diagnosis, and balance/mobility. Based on this evidence, it would seem necessary to include these elements within future prevention programs. For example, since women appear to be at greatest risk of falling and experiencing hip fractures, targetting females, particularly those of advanced age, for intervention must be a priority within future research; however, targetting this group specifically does not negate the need for prevention among other groups of individuals. In addition, targetting individuals that would benefit from such an intervention should also be considered. This type of intervention may then not be appropriate for the frailest elderly, if they are not able to partake in the program.

The recurrent risk factors from Table 7.1 also suggest that medication use, diagnosis and rest/sleep to be important elements in falling for seniors. Thus, these elements should be included in an intervention, within an education program format (e.g., benefits of rest/sleep, medical conditions that may increase risk, proper use of medication) or possibly as part of a geriatric assessment by a physician or nurse (e.g., medication review, controlling some of side effects of certain diagnoses that may increase fall risk). Also, improving balance control, through the use of a similar balance control program as described within this dissertation, appears to be one of the most important elements necessary within an intervention. However, it is important that all factors be incorporated into a multifactorial program (see, for example, Tinetti's (1994) multifactorial risk abatement intervention) in order to substantially reduce risk of falling. Further, to effectively study prevention, longitudinal studies must be conducted to determine the causal pathways between the variables in question. In addition, further examination of other areas (e.g., the effects of dietary supplements, such as vitamin D and calcium, in the prevention of fractures, particularly among females that are more likely to develop osteoporosis) is warranted (Lilley et al., 1995).

7.2: Future Research and Policy Implications

With the population aging, the need to prevent falls will become more important for the quality of life of the elderly and for the control of health care costs of the nation. Weindruch et al. (1991) contend that physical frailty, defined as severe impairments in strength, mobility, balance, and endurance, combined with undesirable behavioral, environmental, and social conditions increase the risk of injuries, such as falling. Previously, elderly persons with physical impediments were treated palliatively, rather than with preventive or rehabilitative strategies (Weindruch et al., 1991); however, frailty and age-related changes that contribute to falling do not represent conditions that are inevitable and irreversible, and they are amenable to intervention. In order to maintain or improve the quality of life of seniors and to manage the health care costs attributable to falls, further work is essential.

There are several limitations in the falls research that contribute to the lack of knowledge concerning the risk factors and prevention strategies for falls. However, through the use of multiple data sources, as utilized within this analyses, and through the collaboration of researchers studying falls, the potential to overcome these limitations seems probable. The greatest limitation facing falls research is the lack of a standard, universal definition and classification system for falls; however, with reports such as the publication by leading fall researchers that comprise the Kellogg International Work Group (1987), the acceptance of a universal definition for falls appears conceivable. Lach et al. (1991) contend that the multiplicity of risk factors for falls may obscure the different risk factors for different types of falls, and their relative contribution of risk may also differ. Thus, guidelines must be developed to outline the different fall types in order for ease of comparison between research groups. This process would best be accomplished through a forum of falls researchers, with similar commitments towards the prevention of falls. Sattin (1992) advocates the need for researchers to provide better translation and dissemination of their findings to health care providers. The establishment of the FISCIT trails within the United States authenticates the possibility of such an endeavour.

Although retrospective (see, for example, Blake et al., 1988; Prudham & Evans, 1981) and cross-sectional (see, for example, Wickham et al.,1989) designs may limit the conclusions drawn from studies, they made invaluable contributions to the development of more recent longitudinal studies and surveys (e.g., National Population Health Survey). Additionally, studies that do not approach the fall event from a multidisciplinary perspective (see for example, Braudy-Harris, 1989; Sobel & McCart, 1983) may overlook significant risk factors for falling or interpret inappropriately confounding explanations for some factors associated with falling.

In order for the prevention of falls to occur, the myth held by some health professionals, elderly and their family members about falls being a normal consequence of aging must be dispelled. The Kellogg International Work Group (1987) contends that many physicians overlook the need to question seniors about fall episodes. If information about the potentially modifiable risk factors for falling is made available to health professionals and the elderly, the dissemination of this information may aid in prevention. However, for falls that are attributed to diseases or health conditions, a thorough geriatric assessment may be warranted, and initiated by the physician. Tideiksaar and Kay (1986) suggest that the following be completed: (1) detailed fall history (e.g., where and when falls occurred, use of assistive devices at time of fall, presence of symptoms at time of fall, activity engaged in at time of fall, inclusion of medical conditions and medications), (2) physical examination to rule out all intrinsic causes of falling (e.g., emphasis on examination of the cardiovascular system, musculoskeletal system, and neurological system), (3) gait and balance assessment, (4) laboratory investigation that is based on information obtained from the history and physical assessment (e.g., electrocardiogram).

Through the use of multiple data sources several noteworthy issues concerning risk factors and prevention strategies were identified. For example, within these analyses certain risk factors (e.g., female gender, irregular rest/sleep patterns, use of medications, support, diagnosis, balance and mobility) were recurrently identified, thus indicating areas in which to focus future research. In addition, the multivariate analyses of the risk factors for one-time and multiple fallers within the institutional and community-based settings provided detailed information about risk of falling depending on one's fall status. Since the results generally revealed similar risk factors for one-time and multiple fallers, it is possible that intervention strategies may not have to differ between the fall groups; however, replication of these results and verification of this hypothesis is necessary. Additionally,the continued examination of the varying levels of risk associated with interacting variables is warranted, given the results from the Survey on Ageing and Independence. Also, the results from this dissertation suggest the need for inclusion of factors from a number of realms (e.g., physical, medical, social, psychological) in future studies examining the risk factors and prevention strategies for falls. Falling is generally not the result of one particular risk factor, as indicated by this thesis, and thus should not be studied in this fashion. Lastly, given that the balance intervention program appeared to signficantly improve balance and balance confidence in the experimental group, it would seem necessary to continue to examine this intervention, but as a segment in a more comprehensive prevention program for falls.

Table 7.1: Summary of Fall Risk Factors for the Data Analyses

Classification of Variables	Variables of Interest	SAI Models: Internal	SAI Models: External	SAI Models: Internal Severe	SAI Models: External Severe	NPHS Models	Freeport Models: Time-To-1st-Fall	Freeport Models: Time-to-2nd-Fall	Intervention Models: Time-To-1st-Fall	Intervention Models: Time-to-2nd-Fall
Socio-demographic Variables	Advanced Age	• (▣)				•				
	Female Gender	• (▣)	• (▣)	•		•			Males@ risk	
	Higher Education	•	•	•						
Health Practice Variables	Avoids Alcohol	•	•							
	Smoker	•								
	Irregular Rest	•	•	•	•					•
	Medication use					• (†)	• (††)			
Social Support Variables	Not Married		•		•					
	Family Support	•		•					•	
	Friend Support	•		•						

† increased risk (analgesics, sleeping pills), decreased risk (high blood pressure medications)
‡ increased risk (arthritis, urinary problems)
▣ interaction term

†† increased risk with psychotherapeutics
‡‡ increased risk (heart problems)

continued ...

Table: Summary of Fall Risk Factors for the Data Analyses

Classification of Variables	Variables of Interest	SAI Models				NPHS Model	Freeport Models		Intervention Models	
		Internal	External	Internal Severe	External Severe		Time-To-1st-Fall	Time-to-2nd-Fall	Time-To-1st-Fall	Time-to-2nd-Fall
Measures of Frailty	Activity Limitations	• (▣)	•	•	•					
	Poor Perceived Health			•						
	Health Change						•	•		
	Diagnosis					• (‡)	• (‡‡)			• (‡‡)
	Fall History								•	
	Received Homecare					•				
	External Injury									•

† increased risk (analgesics, sleeping pills), decreased risk (high blood pressure medications)
‡ increased risk (arthritis, urinary problems)
▣ interaction term
†† increased risk with psychotherapeutics
‡‡ increased risk (heart problems)

continued ...

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Classification of Variables	Variables of Interest	SAI Models				NPHS Model	Freeport Models		Intervention Models	
		Internal	External	Internal Severe	External Severe		Time-To-1st-Fall	Time-to-2nd-Fall	Time-To-1st-Fall	Time-to-2nd-Fall
Exposure to Risk Variables	More Activity Vs Others	•		•						
	Assisted Others		•		•					
	Home in Need of Repairs	• (▣)	• (▣)	•						
Balance & Stability Measures	Impaired Balance								•	•
	Mobility					• (impaired)	• (walks)	• (walks)		
	Transfers Independently						•	•		
	Decreased Balance Confidence								•	•

† increased risk (analgesics, sleeping pills), decreased risk (high blood pressure medications)
‡ increased risk (arthritis, urinary problems)
▣ interaction term

†† increased risk with psychotherapeutics
‡‡ increased risk (heart problems)

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Appendix 1: Survey on Ageing and Independence (Chapter 3)

1 2 3 4
5
6
7 8
9
10.
11 12

Time period	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
09:00 - 12:00						
12:01 - 16:00						
16:01 - 19:00						
19:01 - 21:00						

	Language of interview	Final Status Code	Start time	Finish time
1 ○ Phone interview 2 ○ Personal interview	3 ○ English 4 ○ French		:	:

Introduction

Hello. I'm ______________ from Statistics Canada. I'm calling to complete a questionnaire on your retirement or pre-retirement plans, your health and lifestyle. By the year 2000, close to one third of Canada's population will be over 45 years of age. Your answers will provide information to policy and program developers for today's seniors and the seniors of tomorrow.

All the information we collect in this survey will be kept confidential.

I would like to begin by asking you some questions about yourself.

SECTION A. Main activity

A.1 What is your current marital status? Are you ....

1 ○ **Married or living common-law?**

2 ○ **Separated?**

3 ○ **Divorced?**

4 ○ **Widowed?**

5 ○ **Single** *(never married)*? ▶ *Go to A.3*

A.2 *(See A.1)* **How long have you been __________?**

Years *(if less than a year, enter 01)*

A.3 What is the date of your birth?

5 Day 7 Month 8 Year

A.4 Interviewer check item:

1 ○ If born before September 1926 ▶ Go to A.31 (page 4)

2 ○ If born after September 1926 ▶ Go to A.5

3 ○ If born in September 1926, ask respondent:

▶ **Are you now 65 years of age?**

4 ○ **Yes** ▶ *Go to A.31 (page 4)*

5 ○ **No** ▶ *Go to A.5*

Respondents under 65 years

A.5 **Do you currently have a paid job or operate a business or farm?**

6 ○ Yes

7 ○ No ▸ *Go to A.17 (next page)*

A.6 **During the past twelve months, that is since September 1990, how many weeks did you work at any job or business? Include time for vacation, illness, strikes or lockouts.**

☐☐ **Weeks worked**

A.7 Interviewer check item:

1 ○ If 00 weeks worked reported in A.6 ▸ *Go to A.12*

2 ○ Otherwise ▸ *Go to A.8*

A.8 **During those weeks, was the work mostly full-time, that is 30 hours or more per week, or part-time, that is less than 30 hours per week?**

3 ○ Full-time

4 ○ Part-time ▸ *Go to A.12*

Full-time workers

A.9 **Which of the following are major activities in your life at this time?** *(Mark all that apply)*

1 ○ **Working for pay or profit?**

2 ○ **Managing a home or being a homemaker?**

3 ○ **Taking care of a family member or close friend?**

4 ○ **Doing volunteer work?**

5 ○ **Something else?**

Interviewer: if only one activity marked, go to A.11

A.10 **Of the activities just mentioned, what best describes the main thing you currently do?** *(Mark one only)*

1 ○ Working for pay or profit

2 ○ Managing a home or being a homemaker

3 ○ Working for pay or profit and managing a home

4 ○ Taking care of a family member or close friend

5 ○ Doing volunteer work

6 ○ Something else

Part-time workers and workers with 00 weeks worked in past 12 months

A.12 **Which of the following are major activities in your life at this time?** *(Mark all that apply)*

1 ○ **Working for pay or profit?**

2 ○ **Managing a home or being a homemaker?**

3 ○ **Taking care of a family member or close friend?**

4 ○ **Doing volunteer work?**

5 ○ **Something else?**

Interviewer: if only one activity marked, go to A.14

A.13 **Of the activities just mentioned, what best describes the main thing you currently do?** *(Mark one only)*

1 ○ Working for pay or profit

2 ○ Managing a home or being a homemaker

3 ○ Working for pay or profit and managing a home

4 ○ Taking care of a family member or close friend

5 ○ Doing volunteer work

6 ○ Something else

A.14 **Have you permanently stopped working full-time for pay or profit?**

1 ○ Yes

2 ○ No ▸ *Go to A.16*

3 ○ Don't know ▸ *Go to A.16*

A.15 **Do you consider yourself to be retired?**

4 ○ Yes ▸ *Go to SECTION B (page 5)*

5 ○ No

Non-workers

A.17 **Are you currently looking for work?**

1 ○ Yes

2 ○ No ▶ *Go to A.23*

Non-workers – Looking for work

A.18 **Which of the following are major activities in your life at this time?** *(Mark all that apply)*

3 ○ **Looking for work?**

4 ○ **Managing a home or being a homemaker?**

5 ○ **Taking care of a family member or close friend?**

6 ○ **Doing volunteer work?**

7 ○ **Something else?**

Interviewer: if only one activity marked, go to A.20

A.19 **Of the activities just mentioned, what best describes the main thing you currently do?** *(Mark one only)*

1 ○ Looking for work

2 ○ Managing a home or being a homemaker

3 ○ Taking care of a family member or close friend

4 ○ Doing volunteer work

5 ○ Something else

A.20 **Are you looking for full-time work, that is, 30 hours or more per week, or part-time work, less than 30 hours per week?**

6 ○ Full-time ▶ *Go to A.22*

7 ○ Part-time

8 ○ Both ▶ *Go to A.22*

A.21 **Have you permanently stopped working full-time for pay or profit?**

1 ○ Yes ▶ *Go to SECTION B (page 5)*

2 ○ No

3 ○ Don't know

Non-workers – Not looking for work

A.23 **Which of the following are major activities in your life at this time?** *(Mark all that apply)*

1 ○ Managing a home or being a homemaker?

2 ○ Taking care of a family member or close friend?

3 ○ Doing volunteer work?

4 ○ Something else?

Interviewer: if only one activity marked, go to A.25

A.24 **Of the activities just mentioned, what best describes the main thing you currently do?** *(Mark one only)*

5 ○ Managing a home or being a homemaker

6 ○ Taking care of a family member or close friend

7 ○ Doing volunteer work

8 ○ Something else

A.25 **Did you ever work full-time for pay or profit, that is 30 hours or more per week?**

1 ○ Yes

2 ○ No ▶ *Go to SECTION D (page 8)*

A.26 **In what year did you last have a paid job or operate a business or farm?**

[|] Year

A.27 **Have you permanently stopped working full-time for pay or profit?**

3 ○ Yes

4 ○ No ▶ *Go to A.30*

5 ○ Don't know ▶ *Go to C.2 part b. (page 7)*

A.28 **Are you permanently unable to work because of a disability?**

6 ○ Yes

7 ○ No

A.29 **Did you ever retire from a job or business? Exclude lay-offs, quitting, or stopping work to have a family.**

1 ○ Yes ▶ *Go to SECTION B (page 5)*

2 ○ No ▶ *Go to SECTION D (page 8)*

A 31 In what year did you last have a paid job or operate a business or farm?

Year ▸ Go to A 46 (next page)

OR

501 ◯ Currently working

502 ◯ Never worked ▸ Go to A 43 (next page)

Currently working

A 32 During the past twelve months, that is since September 1990, how many weeks did you work at any job or business? Include time for vacation, illness, strikes or lockouts.

Weeks worked

A 33 Interviewer check item:

2 ◯ If 00 weeks worked reported in A 32 ▸ Go to A 38

3 ◯ Otherwise ▸ Go to A 34

A 34 During those weeks, was the work mostly full-time, that is 30 hours or more, or part-time, that is less than 30 hours?

1 ◯ Full-time

2 ◯ Part-time ▸ Go to A 38

Full-time workers

A 35 Which of the following are major activities in your life at this time? (Mark all that apply)

3 ◯ Working for pay or profit?

4 ◯ Managing a home or being a homemaker?

5 ◯ Taking care of a family member or close friend?

6 ◯ Doing volunteer work?

7 ◯ Something else?

Interviewer: If only one activity marked, go to A 37

A 36 Of the activities just mentioned, what best describes the main thing you currently do? (Mark one only)

1 ◯ Working for pay or profit

2 ◯ Managing a home or being a homemaker

3 ◯ Working for pay or profit and managing a home

4 ◯ Taking care of a family member or close friend

5 ◯ Doing volunteer work

6 ◯ Something else

A 37 At what age do you expect to retire?

Age ▸ Go to SECTION C (page 7)

Part-time workers and workers with 00 weeks worked in past 12 months

A 38 Which of the following are major activities in your life at this time? (Mark all that apply)

1 ◯ Working for pay or profit?

2 ◯ Managing a home or being a homemaker?

3 ◯ Taking care of a family member or close friend?

4 ◯ Doing volunteer work?

5 ◯ Something else?

Interviewer: If only one activity marked, go to A 40

A 39 Of the activities just mentioned, what best describes the main thing you currently do? (Mark one only)

1 ◯ Working for pay or profit

2 ◯ Managing a home or being a homemaker

3 ◯ Working for pay or profit and managing a home

4 ◯ Taking care of a family member or close friend

5 ◯ Doing volunteer work

6 ◯ Something else

A 40 Have you permanently stopped working full-time for pay or profit?

1 ◯ Yes

2 ◯ No ▸ Go to A 42

3 ◯ Don't know ▸ Go to A 42

A 41 Do you consider yourself to be retired?

4 ◯ Yes ▸ Go to SECTION B (next page)

5 ◯ No

A 42 At what age do you expect to retire?

5

Age ▸ Go to SECTION C (page 7)

Never worked

A.43 **Are you permanently unable to work because of a disability?**

1 ○ Yes

2 ○ No

A.44 **Which of the following are major activities in your life at this time?** *(Mark all that apply)*

3 ○ Managing a home or being a homemaker?

4 ○ Taking care of a family member or close friend?

5 ○ Doing volunteer work?

6 ○ Something else?

Interviewer: if only one activity marked, go to SECTION D (page 8)

A.45 **Of the activities just mentioned, what best describes the main thing you currently do?** *(Mark one only)*

1 ○ Managing a home or being a homemaker

2 ○ Taking care of a family member or close friend

3 ○ Doing volunteer work

4 ○ Something else

Now go to SECTION D (page 8)

Stopped working

A.46 **Which of the following are major activities in your life at this time?** *(Mark all that apply)*

5 ○ Managing a home or being a homemaker?

6 ○ Taking care of a family member or close friend?

7 ○ Doing volunteer work?

8 ○ Something else?

Interviewer: if only one activity marked, go to A.48

SECTION B. Retirement

Now I have some questions about your retirement.

B.1 **What was your age when you retired?**
(If respondent retired more than once, use last retirement)

3 [|] Age at retirement

OR

401 ○ Didn't retire ▶ Go to *SECTION D (page 8)*

B.2 **Would you say your retirement was voluntary, that is you retired when you wanted to?**

5 ○ Yes

6 ○ No

B.3 **There are many preparations that people make for retirement. Did you ...**

	Yes	No
a. change your work pattern? *(For example, work part-time or work more hours)*	01 ○	02 ○
b. develop physical activities?	03 ○	04 ○
c. develop other leisure activities and hobbies?	05 ○	06 ○
d. gather retirement information? *(For example, talk with a consultant, attend a course)*	07 ○	08 ○
The next few questions are about your household financial preparations for retirement. Did you...		
e. contribute to an RRSP? ..	09 ○	10 ○
f. build up your savings? ...	11 ○	12 ○
g. make other investments? *(Includes buying properties)*	13 ○	14 ○
In preparation for retirement, did you ...		
h. pay-off or avoid debts? ..	15 ○	16 ○
i. make major purchases? ..	17 ○	18 ○

B.6 There are many reasons why people retire. Which of the following were reasons why you retired?

	Yes	No
a. Your health	01 ◯	02 ◯
b. To provide care to a family member	03 ◯	04 ◯
c. Had adequate retirement income *(such as pensions and investments)*	05 ◯	06 ◯
d. Mandatory retirement policies	07 ◯	08 ◯
e. Company early retirement plan	09 ◯	10 ◯
f. Your job ended and you were unable to find other work	11 ◯	12 ◯
g. Pressure from co-workers to retire	13 ◯	14 ◯
h. Wanted to stop working	15 ◯	16 ◯

B.7 *Interviewer check item: (See A.1)*

1 ◯ *If respondent is married or living common-law ▶ Go to B.8*

2 ◯ *Otherwise ▶ Go to B.9*

B.8 Sometimes people's reasons for retirement are influenced by their spouse/partner. Which of the following reasons influenced your retirement?

	Yes	No
a. Your spouse/partner's health	1 ◯	2 ◯
b. Your spouse/partner's retirement income *(such as pensions and investments)*	3 ◯	4 ◯
c. The timing of your spouse/partner's retirement	5 ◯	6 ◯
d. Pressure from your spouse/partner to retire	7 ◯	8 ◯

B.9 After you retired, did you ever go back to work at any job or employment?

1 ◯ Yes

2 ◯ No ▶ *Go to B.12*

B.10 Was this ... *(Mark one only)*

3 ◯ for the same employer?

4 ◯ for a different employer?

5 ◯ for yourself or your own business?

B.12 At the moment you officially retired, for whom did you work? *(Name of business, government department or agency, or person.)*

B.13 What kind of business, industry or service was this? *(Give full description: e.g., federal government, canning industry, forestry services.)*

B.14 What kind of work were you doing? *(E.g., office clerk, factory worker, forestry technician.)*

B.15 In this work, what were your most important activities or duties? *(E.g., filing documents, drying vegetables, forest examiner.)*

B.16 In this job, did you work mainly...

1 ◯ in your own business, farm or professional practice? ▶ *Go to Section E (page 9)*

2 ◯ for others for wages, salary or commission?

The next few questions ask about preparations for retirement.

C.1 At the age you expect to retire, do you think that your income and investments will be adequate to enable you to retire?

1 ○ Yes

2 ○ No

3 ○ Don't know

C.2 There are many preparations that people make for retirement. Have you done or are you doing any of the following ...

	Yes	No
a. changed your work patterns? *(For example, worked part-time or worked more hours)*	01 ○	02 ○
b. *(There are many preparations that people make for retirement. Have you done or are you doing any of the following ...)* developed physical activities?	03 ○	04 ○
c. developed other leisure activities and hobbies?	05 ○	06 ○
d. gathered retirement information? *(For example, talked with a consultant or attended a course)*	07 ○	08 ○

The next few questions are about your household financial preparations for retirement. Have you ...

	Yes	No
e. contributed to an RRSP?	09 ○	10 ○
f. built up your savings?	11 ○	12 ○
g. made other investments? *(Includes buying properties)*	13 ○	14 ○

In preparation for retirement, have you ...

	Yes	No
h. paid-off or avoided debts?	15 ○	16 ○
i. made major purchases?	17 ○	18 ○

C.3 Do you have a pension plan through employment *(besides Canada-Québec Pension Plan)*?

1 ○ Yes

2 ○ No

C.4 Do you feel that you are adequately preparing for your retirement?

3 ○ Yes

4 ○ No

C.5 There are many reasons why people retire. Which of the following will most likely be the reasons that you retire? Will it be ..

	Yes	No	Don't know
a. Your health?	31 ○	32 ○	33 ○
b. Your need to provide care to a family member?	04 ○	05 ○	06 ○
c. Having adequate retirement income? *(Such as pensions and investments)*	07 ○	08 ○	09 ○
d. Mandatory retirement policies?	10 ○	11 ○	12 ○
e. Company early retirement plan?	13 ○	14 ○	15 ○
f. Your job ending and you being unable to find other work?	16 ○	17 ○	18 ○
g. Pressure from co-workers to retire?	19 ○	20 ○	21 ○
h. Wanting to stop working?	22 ○	23 ○	24 ○

C.6 *Interviewer check item. (See A.1)*

1 ○ *If respondent is married or living common-law* ▸ *Go to C.7*

2 ○ *Otherwise* ▸ *Go to SECTION E (page 9)*

C.7 Sometimes people's reasons for retirement are influenced by their spouse/partner. Which of the following will most likely influence your retirement?

	Yes	No	Don't know
a. Your spouse/partner's health	01 ○	02 ○	03 ○
b. Your spouse/partner's retirement income *(such as pensions and investments)*	04 ○	05 ○	06 ○
c. Your spouse/partner's retirement	07 ○	08 ○	09 ○
d. Pressure from your spouse/partner to retire	10 ○	11 ○	12 ○

D.1 There are many preparations that people make for their future. Please tell me if you have done any or are currently doing any of the following ...

	Yes	No
a. developed physical activities?	01 ○	02 ○
b. developed other leisure activities and hobbies?	03 ○	04 ○
c. gathered retirement information? *(For example, talked with a consultant or attended a course)*	05 ○	06 ○

The next few questions are about your <u>household</u> financial preparations for the future. Have you...

	Yes	No
d. contributed to an RRSP?	07 ○	08 ○
e. built up your savings?	09 ○	10 ○
f. made other investments? *(Includes buying properties)*	11 ○	12 ○

In preparation for the future, have you ...

	Yes	No
g. paid-off or avoided debts?	13 ○	14 ○
h. made major purchases?	15 ○	16 ○

D.2 Do you have a pension plan through employment (besides Canada/Quebec Pension Plan)?

1 ○ Yes

2 ○ No

D.3 *Interviewer check item: (See A.1)*

3 ○ *If married or living common-law* ▶ *Go to D.4*

4 ○ *If widowed* ▶ *Go to D.9*

5 ○ *Otherwise* ▶ *Go to SECTION E (next page)*

D.5 At what age do you expect your spouse/partner to retire?

☐☐ Age ▶ *Go to D.7*

OR

01 ○ Don't expect him/her to retire ▶ *Go to D.7*

02 ○ Don't know ▶ *Go to D.7*

D.6 For your spouse/partner, which of the following were reasons for his/her retirement?

	Yes	No	Don't know
a. Your own health?	01 ○	02 ○	03 ○
b. Your spouse/partner's health?	04 ○	05 ○	06 ○
c. The need to provide care to a family member?	07 ○	08 ○	09 ○
d. Having adequate retirement income? *(such as pensions and investments)*	10 ○	11 ○	12 ○
e. Mandatory retirement policies?	13 ○	14 ○	15 ○
f. Company early retirement plan?	16 ○	17 ○	18 ○
g. Lack of available work?	19 ○	20 ○	21 ○

D.7 Does your spouse/partner have a private pension plan through employment *(besides Canada/Quebec Pension Plan)*?

4 ○ Yes

5 ○ No ▶ *Go to SECTION E (next page)*

6 ○ Don't know ▶ *Go to SECTION E (next page)*

D.8 On the death of your spouse/partner would you receive benefits from his/her pension plan *(excluding Canada Quebec Pension Plan or Old Age Security)*?

1 ○ Yes ▶ *Go to SECTION E (next page)*

2 ○ No ▶ *Go to SECTION E (next page)*

3 ○ Don't know ▶ *Go to SECTION E (next page)*

D.9 Did your spouse/partner have a private pension plan through employment *(besides Canada/Quebec Pension Plan)*?

4 ○ Yes

5 ○ No ▶ *Go to SECTION E (next page)*

6 ○ Don't know ▶ *Go to SECTION E (next page)*

Now I am going to ask you a few questions about your activities. Physical activity includes activities you do at work, at home and in your leisure time. It includes activities like walking, gardening, washing windows, dancing and golf.

E.1 Compared to other people your age, would you say that you are physically ...

- 5 ○ more active?
- 6 ○ as active?
- 7 ○ less active?
- 8 ○ don't know

E.2 Do you consider the amount of physical activity you get to be ...

- 1 ○ too much?
- 2 ○ too little?
- 3 ○ the right amount?
- 4 ○ don't know

E.3 Do you think that physical activity makes a difference in helping people avoid health problems like heart disease and high blood pressure as they get older? Does it make ...

- 5 ○ a big difference?
- 6 ○ some difference?
- 7 ○ little or no difference?
- 8 ○ don't know

E.4 Do you think that physical activity makes a difference in helping people remain independent as they get older? Does it make ...

- 1 ○ a big difference?
- 2 ○ some difference?
- 3 ○ little or no difference?
- 4 ○ don't know

E.5 In the next year, do you intend to be more physically active, as active, or less active than you are now?

- 5 ○ More active
- 6 ○ As active
- 7 ○ Less active
- 8 ○ Don't know

Now I want to ask you some questions about activities you do in your leisure time.

E.6 During a typical month, do you often, sometimes or rarely ...

	Often	Sometimes	Rarely
a. watch TV?	01 ○	02 ○	03 ○

During a typical month, do you often, sometimes or rarely ...

	Often	Sometimes	Rarely
b. listen to radio, records, tapes, etc.?	04 ○	05 ○	06 ○
c. have a chat with others on the phone?	07 ○	08 ○	09 ○

During a typical month, do you often, sometimes or rarely ...

	Often	Sometimes	Rarely
d. do arts, crafts, or other hobbies?	10 ○	11 ○	12 ○
e. read papers, magazines, or books?	13 ○	14 ○	15 ○
f. have family or friends over?	16 ○	17 ○	18 ○

Now I am going to ask you a few questions about your activity outside your home.

E.7 During a typical month, do you often, sometimes or rarely ...

	Often	Sometimes	Rarely
a. go to visit friends or relatives?	19 ○	20 ○	21 ○
b. go shopping? *(Excluding groceries)*	22 ○	23 ○	24 ○
c. go out to movies?	25 ○	26 ○	27 ○
d. eat out?	28 ○	29 ○	30 ○
e. go out for a drive?	31 ○	32 ○	33 ○
f. go for a walk?	34 ○	35 ○	36 ○
g. go to clubs, church or a community centre?	37 ○	38 ○	39 ○
h. go to the library?	40 ○	41 ○	42 ○
i. play cards or other games?	43 ○	44 ○	45 ○

E.8 This summer, did you ...

	Yes	No
a. attend sporting events?	1 ○	2 ○
b. attend concerts, plays or other performing arts events?	3 ○	4 ○
c. go to museums or to art galleries?	5 ○	6 ○

E.9 In general, do you feel safe and secure in your house/apartment?

- 1 ○ Yes
- 2 ○ No
- 3 ○ don't know

E.10 In general, do you feel safe and secure outside in your neighbourhood?

- 4 ○ Yes ▸ *Go to SECTION F (next page)*
- 5 ○ No
- 6 ○ don't know ▸ *Go to SECTION F (next page)*

E.11 Does this concern limit your activities outside your home ...

- 1 ○ a great deal?
- 2 ○ somewhat?
- 3 ○ not at all?

I am now going to ask some questions about your health.

F 1 How would you describe your state of health? Would you say, in general, your health is ...

- 4 ◯ excellent?
- 5 ◯ good?
- 6 ◯ fair?
- 7 ◯ poor?
- 8 ◯ Don't know

F 2 Compared to other people your age, would you say your health is ...

- 1 ◯ better?
- 2 ◯ about the same?
- 3 ◯ worse?
- 4 ◯ Don't know

F 3 How one feels at any particular time is affected by life experiences. In the past twelve months have you ...

	Yes	No	Don't know
a. changed or lost a job?	01 ◯	02 ◯	03 ◯
b. changed residence?	04 ◯	05 ◯	06 ◯
c. had a person move into or leave your home?	07 ◯	08 ◯	09 ◯
d. had a death in the family?	10 ◯	11 ◯	12 ◯
e. had a death of a close friend?	13 ◯	14 ◯	15 ◯
f. had a serious illness or injury?	16 ◯	17 ◯	18 ◯
g. had a family member or a friend seriously ill or injured?	19 ◯	20 ◯	21 ◯

F 4 *Interviewer check item*

- 1 ◯ *If any marked "Yes" in F 3 ▶ Go to F 5*
- 2 ◯ *Otherwise ▶ Go to F.7*

F 5 Have you done any of the following to cope with stress from *(Read "Yes" response(s) from F 3)*? Have you been ...

	Yes	No
a. getting help from friends or relatives?	01 ◯	02 ◯
b. getting professional help?	03 ◯	04 ◯
c. getting help from someone who has dealt with a similar experience? *(Exclude self-help groups)*	05 ◯	06 ◯
d. just trying to accept it?	07 ◯	08 ◯
e. keeping busy?	09 ◯	10 ◯
f. praying or meditating?	11 ◯	12 ◯
g. changing the amount you smoke, drink or eat?	13 ◯	14 ◯
h. doing anything else to cope? *(Specify):*	15 ◯	16 ◯

F 7 I want to ask you some questions about the types of things you do on a <u>daily basis</u> to stay healthy. Do you...

	Yes	No
a. eat a balanced diet?	17 ◯	18 ◯
b. get enough rest and sleep?	19 ◯	20 ◯
c. keep physically active?	21 ◯	22 ◯
d. brush your teeth?	23 ◯	24 ◯
e. avoid smoking?	25 ◯	26 ◯
f. avoid alcohol, or drink in moderation?	27 ◯	28 ◯

F.8 Are you at all limited in the kind or amount of activity you can do because of a long-term illness, physical condition or health problem? By long term I mean a condition that lasted or is expected to last more than 6 months.

- 1 ◯ Yes
- 2 ◯ No ▶ *Go to F.15*

F 9 Are your activities limited ...

	Yes	No	Don't know	N.A
a. at home?	01 ◯	02 ◯	03 ◯	04 ◯
b. at work *(or school)*?	05 ◯	06 ◯	07 ◯	08 ◯
c. in other activities *(such as leisure time pursuits or transportation)*?	09 ◯	10 ◯	11 ◯	12 ◯

F 11 How well do you feel you are coping with this limitation? Would you say ...

- 3 ○ very well?
- 4 ○ fairly well?
- 5 ○ not very well?
- 6 ○ not at all well?
- 7 ○ Don't know

F 12 For each of the following activities, tell me if you can do it yourself, if you need assistance, or if you are totally unable to do it.

	Self	Needs help	Unable to do
a. Walking about 3 city blocks without resting	01 ○	02 ○	03 ○
b. Walking up or down a flight of stairs	04 ○	05 ○	06 ○
c. Dressing or undressing	07 ○	08 ○	09 ○
d. Cutting your own toenails	10 ○	11 ○	12 ○
e. Using the toilet	13 ○	14 ○	15 ○

F 13 Because of your condition, do you have any of the following health-care features?

	Yes	No
a. bathroom modifications?	16 ○	17 ○
b. extra handrails throughout your home?	18 ○	19 ○
c. access ramps?	20 ○	21 ○
d. widened doorways?	22 ○	23 ○
e. a street-level entrance *(no steps)*?	24 ○	25 ○
f. an entrance that opens automatically?	26 ○	27 ○
g. an elevator or lift device?	28 ○	29 ○
h. handicap parking?	30 ○	31 ○
i. some other modifications to your home? *(Specify):*	32 ○	33 ○

F 14 Do you have any of the following electronic devices?

	Yes	No
a. Voice Print? *(National Broadcast Reading Services - daily readings of newspapers and magazines via a broadcast system, that is, radio or cable designed for visually-impaired individuals)*	1 ○	2 ○
b. Closed-captioned TV? *(A system for hearing-impaired television viewers whereby a simplified version of the dialogue is printed on screen via a special decoder)*	3 ○	4 ○

Now go to F 16

F 15 Do you have any of the following health-care features at home ...

	Yes	No
a. bathroom modifications such as handrails?	31 ○	32 ○
b. extra handrails throughout your home?	33 ○	34 ○
c. a street-level entrance *(no steps)*?	35 ○	36 ○
d. closed-captioned TV? *(A system for hearing-impaired television viewers whereby a simplified version of the dialogue is printed on screen via a special decoder)*	37 ○	38 ○
e. some other modifications to your home? *(Specify):*	39 ○	40 ○

F 16 Would you describe your life as ...

- 1 ○ very stressful?
- 2 ○ not very stressful? ▶ *Go to F 18*
- 3 ○ not at all stressful? ▶ *Go to F 18*

F 17 What is the main reason for this stress? Is it related to ... *(Mark one only)*

- 4 ○ employment?
- 5 ○ family?
- 6 ○ health?
- 7 ○ finances?
- 8 ○ something else? *(Specify):*

F 18 Here is a list that describes some of the ways people feel at different times. During the past few weeks, how often have you felt ...

	Often	Sometimes	Never
a. On top of the world? Was it	31 ○	32 ○	33 ○
During the past few weeks, how often have you felt ... b. very lonely or remote from other people? Was it	34 ○	35 ○	36 ○
During the past few weeks, how often have you felt ... c. particularly excited or interested in something?	07 ○	08 ○	09 ○
d. depressed or very unhappy?	10 ○	11 ○	12 ○
e. pleased about having accomplished something?	13 ○	14 ○	15 ○
f. bored?	16 ○	17 ○	18 ○
g. proud because someone complimented you on something you had done?	19 ○	20 ○	21 ○
h. so restless you couldn't sit long in a chair?	22 ○	23 ○	24 ○
i. that things were going your way?	25 ○	26 ○	27 ○
j. upset because someone criticized you?	28 ○	29 ○	30 ○

SECTION G. Social Support

There are many ways in which people may give their time and skills. It is hard to remember all the things one could have done during the past year, so let me ask you specifically ...

G.1 During the past twelve months, have you regularly provided any of the following types of assistance to others, either living with you or outside your home? Have you provided help with ...

	Yes	No	Don't know
a. housework?	31 ○	32 ○	33 ○
b. yardwork?	34 ○	35 ○	36 ○
c. meal preparation?	37 ○	38 ○	39 ○
d. grocery shopping?	40 ○	41 ○	42 ○
e. transportation?	43 ○	44 ○	45 ○
f. babysitting?	46 ○	47 ○	48 ○
g. managing money?	49 ○	50 ○	51 ○
h. personal care *(such as bathing, dressing)*?	52 ○	53 ○	54 ○
i. emotional support?	55 ○	56 ○	57 ○
j. volunteer service through a group or organization?	58 ○	59 ○	60 ○

G.2 *Interviewer check item*

1 ○ *If any marked "Yes" in G.1 ▶ Go to G.3*

2 ○ *Otherwise ▶ Go to G.4*

G.3 Who did you help? Was it ...

	Yes	No
.	01 ○	02 ○
b. a mother/father?	03 ○	04 ○
c. a son?	05 ○	06 ○
d. a daughter?	07 ○	08 ○
e. a grandchild?	09 ○	10 ○
f. another family member? *(An in-law or brother sister)*	11 ○	12 ○
g. a friend or neighbour?	13 ○	14 ○
h. a volunteer group or organization?	15 ○	16 ○
i. someone else? *(specify)*	17 ○	18 ○

I am now going to ask you about any help you may have received on a regular basis.

G.4 During the past twelve months, have you regularly received any of the following types of assistance from others either living with you or from outside your home? Have you received help with ...

	Yes	No	Don't know
a. housework?	19 ○	20 ○	21 ○
b. yardwork?	22 ○	23 ○	24 ○
c. meal preparation?	25 ○	26 ○	27 ○
d. grocery shopping?	28 ○	29 ○	30 ○
e. transportation?	31 ○	32 ○	33 ○
f. babysitting?	34 ○	35 ○	36 ○
g. managing money?	37 ○	38 ○	39 ○
h. personal care *(such as bathing, dressing)*?	40 ○	41 ○	42 ○
i. emotional support?	43 ○	44 ○	45 ○

G.5 *Interviewer check item:*

1 ○ *If any marked "Yes" in G.4 ▶ Go to G.6*

2 ○ *Otherwise ▶ Go to G.7*

G.6 Who helped you? Was it ...

	Yes	No
	01 ○	02 ○
b. a mother/father?	03 ○	04 ○
c. a son?	05 ○	06 ○
d. a daughter?	07 ○	08 ○
e. a grandchild?	09 ○	10 ○
f. another family member? *(An in-law or brother sister)*	11 ○	12 ○
g. a friend or neighbour?	13 ○	14 ○
h. a volunteer group or organization?	15 ○	16 ○
i. someone else? *(specify):*	17 ○	18 ○

Now I have a few questions about your family.

G.8 How many brothers and sisters do you have still living? *(Include step, adopted, and half brothers and sisters).*

[|] Number

OR

94 ○ None

G.9 How many children do you have still living? *(Include step and adopted children).*

[|] Number

OR

95 ○ None

I would like you to think now about your family and close friends. By family, I mean spouse or partner, children and other relatives.

G.10 Do you have any family members you feel close to? That is, family members you feel at ease with, can talk to about private matters, or can call on for help?

6 ○ Yes ▸ How many? [|]

7 ○ No ▸ *Go to G.14*

G.11 Thinking about the family member you feel closest to, does this person live ... *(Mark one only)*

1 ○ in the same household as yourself?

2 ○ within your neighbourhood?

3 ○ within the same city or town?

4 ○ in another city or town?

G.12 Is this closest family member male or female?

5 ○ Male

6 ○ Female

G.13 Are you satisfied or dissatisfied with the kind and frequency of contact you have with family members, including personal contact, phone calls and letters?

1 ○ Satisfied

2 ○ Dissatisfied

Is that very or somewhat?

3 ○ Very

4 ○ Somewhat

G.14 Not counting family members, do you have any close friends? That is, do you have any friends with whom you feel at ease, can talk to about private matters, or can call on for help?

5 ○ Yes

6 ○ No ▸ *Go to G.19*

G.15 How many close friends do you have?

[|] Number of close friends

G.16 Thinking about the friend you feel closest to, does this person live... *(Mark one only)*

1 ○ In the same household as yourself?

2 ○ within your neighbourhood?

3 ○ within the same city or town?

4 ○ In another city or town?

G.17 Is this closest friend male or female?

5 ○ Male

6 ○ Female

G.18 Are you satisfied or dissatisfied with the kind and frequency of contact you have with friends, including personal contact, phone calls and letters?

1 ○ Satisfied

2 ○ Dissatisfied

Is that very or somewhat?

3 ○ Very

4 ○ Somewhat

G.19 Do you have a household pet?

5 ○ Yes

6 ○ No

SECTION H. Dwelling Characteristics & Accident and Safety

The next questions concern your home.

H 1 **Is your home in need of any repairs?** ***(Do not include desirable remodelling, additions or conversions)***

1 ◯ Yes

2 ◯ No (only regular maintenance) ▶ *Go to H 3*

H 2 **Does it require major or minor repairs?** ***(Examples of major repairs are sagging floors, damaged walls or damaged electrical wiring. Examples of minor repairs are broken windows, leaking sinks or small cracks in interior walls).***

3 ◯ Major repairs

4 ◯ Minor repairs

5 ◯ Both

H 3 **Do you ... own or rent this dwelling?**

6 ◯ Own

7 ◯ Rent ▶ *Go to H.8*

8 ◯ Other ▶ *Go to H.8*

H 4 **Is this with a mortgage or is your mortgage paid off completely?**

1 ◯ With mortgage

2 ◯ Paid off completely ▶ *Go to H 6*

3 ◯ Don't know ▶ *Go to H 6*

H 5 **What is the amount remaining on your mortgage?**

S ☐☐☐ (nearest thousand - *if greater than 995, enter 996*)

997 ◯ Don't know

998 ◯ Refused

H 6 **If you were selling this dwelling now, for how much would you expect to sell it?**

S ☐☐☐ (nearest thousand - *if greater than 995, enter 996*)

997 ◯ Don't know

998 ◯ Refused

H 7 **In addition to your present home do you ... own other property?** ***(For example, vacation home, rental property, business property or any other real estate)***

1 ◯ Yes ▶ *Go to H 9*

2 ◯ No ▶ *Go to H 13*

H 9 **Is this with a mortgage or is the mortgage completely paid off?** ***(If more than one property, select the higher mortgage).***

5 ◯ With mortgage

6 ◯ Paid off completely ▶ *Go to H 11*

7 ◯ Don't know ▶ *Go to H 11*

H 10 **What is the amount remaining on this mortgage?**

S ☐☐☐ (nearest thousand - *if greater than 995, enter 996*)

997 ◯ Don't know

998 ◯ Refused

H 11 **Is this property ...**

3 ◯ **Inside Canada?**

4 ◯ **Outside Canada?**

H 12 **If you were selling this property now, for how much would you expect to sell it?**

S ☐☐☐ (nearest thousand - *if greater than 995, enter 996*)

997 ◯ Don't know

998 ◯ Refused

H 13 **Have you moved in the past 5 years, that is, since September 1986?**

1 ◯ Yes

2 ◯ No ▶ *Go to H 15*

H 14 **What were the reasons for this move?** *(Mark all that apply)*

01 ◯ To provide care support to a relative

02 ◯ To receive care support from a relative

03 ◯ Job change or transfer

04 ◯ Retirement (of self or spouse partner)

05 ◯ Decline in health (of self or spouse partner)

06 ◯ Separation or divorce

07 ◯ Death of spouse partner

08 ◯ Financial reasons

09 ◯ Previous home too big or too small

10 ◯ Wanted more opportunities for recreation leisure and physical activity

H.15 Many new products available today contribute to an independent life. The next questions are on some electronic devices that you may have in your home.

Do you own or use a ...

In the next year, do you intend to acquire this?

		Yes	No
1. Microwave oven?			
01 ◯ Yes			
02 ◯ No	▶	04 ◯	05 ◯
03 ◯ Don't know			
2. Cable TV?			
06 ◯ Yes			
07 ◯ No	▶	10 ◯	11 ◯
08 ◯ Not available			
09 ◯ Don't know			
3. Pay TV?			
12 ◯ Yes			
13 ◯ No	▶	16 ◯	17 ◯
14 ◯ Not available			
15 ◯ Don't know			
4. VCR?			
18 ◯ Yes			
19 ◯ No	▶	21 ◯	22 ◯
20 ◯ Don't know			
5. Computer?			
23 ◯ Yes			
24 ◯ No	▶	25 ◯	27 ◯
25 ◯ Don't know			
6. Satellite dish?			
28 ◯ Yes			
29 ◯ No	▶	31 ◯	32 ◯
30 ◯ Don't know			

Accident and Safety

H.16 *Interviewer check item:*

1 ◯ *If respondent is 65 years or over (see A.3 & A.4)* ▶ *Go to H.17*

2 ◯ *Otherwise* ▶ *Go to SECTION J (page 17)*

I am now going to ask you some questions about safety in and around your home.

H.17 Thinking about the past twelve months, were you injured in an accident around your home? We are looking for an injury that altered your routine for at least a day.

3 ◯ Yes

4 ◯ No ▶ *Go to H.25*

H.18 Thinking about the most recent accident, what injuries did you have? *(Mark all that apply)*

31 ◯ Cuts
32 ◯ Bruises
33 ◯ Dislocations
34 ◯ Fractures
35 ◯ Sprain Strain
36 ◯ Choking Suffocation
37 ◯ Swelling
38 ◯ Burns
39 ◯ Scalds
40 ◯ Poisoning
41 ◯ Concussion
42 ◯ Tenderness

H.19 Where did the accident happen?

13 ◯ Kitchen
14 ◯ Basement stairs
15 ◯ Basement
16 ◯ Driveway
17 ◯ Frontyard
18 ◯ Backyard
19 ◯ Path or sidewalk
20 ◯ Stairs
21 ◯ Living room
22 ◯ Dining room
23 ◯ Bathroom
24 ◯ Bedroom
25 ◯ Hallway
26 ◯ Entrance way
27 ◯ Other

H 20 Did any equipment or product contribute to the accident?

1 ◯ Yes

2 ◯ No ▶ *Go to H 22*

H 21 What was it?

3 ◯ Kitchen equipment

4 ◯ Bathroom fixtures

5 ◯ Chemicals

6 ◯ Electrical equipment

7 ◯ Carpet or stairs

8 ◯ Other

H 22 What time of day did the accident happen? ...

1 ◯ Morning

2 ◯ Afternoon

3 ◯ Evening

4 ◯ During the night

H 23 Did you get treatment from a health care professional, such as a doctor, or did you treat the injury yourself?

5 ◯ Health care professional

6 ◯ Self

7 ◯ Both

H 24 Did this accident happen in the ...

1 ◯ Fall?

2 ◯ Winter?

3 ◯ Spring?

4 ◯ Summer?

H 25 In the past twelve months, were you injured in an accident <u>away from your home</u> *(excluding automobile accidents)*? We are looking for an injury that altered your routine for at least a day

5 ◯ Yes

6 ◯ No ▶ *Go to SECTION J (next page)*

H 26 Thinking about the most recent accident, what injuries did you have? *(Mark all that apply)*

01 ◯ Cuts

02 ◯ Bruises

03 ◯ Dislocations

04 ◯ Fractures

05 ◯ Sprain Strain

06 ◯ Choking Suffocation

07 ◯ Swelling

08 ◯ Burns

09 ◯ Scalds

10 ◯ Poisoning

11 ◯ Concussion

12 ◯ Tenderness

H 27 What time of day did the accident happen? ...

1 ◯ Morning

2 ◯ Afternoon

3 ◯ Evening

4 ◯ During the night

H 28 Did you get treatment from a health care professional, such as a doctor, or did you treat the injury yourself?

5 ◯ Health care professional

6 ◯ Self

7 ◯ Both

H 29 Did this accident happen in the ...

1 ◯ Fall?

2 ◯ Winter?

3 ◯ Spring?

4 ◯ Summer?

SECTION J. Transportation and Travel

The next section includes questions on transportation and the travels you may have done within the past twelve months.

J.1 Do you have a valid driver's license?

5 ○ Yes

6 ○ No ▸ *Go to J.5*

J.2 Do you or any member of your household lease or own a car or truck?

7 ○ Yes

8 ○ No ▸ *Go to J.5*

J.3 Do you use this vehicle mostly as a driver or passenger?

1 ○ Mostly as a driver

2 ○ Mostly as a passenger

3 ○ Does not use this vehicle ▸ *Go to J.5*

J.4 How often do you drive? ..

4 ○ More than 3 times a week?

5 ○ 1 to 3 times a week?

6 ○ 1 to 3 times a month?

7 ○ Less than once a month?

8 ○ Never?

J.5 Is public transportation, for example, bus, rapid transit or subway, available in your area?

1 ○ Yes

2 ○ No ▸ *Go to J.8*

J.6 Within the past twelve months, have you used local public transportation?

3 ○ Yes

4 ○ No

J.7 Within the past twelve months, have you wanted to use local public transportation but been unable to do so?

5 ○ Yes

6 ○ No

J.8 Within the past twelve months, did you take a trip lasting more than one day outside your city or town?

1 ○ Yes

2 ○ No ▸ *Go to SECTION K (next page)*

J.9 Within the past twelve months, did you take a trip away from home which lasted 4 weeks or more, excluding any business trips?

1 ○ Yes

2 ○ No ▸ *Go to SECTION K (next page)*

J.10 Was this trip within Canada or outside Canada?

3 ○ Within Canada

4 ○ Outside Canada

5 ○ Both

J.11 In what months were you away?
(Mark all that apply)

01 ○ September

02 ○ October

03 ○ November

04 ○ December

05 ○ January

06 ○ February

07 ○ March

08 ○ April

09 ○ May

10 ○ June

11 ○ July

12 ○ August

SECTION K. Demographic Characteristics

K.1 **Were you born in Canada?**

1 ○ Yes ▶ *Go to K.3*
2 ○ No

K.2 **In what country were you born?**

01 ○ United Kingdom
02 ○ Italy
03 ○ U.S.A.
04 ○ India
05 ○ U.S.S.R.
06 ○ Germany
07 ○ Poland
08 ○ Portugal
09 ○ Rep. of China
10 ○ Netherlands
11 ○ Other *(Specify)*

K.3 **What languages do you speak well enough to conduct a conversation?**

12 ○ English
13 ○ French
14 ○ Italian
15 ○ German
16 ○ Chinese
17 ○ Ukrainian
18 ○ Portuguese
19 ○ Dutch
20 ○ Polish
21 ○ Greek
22 ○ Other *(Specify)*

Interviewer: If only one language, go to K.5

K.4 **What is your main language, that is the language in which you are most at ease?** *(Mark more than one only if the respondent is equally at ease in more than one language)*

01 ○ English
02 ○ French
03 ○ Italian
04 ○ German
05 ○ Chinese
06 ○ Ukrainian
07 ○ Portuguese
08 ○ Dutch
09 ○ Polish
10 ○ Greek
11 ○ Other *(Specify)*

K.5 **Canadians come from many ethnic or cultural backgrounds** *(such as French, German, Italian).* **From which ethnic or cultural background did your parents descend?** *(Accept multiple responses, do not probe)*

12 ○ English
13 ○ French
14 ○ German
15 ○ Italian
16 ○ Scottish
17 ○ Irish
18 ○ Ukrainian
19 ○ Chinese
20 ○ Dutch
21 ○ North American Indian
22 ○ Jewish
23 ○ Polish
24 ○ East Indian
25 ○ Portuguese
26 ○ Greek
27 ○ Canadian
28 ○ Other *(Specify)*

K.6 **Did you have any wartime service in the active military force of Canada or its allied forces?**

1 ○ Yes, Canadian
2 ○ Yes, Allied Forces
3 ○ No ▶ *Go to K.9*

K.7 **In which war or conflict did you serve?** *(Mark all that apply)*

4 ○ World War I
5 ○ World War II
6 ○ Korean Conflict
7 ○ Persian Gulf
8 ○ Other

K.8 **Did you serve in ...**

1 ○ Canada
2 ○ Overseas
3 ○ Both

K.9 *Interviewer check item.*

4 ○ *If single (see A.1)* ▶ *Go to Section L (next page)*
5 ○ *Otherwise* ▶ *Go to K.10*

These next few questions are about your household finances.

L.1 In general, how well do your income and investments currently satisfy your needs? ...

1 ○ very well?

2 ○ adequately?

3 ○ not very well?

4 ○ totally inadequately?

5 ○ Don't know

L.2 Looking to your future, how well do you think your income and investments will continue to satisfy your needs? ...

1 ○ very well?

2 ○ adequately?

3 ○ not very well?

4 ○ totally inadequately?

5 ○ Don't know

L.3 Do you have any large debts, that is of $5,000 or more *(exclude mortgages)*?

6 ○ Yes

7 ○ No ▸ *Go to L.5*

8 ○ Don't know ▸ *Go to L.5*

9 ○ Refused ▸ *Go to L.5*

L.4 Is this debt a ...

	Yes	No	Refused
a. personal loan?	01 ○	02 ○	03 ○
b. car loan?	04 ○	05 ○	06 ○
c. home improvement loan?	07 ○	08 ○	09 ○
d. credit card debt? .	10 ○	11 ○	12 ○
e. other debt?	13 ○	14 ○	15 ○

L.5 At the present time, are you assuming any financial responsibility for ...

	Yes	No
a. a child?	1 ○	2 ○
b. any other family member?	3 ○	4 ○
c. anyone else?	5 ○	6 ○

The next questions are about your personal income.

L.6 Are you currently receiving income from any of the following sources? Are you receiving income from ...

	Yes	No
a. work *(self-employment, salaries, wages, commissions, tips)*?	01 ○	02 ○
b. a retirement pension *(include superannuation and annuities)*?	03 ○	04 ○

c. government pension?

05 ○ Yes ▸ Are you receiving income from ...

06 ○ No

	Yes	No
1) Old Age Security Pension, Guaranteed Income Supplement, Spouse's Allowance?	07 ○	08 ○
2) Canada/Quebec Pension Plan?	09 ○	10 ○
d. other government sources *(such as Unemployment Insurance Benefits, Social Assistance, worker's compensation, disability insurance, family allowances, veteran's allowance)*?	11 ○	12 ○
e. investments *(interest, dividends, capital gains, net rents)*?	13 ○	14 ○
f. income from other family members?	15 ○	16 ○
g. income from other sources *(alimony, family inheritance, estate)*?	17 ○	18 ○

L.7 *Interviewer check item:*

1 ○ *If more than one 'Yes' marked in L.6 ▸ Go to L.8*

2 ○ *Otherwise ▸ Go to L.9*

L.8 Of all your income sources you have mentioned, which one do you consider the main source?

3 ○ Income from work (self-employment, salaries, wages, commissions, tips)

4 ○ Income from a retirement pension (including superannuation and annuities)

5 ○ Income from government pension (Old Age Security, guaranteed income Supplement, Spouse's Allowance, Canada-Quebec Pension plan)

6 ○ Income from other government sources (such as Unemployment Insurance Benefits, Social Assistance, Worker's Compensation, disability insurance, family allowances, veteran's allowance)

7 ○ Income from investments (interest, dividends, capital gains, net rents)

8 ○ Income from other family members

9 ○ Income from other sources (alimony, family inheritance, estate)

L 9 What is your best estimate of your own income from all sources, before deductions during 1990? Was your income ...

- 10 ◯ Less than $20,000?
  - 11 ◯ Less than $10,000?
    - 13 ◯ Less than $5,000?
    - 14 ◯ $5,000 or more?
  - 12 ◯ $10,000 or more?
    - 15 ◯ Less than $15,000?
    - 16 ◯ $15,000 or more?
- 20 ◯ $20,000 or more?
  - 21 ◯ Less than $40,000?
    - 23 ◯ Less than $30,000?
    - 24 ◯ $30,000 or more?
  - 22 ◯ $40,000 or more?
    - 25 ◯ Less than $60,000?
    - 26 ◯ $60,000 to $80,000?
    - 27 ◯ more than $80,000?
- 34 ◯ No income
- 35 ◯ Don't know
- 36 ◯ Refused

L 10 How many people in your household other than yourself received income in 1990?

[ ] Number

Interviewer: if none ▸ Go to SECTION M

L 11 What is your best estimate of the total income of all household members from all sources, before deductions during 1990? Was it ...

- 30 ◯ Less than $20,000?
  - 31 ◯ Less than $10,000?
    - 33 ◯ Less than $5,000?
    - 34 ◯ $5,000 or more?
  - 32 ◯ $10,000 or more?
    - 35 ◯ Less than $15,000?
    - 36 ◯ $15,000 or more?
- 40 ◯ $20,000 or more?
  - 41 ◯ Less than $40,000?
    - 43 ◯ Less than $30,000?
    - 44 ◯ $30,000 or more?
  - 42 ◯ $40,000 or more?
    - 45 ◯ Less than $60,000?
    - 46 ◯ $60,000 to $80,000?

SECTION M. Overall satisfaction

M 1 Throughout the survey I have been asking you about many aspects of your life. How do you feel about your life as a whole? Are you satisfied or dissatisfied?

1 ◯ Satisfied

2 ◯ Dissatisfied

Is that very or somewhat?

3 ◯ Very

4 ◯ Somewhat

SECTION N. Contacts for follow-up

N 1 Statistics Canada is conducting this survey jointly with Health and Welfare Canada. The information collected will be kept confidential and used only for statistical purposes. Do you agree to share your answers with Health and Welfare Canada?

5 ◯ Yes

6 ◯ No

This survey is part of a larger project. For this reason, we may need to contact you some time in the future.

N 2 Would you be willing to be contacted in the future for a follow-up of this project?

1 ◯ Yes

3 ◯ No ▸ *Thank respondent and end the interview*

N 3 I would like to confirm your present address *(Read the address on the label on the front cover of the questionnaire - mark corrections below if necessary)*

1 ◯ Address O.K

2 ◯ Correction ▸ Address

____

____

N 4 In case you move or change telephone numbers it would be helpful if you could provide the name, address and telephone number of someone we could contact, such as a friend or relative, who would help us to contact you.

Name of Contact:

First name ____________

Last name ____________

Address of Contact:

____

____

Appendix 2: Sections from the National Population Health Survey (Chapter 4)

Household Record Variables
(To be collected at initial contact from knowledgeable person)

DEMO_INT The next few questions will provide important basic information on the people in your household.

DEMO_Q1 What are the names of all persons now living or staying here who have no usual place of residence elsewhere?
(First and last names)

DEMO_Q2 Are there any persons away from this household attending school, visiting, travelling or in hospital who usually live here?

___ Yes (go to DEMO-Q1)
___ No

EMO_Q3 Does anyone else live at this dwelling such as relatives, roomers, boarders or employees?

___ Yes (go to DEMO-Q1)
___ No

DEMO_Q4 What is ... 's date of birth?

DD/MM/YY (Age is calculated and confirmed with respondent.)

DEMO_Q5 Enter or ask ... 's sex.

___ Male
___ Female

DEMO_Q6 What is ... current marital status?
(Note: if age < 15, marital status is automatically = single)

___ Now married
___ Common-law
___ Living with a partner
___ Single (never married)
___ Widowed
___ Separated
___ Divorced

DEMO_Q7 Enter ... 's family Id code.

(A to Z)

Legal household check.

Reject household at this point if screening criteria are not met.

Selection criteria applied.

DEMO_Q8 Relationships of everyone to everyone else;

Birth Parent	Common law partner
Step Parent	In-law
Foster Parent	Other Related
Birth Child	Unrelated
Step Child	Husband/Wife
Foster Child	Adopted Child
Sister/brother	Adoptive Parent
Grandparent	Same-sex Partner
Grandchild	

HHLD_Q1 Now a few questions about your dwelling. Is this dwelling owned by a member of this household (even if being paid for)?

___ Yes
___ No

HHLD_Q3 How many bedrooms are there in this dwelling?
(If no separate, enclosed bedroom enter "00".)

___ number of bedrooms (2 digits)

HHLD_Q4 Is there a pet in this household?

___ Yes
___ No (Go to HHLD-Q6)

HHLD_Q5 What kind of pet?
(Do not read list. Mark all that apply)

___ Dog
___ Cat
___ Other (Go to HHLD-Q6)

HHLD_Q5a Does this pet or do any of these pets live mainly indoors?

___ Yes
___ No

HHLD_Q6 Record type of dwelling (by interviewer observation)

___ Single detached house
___ Semi-detached or double (side-by-side)
___ Garden house, town-house or row house
___ Duplex (one above the other)
___ Low-rise apartment (less than 5 stories)
___ High-rise apartment (5 or more stories)
___ Institution
___ Hotel, rooming or lodging house, logging or construction camp, Hutterite Colony
___ Mobile home
___ Other (Specify ___________)

UTIL-Q6 During the past 12 months, was there ever a time when you/he/she needed health care or advice but did not receive it?

___ Yes
___ No (Go to UTIL-C9)

UTIL-Q7 Thinking of the most recent time, why did ... not get care?

____

UTIL-Q8 Again, thinking of the most recent time, what was the type of care that was needed? (Do not read list. Mark all that apply.)

___ Treatment of a physical health problem
___ Treatment of an emotional or mental health problem
___ A regular check-up (or for regular pre-natal care)
___ Care of an injury
___ Any other reason (Specify_____________)

UTIL-C9 IF age < 18 then go to next section.

UTIL-Q9 Home care services are *health care or homemaker* services received at home, with the cost being entirely or partially covered by government. Examples are: nursing care; help with bathing; help around the home; physiotherapy; counselling; and meal delivery. Have/Has ... received any home care services in the past 12 months?

___ Yes
___ No (Go to next section)

UTIL-Q10 What type of services have/has ... received?

(Specify____________________)

Restriction of Activities

RESTR-CINT If age<12, go to next section.

RESTR-INT The next few questions deal with any health limitations which affect ... (r/'s) daily activities. In these questions, "long-term conditions" refer to conditions that have lasted or are expected to last 6 months or more.

RESTR-Q1 Because of a long-term physical or mental condition or a health problem, are/is ... limited in the kind or amount of activity you/he/she can do:

a) at home?

___ Yes
___ No

b) at school?

___ Yes
___ No
___ Not applicable

c) at work?

___ Yes
___ No
___ Not applicable

d) in other activities such as transportation to or from work or leisure time activities?

___ Yes
___ No

RESTR-Q2 Do(es) ... have any long term disabilities or handicaps?

___ Yes
___ No

If any yes in RESTR-Q1 (a)-(d), ask RESTR-Q3.
If yes in RESTR-Q2 only, ask RESTR-Q4.
Otherwise go to RESTR-Q6.

RESTR-Q3 What is the main condition or health problem causing ... to be limited in your/his/her activities?

__________________(25 spaces) (Go to RESTR-Q5)

RESTR-Q4 What is the main condition or health problem causing ... to have a long term disability or handicap?

__________________(25 spaces)

RESTR-Q5 Which one of the following is the best description of the cause of this condition?
(Read list. Mark one only.)

___ Injury - at home
___ Injury - sports or recreation
___ Injury - motor vehicle
___ Injury - work-related
___ Existed at birth
___ Work environment
___ Disease or illness
___ Natural aging process
___ Psychological or physical abuse
___ Other (Specify__________________)

RESTR-Q6 The next question asks about help received. This may not apply to ... , but we need to ask the same question of everyone. Because of any condition or health problem, do(es) ... need the help of another person in:

(Read list. Mark all that apply.)

- ___ Preparing meals?
- ___ Shopping for groceries or other necessities?
- ___ Doing normal everyday housework?
- ___ Doing heavy household chores such as washing walls, yard work, etc.?
- ___ Personal care such as washing, dressing or eating?
- ___ Moving about inside the house?
- ___ None of the above

Chronic Conditions

CHRON-CINT If age<12 go to next section.

CHRON-INT Now I'd like to ask about any chronic health conditions ... may have. Again, "long-term conditions" refer to conditions that have lasted or are expected to last 6 months or more.

CHRON-Q1 Do(es) ... have any of the following long-term conditions that have been diagnosed by a health professional:

(Read list. Mark all that apply.)

(a) Food allergies?
(b) Other allergies?
(c) Asthma?(If YES ask CHRON-Q1cc1)
(d) Arthritis or rheumatism?
(e) Back problems excluding arthritis?
(f) High blood pressure?
(g) Migraine headaches?
(h) Chronic bronchitis or emphysema?
(i) Sinusitis?
(j) Diabetes?
(k) Epilepsy?
(l) Heart disease?
(m) Cancer? (If yes ask CHRON-Q1mm)
(n) Stomach or intestinal ulcers?
(o) Effects of stroke?
(p) Urinary incontinence?
(q) Acne requiring prescription medication? (Ask if age<30)

For persons aged < 18 years go to (u).

(r) Alzheimer's disease or other dementia?
(s) Cataracts?
(t) Glaucoma?
(u) Any other long term condition? (Specify ____________)
(v) None

CHRON-Q1mm What type(s) of cancer is this? For example, skin, lung or colon cancer.

____

EDUC-Q1 Excluding kindergarten, how many years of elementary and high school have/has ... successfully completed?

(Do not read list. Mark one only.)

___	No schooling (Go to next section)		
___	One to five years	___	Ten
___	Six	___	Eleven
___	Seven	___	Twelve
___	Eight	___	Thirteen
___	Nine		

(If age < 15 then go to next section)

EDUC-Q2 Have/has ... graduated from hign school?

___ Yes
___ No

EDUC-Q3 Have/has ... ever attended any other kind of school such as university, community college, business school, trade or vocational school, CEGEP or other post-secondary institution?

___ Yes
___ No (Go to C5)

EDUC-Q4 What is the highest level of education that ... have/has attained?

(Do not read list. Mark one only.)

___ Some trade, technical, vocational school or business college
___ Some community college, CEGEP or nursing school
___ Some university
___ Diploma or certificate from trade, technical or vocational school, or business college
___ Diploma or certificate from community college, CEGEP, or nursing school)
___ Bachelor's or undergraduate degree or teacher's college (e.g., B.A., B.Sc., LL.B.)
___ Master's (e.g. M.A., M. Sc., M.Ed.)
___ Degree in medicine, dentistry, veterinary medicine or optometry (M.D., D.D.S., D.M.D., D.V.M., O.D.)
___ Earned doctorate (e.g. Ph.D., D.Sc., D.Ed.)
___ Other (Specify_____)

EDUC-C5 If age >= 65, go to next section.

EDUC-Q5 Are/Is ... currently attending a school, college or university?

___ Yes
___ No (go to next section)

EDUC-Q6 Are/Is ... enrolled as a full-time or part-time student?

___ full-time
___ part-time

Labour Force

LFS-C1 If age<15 go to next section.

LFS-Q1 What do/does ... consider to be your/his/her current main activity? (For example, working for pay, caring for family.)
(Do not read list. Mark one only.)

___ Caring for family
___ Working for pay or profit
___ Caring for family and working for pay or profit
___ Going to school
___ Recovering from illness/on disability
___ Looking for work
___ Retired
___ Other (Specify)

LFS-I2 The next section contains questions about jobs or employment which ... have/has had during the past 12 months[2]. Please include such employment as part-time jobs, contract work, baby sitting and any other paid work.

LFS-C2 If LFS-Q1 = 2 or 3 —> go to LFS-Q3.n

LFS-Q2 Have/has you/he/she ... worked for pay or profit at any time in the past 12 months?

___ Yes
___ No (go to Q3.n)

LFS-C2A If LFS-Q1=7 (retired) —> go to LFS-C18 else go to LFS-Q17B

Note: Questions LFS-Q3 to LFS-Q11 are done as a roster allowing up to 6 jobs to be entered.

LFS-Q3.n For whom/whom else have/has you/he/she ... worked for pay or profit in the past 12 months?

____________________ (50 chars)

LFS-Q4.n Did you/he/she ... have that job 1 year ago, that is, on %12MOSAGO% without a break in employment since then?

___ Yes (Go to LFS-Q6.n)
___ No

LFS-Q5.n When did you/he/she ... start working at this job or business?

MM/DD/YY

LFS-Q6.n Do/Does you/he/she ... now have that job?

Yes (Go to LFS-Q8.n)
No

Income
(Ask from knowledgeable person only)

INCOM-Q1 Thinking about your total household income, from which of the following sources did your household receive any income in the past 12 months?
(Read list. Mark all that apply.)

___ Wages and salaries
___ Income from self-employment
___ Dividends and interest on bonds, deposits and savings, stocks, mutual funds, etc.
___ Unemployment insurance
___ Worker's compensation
___ Benefits from Canada or Quebec Pension Plan
___ Retirement pensions, superannuation and annuities
___ Old Age Security and Guaranteed Income Supplement
___ Child Tax Benefit
___ Provincial or municipal social assistance or welfare
___ Child Support
___ Alimony
___ Other Income (eg. rental income, scholarships, other government income, etc.)
___ None (Go to next section)

If more than one source of income is indicated ask INCOM-Q2.
Otherwise ask INCOM-Q3.

INCOM-Q2 What was the main source of income?
(Do not read list. Mark one only.)

___ Wages and salaries
___ Income from self-employment
___ Dividends and interest on bonds, deposits and savings, stocks, mutual funds, etc.
___ Unemployment insurance
___ Worker's compensation
___ Benefits from Canada or Quebec Pension Plan
___ Retirement pensions, superannuation and annuities
___ Old Age Security and Guaranteed Income Supplement
___ Child Tax Benefit
___ Provincial or Municipal Social Assistance or Welfare
___ Child Support
___ Alimony
___ Other Income (eg. rental income, scholarships, other government income, etc.)

INCOM-Q3 **What is your best estimate of the total income before taxes and deductions of all household members from all sources in the past 12 months? Was the total household income:**

- ___ Less than $20,000?
  - ___ Less than $10,000?
    - ___ Less than $5,000? (go to next section)
    - ___ $5,000 and more? (go to next section)
  - ___ $10,000 and more?
    - ___ Less than $15,000? (go to next section)
    - ___ $15,000 and more? (go to next section)
- ___ $20,000 and more?
  - ___ Less than $40,000?
    - ___ Less than $30,000? (go to next section)
    - ___ $30,000 and more? (go to next section)
  - ___ $40,000 and more?
    - ___ Less than $50,000 (go to next section)
    - ___ $50,000 to less than $60,000? (go to next section)
    - ___ $60,000 to less than $80,000? (go to next section)
    - ___ $80,000 and more? (go to next section)
- ___ No income

Administration

H05-P1 Was this interview conducted on the telephone or in person?

- ___ On telephone
- ___ In person
- ___ Both (Specify in comments)

H05-P2 Record language of interview

English	Persian (Farsi)
French	Polish
Arabic	Portuguese
Chinese	Punjabi
Cree	Spanish
German	Tagalog (Filipino)
Greek	Ukrainian
Hungarian	Vietnamese
Italian	Other (Specify_______________)
Korean	

Non-proxy interview
(To be conducted for selected respondent only and age>=12)
(Proxy for those unable to answer due to special circumstances)

H06-P1 Who is providing the information for this person's form?

____

H06-INT This part of the survey deals with various aspects of ... (r/s) health. I'll be asking about such things as physical activity, social relationships, health status and stress. By health, we mean not only the absence of disease or injury but also physical, mental and social well-being. I'll start with a few questions concerning ... (r/s) health in general.

General Health

GENHLT-Q1 In general, would you say ... r/s health is:
(Read list. Mark one only.)

___ Excellent?
___ Very good?
___ Good?
___ Fair?
___ Poor?

Check item: If sex = female & (age >= 15 & age <= 49) ask GENHLT-Q2. Otherwise go to next section.

GENHLT-Q2 It is important to know when analyzing health whether or not the person is pregnant. Are/Is ... pregnant?

___ Yes
___ No (Go to next section)

GENHLT-Q3 Are/Is you/she planning to use the services of a physician, midwife or both?
(Do not read list. Mark one only.)

___ Physician only
___ Midwife only
___ Both physician and midwife
___ Neither

Height/Weight

HTWT-Q1 How tall are/is ... without shoes on?

___ feet ___ inches OR ___ centimetres

HTWT-Q2 How much do/does you/he/she weigh?

___ pounds OR ___ kilograms

Smoking

SMOK-INT The next few questions are about smoking.

SMOK-Q1 Does anyone in this household smoke regularly inside the house?

__ Yes
__ No

SMOK-Q2 At the present time do/does ... smoke cigarettes daily, occasionally or not at all?

__ Daily
__ Occasionally (go to SMOK-Q5)
__ Not at all (go to SMOK-Q4a)

SMOK-Q3 At what age did you/he/she begin to smoke cigarettes daily?

__ Age

SMOK-Q4 How many cigarettes do/does you/he/she smoke each day now?

__ Number of cigarettes

(Go to next section)

SMOK-Q4a Have/has you/he/she ever smoked cigarettes at all?

__ Yes
__ No (Go to next section)

SMOK-Q5 Have/has you/he/she ever smoked cigarettes daily?

__ Yes
__ No (Go to next section)

SMOK-Q6 At what age did you/he/she begin to smoke (cigarettes) daily?

__ Age

SMOK-Q7 How many cigarettes did you/he/she usually smoke each day?

__ Number of cigarettes

SMOK-Q8 At what age did you/he/she stop smoking (cigarettes) daily?

__ Age

ALCO-Q1 During the past 12 months[2], have/has ... had a drink of beer, wine, liquor or any other alcoholic beverage?

__ Yes
__ No (Go to ALCO-Q5B)

ALCO-Q2 During the past 12 months, how often did you/he/she drink alcoholic beverages?
(Do not read list. Mark one only.)

__ Every day
__ 4-6 times a week
__ 2-3 times a week
__ Once a week
__ 2-3 times a month
__ Once a month
__ Less than once a month

ALCO-Q3 How many times in the past 12 months have/has you/he/she had 5 or more drinks on one occasion?

__ Number of times

If PROXY=yes then go to ALCO-Q5

ALCO-Q4 In the past 12 months, what is the highest number of drinks you had on one occasion?

__ Number of drinks

ALCO-Q5 Thinking back over the past week, that is, from %1WKAGO% to yesterday, did ... have a drink of beer, wine, liquor or any other alcoholic beverage?

__ Yes
__ No (Go to next section)

ALCO-Q5A Starting with yesterday, how many drinks did ... have on:

__ Monday?
__ Tuesday?
__ Wednesday?
__ Thursday?
__ Friday?
__ Saturday?
__ Sunday?

(Go to next section)

ALCO-Q5B Did you/he/she ever have a drink?

___ Yes
___ No (Go to next section)

ALCO-Q6 Did you/he/she ever regularly drink more than 12 drinks a week?

___ Yes
___ No (Go to next section)

ALCO-Q7 Why did you/he/she reduce or quit drinking altogether?
(Do not read list. Mark all that apply.)

___ Dieting
___ Athletic training
___ Pregnancy
___ Getting older
___ Drinking too much/drinking problem
___ Affected work, studies, employment opportunities
___ Interfered with family or home life
___ Affected physical health
___ Affected friendships or social relationships
___ Affected financial position
___ Affected outlook on life, happiness
___ Because of influence of family or friends
___ Other (specify_____________)

Physical Activities
(Non-proxy only)

PHYS-INTa Now I'd like to ask you about some of your physical activities. To begin with, I'll be dealing with physical activities not related to work, that is, leisure time activities.

PHYS-Q1 Have you done any of the following in the past 3 months[3]?
(Read list. Mark all that apply.)

___ Walking for exercise
___ Gardening, yard work
___ Swimming
___ Bicycling
___ Popular or social dance
___ Home exercises
___ Ice hockey
___ Skating
___ Downhill skiing
___ Jogging/running
___ Golfing
___ Exercise class/aerobics
___ Cross-country skiing
___ Bowling
___ Baseball/softball
___ Tennis
___ Weight-training
___ Fishing
___ Volleyball
___ Yoga or tai-chi
___ Other (specify)
___ Other (specify)
___ Other (specify)
___ None

For each response ask PHYS-Q2 to PHYS-Q3.
If "none" go to PHYS-INTb.

Injuries

INJ-INT Now some questions about any injuries, which occurred in the past 12 months[2], that were serious enough to limit ... (r/'s) normal activities. For example, a broken bone, a bad cut or burn, a sore back or sprained ankle, or a poisoning.

INJ-Q1 In the past 12 months, did ... have any injuries that were serious enough to limit your/his/her normal activities?

___ Yes
___ No (Go to next section)

INJ-Q2 How many times were/was you/he/she injured?

___ times

INJ-Q3 Thinking about the most serious injury, what type of injury did you/he/she have? For example, a broken bone or burn.
(Do not read list. Mark one only.)

___ Multiple injuries
___ Broken or fractured bones
___ Burn or scald
___ Dislocation
___ Sprain or strain
___ Cut or scrape
___ Bruise or abrasion
___ Concussion
___ Poisoning by substance or liquid
___ Internal injury
___ Other (specify_______________)

INJ-Q4 What part of your/his/her body was injured?
(Do not read list. Mark one only.)

___ Multiple sites
___ Eyes
___ Head (excluding eyes)
___ Neck
___ Shoulder
___ Arms or hands
___ Hip
___ Legs or feet
___ Back or spine
___ Trunk (excluding back or spine) (including chest, internal organs, etc.)

INJ-Q5 Where did the injury happen?

(Do not read list. Mark one only.)

___ Home and surrounding area
___ Farm
___ Place for recreation or sport
(e.g. golf course, basketball court, playground (including school))
___ Street or highway
___ Building used by general public (e.g. hotel, shopping plaza, restaurant, office building, school)
___ Residential institution (e.g. hospital, jail, etc.)
___ Mine
___ Industrial place or premise (e.g. dockyard)
___ Other (specify ______________)

INJ-Q6 What happened? For example, was the injury the result of a fall, motor vehicle accident, a physical assault etc.?

(Do not read list. Mark one only.)

___ Motor vehicle accident
___ Accidental fall
___ Fire, flames or resulting fumes
___ Accidentally struck by an object/person
___ Physical assault
___ Suicide attempt
___ Accidental injury caused by explosion
___ Accidental injury caused by natural/environmental factors (e.g. weather conditions, Poison ivy, animal bites, stings)
___ Accidental drowning or submersion
___ Accidental suffocation
___ Hot or corrosive liquids, foods or substances
___ Accident caused by machinery (e.g. farm machinery, forklift, woodworking machinery)
___ Accident caused by cutting and piercing instruments or objects (lawnmower, knife, stapler)
___ Accidental poisoning
___ Other (specify________________)

INJ-Q7 Was this a work-related injury?

___ Yes
___ No

INJ-Q8 We would like to know what precautions ... are/is taking, if any, to prevent this kind of injury from happening again. What precautions are/is you/he/she taking?

(Do not read list. Mark all that apply.)

___ Gave up the activity
___ Being more careful
___ Took safety training
___ Increased supervision of child
___ Using protective gear/safety equipment (e.g. bike helmet, car safety restraint, etc.)

Vision

HSTAT-Q1 Are/Is ... *usually* able to see well enough to read ordinary newsprint *without* glasses or contact lenses?

___ Yes (Go to HSTAT-Q4)
___ No

HSTAT-Q2 Are/Is you/he/she *usually* able to see well enough to read ordinary newsprint *with* glasses or contact lenses?

___ Yes (Go to HSTAT-Q4)
___ No

HSTAT-Q3 Are/Is you/he/she able to see at all?

___ Yes
___ No (Go to HSTAT-Q6)

HSTAT-Q4 Are/Is you/he/she able to see well enough to recognize a friend on the other side of the street *without* glasses or contact lenses ?

___ Yes (Go to HSTAT-Q6)
___ No

HSTAT-Q5 Are/Is you/he/she *usually* able to see well enough to recognize a friend on the other side of the street *with* glasses or contact lenses?

___ Yes
___ No

Hearing

HSTAT-Q6 Are/Is ... *usually* able to hear what is said in a group conversation with at least three other people *without* a hearing aid?

___ Yes (Go to HSTAT-Q10)
___ No

HSTAT-Q7 Are/Is you/he/she *usually* able to hear what is said in a group conversation with at least three other people *with* a hearing aid?

___ Yes (Go to HSTAT-Q8)
___ No

HSTAT-Q7a Are/Is you/he/she able to hear at all?

___ Yes
___ No (Go to HSTAT-Q10)

HSTAT-Q8 Are/Is you/he/she ***usually*** able to hear what is said in a conversation with one other person in a quiet room *without* a hearing aid ?

___ Yes (Go to HSTAT-Q10)
___ No

HSTAT-Q9 Are/Is you/he/she ***usually*** able to hear what is said in a conversation with one other person in a quiet room *with* a hearing aid?

___ Yes
___ No

Speech

HSTAT-Q10 Are/Is ... *usually* able to be understood *completely* when speaking with strangers in your own language?

___ Yes (Go to HSTAT-Q14)
___ No

HSTAT-Q11 Are/Is you/he/she able to be understood *partially* when speaking with strangers?

___ Yes
___ No

HSTAT-Q12 Are/Is you/he/she able to be understood *completely* when speaking with those who know you/him/her well?

___ Yes (Go to HSTAT-Q14)
___ No

HSTAT-Q13 Are/Is you/he/she able to be understood *partially* when speaking with those who know you/him/her well?

___ Yes
___ No

Getting Around

HSTAT-Q14 Are/is ... *usually* able to walk around the neighbourhood *without* difficulty and *without* mechanical support such as braces, a cane or crutches?

___ Yes (Go to HSTAT-Q21)
___ No

HSTAT-Q15 Are/Is you/he/she able to walk at all?

___ Yes
___ No (Go to HSTAT-Q18)

HSTAT-Q16 Do/Does you/he/she require mechanical support such as braces, a cane or crutches to be able to walk around the neighbourhood?

Drug Use

DRUG-INT Now I'd like to ask a few questions about ... (r/'s) use of medications, both prescription and over-the-counter as well as other health products.

DRUG-Q1 In the past month[4], did ... take any of the following medications?
(Read list. Mark all that apply.)

- ___ Pain relievers such as aspirin or tylenol (includes arthritis medicine and anti-inflammatories)
- ___ Tranquilizers such as valium
- ___ Diet pills
- ___ Anti-depressants
- ___ Codeine, Demerol or Morphine
- ___ Allergy medicine such as "Sinutab"
- ___ Asthma medications
- ___ Cough or cold remedies
- ___ Penicillin or other antibiotic
- ___ Medicine for the heart
- ___ Medicine for blood pressure
- ___ Diuretics or water pills
- ___ Steroids
- ___ Insulin
- ___ Pills to control diabetes
- ___ Sleeping pills
- ___ Stomach remedies
- ___ Laxatives
- ___ Hormones for menopause or aging symptoms (check item: sex=female, age >= 30)
- ___ Birth control pills (check item: sex=female, age >= 12 & age <= 49)
- ___ Any other medication (Specify________)
- ___ None of the above

DRUG-C1 If any drug(s) specified in DRUG-Q1 go to DRUG-Q2. Otherwise go to DRUG-Q4.

DRUG-Q2 Now, I am referring to yesterday and the day before yesterday. During those two days, how many different medications did you/he/she take?

___ Number of different medications

If number=0 then go to DRUG-Q4
For each number >0 ask DRUG-Q3...up to a maximum of 12.

DRUG-Q3 What is the exact name of the medication that ... took? (Ask the person to look at the bottle, tube or box.)

____

DRUG-Q4 There are many other health products such as ointments, vitamins, herbs, minerals, teas or protein

Social Support
(Non-proxy only)

SOCSUP-INT Now, a few questions about your contact with different groups and support from family and friends.

SOCSUP-Q1 Are you a member of any voluntary organizations or associations such as school groups, church social groups, community centres, ethnic associations or social, civic or fraternal clubs?

___ Yes
___ No (Go to SOCSUP-Q2a)

SOCSUP-Q2 How often did you participate in meetings or activities sponsored by these groups in the past 12 months? If you belong to many, just think of the ones in which you are most active.
(Read list. Mark one only.)

___ At least once a week
___ At least once a month
___ At least 3 or 4 times a year
___ At least once a year
___ Not at all

SOCSUP-Q2a Other than on special occasions (such as weddings, funerals or baptisms), how often did you attend religious services or religious meetings in the past 12 months?
(Read list. Mark one only.)

___ At least once a week
___ At least once a month
___ At least 3 or 4 times a year
___ At least once a year
___ Not at all

SOCSUP-Q3 Do you have someone you can confide in, or talk to about your private feelings or concerns?

___ Yes
___ No

SOCSUP-Q4 Do you have someone you can really count on to help you out in a crisis situation?

___ Yes
___ No

SOCSUP-Q5 Do you have someone you can really count on to give you advice when you are making important personal decisions?

___ Yes
___ No

SOCSUP-Q6 Do you have someone that makes you feel loved and cared for?

___ Yes
___ No

Appendix 3: Program Needs Survey (Chapter 5)

THE FREEPORT HOSPITAL

PROGRAM NEEDS ANALYSIS
Freeport Population 1994

*Date of interview:*______________________

1. PATIENT IDENTIFICATION

Patient I.D. #: ______________________________ **Room #:**________________________
(as of June 1/94)

Chart	1.1	Gender: 0) Male 1) Female
Nutrition	1.2	Height: __________ cm.
Nutrition	1.3	Weight: __________ kg. (Average)
Nutrition	1.4	How many times has the patient been weighed during the past year? ________________________times
Computer	1.5	Date of Birth:_____/_____/_____ (Year/Month/Day)
Computer	1.6	Date of original admission to Freeport:_____/_____/_____ Year/Month/Day
Computer	1.7	Was this person discharged during the past 12 months? 1) Yes 0) No
Computer	1.8	Present Location: 1) Union Terrace 2 2) Union Terrace 3 3) Union Terrace 4 4) Grand River Terrace 2 5) Grand River Terrace 3 6) Grand River Terrace 4 7) Pioneer Terrace 2 8) Pioneer Terrace 3
Computer	1.9	Location prior to original admission to Freeport: 1) Kitchener-Waterloo Hospital 2) St.Mary's Hospital 3) Nursing Home/Home for the Aged: specify ____________________ 4) Cambridge Memorial Hospital 5) Private residence 6) Other (specify:____________________________________

1.10 If admitted from another health care facility, how long was the patient residing there?

1) 0-30 days
2) 31-60 days
3) 61-90 days
4) 90 days-6 months
5) over 6 months-12 months
6) 12 months plus

1.11 Religious Denomination:

1) Anglican
2) Lutheran
3) Presbyterian
4) United
5) Mennonite
6) Roman Catholic
7) Jewish
8) Not Specified
9) Other:______________________________)

1.12 What is the patient's first language (i.e., what language was first spoken by the patient)?

1) English
2) German
3) French
4) Portuguese
5) Other (specify:______________________________)

1.13 How well does the patient grasp or comprehend English? (i.e. how well can the patient understand or be understood in English if their first language wasn't English).

1) Fully fluent
2) Partially fluent
3) Not at all fluent
4) Not applicable (e.g. aphasic, dementia)

1.14 Upon admission, in what type of room did the patient request to be placed?

1) Ward
2) Semi-private
3) Private

1.15 In what type of room does the patient reside now?

1) Ward
2) Semi-private
3) Private

1.16 If there is a discrepancy between the type of room requested and the type of room received, what is the reason for this discrepancy?

1) Lack of availability of desired room
2) Priority given to other considerations(e.g., need for specialized environment or balance of nursing workload)
3) Not known
4) Other (specify:______________________________)

2. DIAGNOSIS AND CARE LEVEL

Chart 2.1 & Computer — Please indicate the patient's current diagnosis. Check more than one category for multiple diagnoses.

_____ Alzheimer's and other Dementias
_____ Arthritis (includes osteoarthritis)
_____ Cancer (specify:_______________________________________
_____ Comatose
_____ Cardiovascular Disorders (Hypertension, Myocardial Infarction, Atherosclerotic Heart Disease, Congestive Heart Disease)
_____ Septicemia
_____ C.O.L.D. (Chronic Obstructive Lung Disease)
_____ Burns
_____ Diabetes
_____ Cerebral Palsy
_____ Fractures
_____ Decubitus Ulcers
_____ Functional Psychiatric Disorder (e.g. Schizophrenia, Depression, Anxiety)
_____ Aphasia
_____ Head Injury
_____ Pneumonia
_____ Multiple Sclerosis
_____ Stasis Ulcer
_____ Parkinson's Disease
_____ Internal Bleeding
_____ Quadriplegia, Paraplegia, Hemiplegia (not stroke induced)
_____ Dehydration
_____ Stroke (includes Cerebrovascular Diseases, Transient Ischemic Attack - T.I.A.)
_____ Aspirations
_____ Other Major Diagnoses (specify:_______________________________

____)

Comp — 2.2 What is the patient's current classification? (as of June 14/94)

1) Continuing Care
2) Rehabilitation & Ambulatory Care
3) Palliative & Complex Care
4) Special Care Program

Nurse — 2.3 For what length of time will this level of care be required?

1) Current level of care no longer required
2) Less than six months
3) Six months to one year
4) More than one year

Nurse — 2.4 Has the patient received any of the following special treatments in the last 14 days?

a. Dialysis	b. Suctioning	g. Tube Feeding
c. Trach Care	d. IV Meds	h. Transfusions
e. Oxygen Therapy	f. Ventilator/Respir.	i. Radiation Tx
j. Chemotherapy	k. Dialysis	l. Wound Care
m. Respiratory Tx	n. Parenteral feeding	

2.5 What change is expected in the patient's current condition?

1) Rapid improvement
2) Slow improvement
3) No change
4) Slow deterioration
5) Rapid deterioration

2.6 In the event of a serious illness or emergency, what **Degree of Active Intervention** has been specified for the patient?

1) Level I - Transfer to Acute Care with Full Intensive Care & CPR
2) Level II - Full Treatment Available at Freeport plus transfer to acute care if necessary
3) Level III -Full Treatment Available at Freeport for the Purpose of Preservation of Life (with no transfer to acute care)
4) Level IV - Supportive Care Only

2.7 Is there a "do not resuscitate" order for the patient?

1) Yes
0) No

2.8 Is patient identified as competent?

1) Yes
0) No

2.9 Is the patient subject to selective monitoring by pharmacy? (i.e. patient has hepatic or renal impairment, uses specific medications)

1) Yes
0) No

3. ACTIVITIES OF DAILY LIVING

For all care questions - take most conservative estimate)

3.1 Rate the severity of the patient's motor impairments in the following areas:

a. Coordination

1) None
2) Mild
3) Moderate
4) Severe

b. Balance (Wheelchair patients: balance in their seat)

1) None
2) Mild
3) Moderate
4) Severe

c. Involuntary Movement

1) None
2) Mild
3) Moderate
4) Severe

3.2 What is the patient's mobility on level surfaces?

1) Walks independently
2) Uses "Go" chair
3) Walks with staff assistance
4) Walks with assistive device (specify device:_______________
5) Uses manual wheelchair
6) Uses power wheelchair
7) Not applicable (non-ambulatory)
8) Uses "Geri" chair
9) Uses "Broda" chair
10) Walks with staff supervision

3.3 If the patient uses a manual wheelchair, what is his/her ability to propel the wheelchair?

1) Propels **manual** wheelchair independently
2) Uses **manual** wheelchair but unable to propel

3.4 If patient uses a power wheelchair, are there safety concerns concerning patient's driving patterns (i.e. **banging into walls or furniture in tight spaces**)?

1) Yes (specify)_______________)
2) No

3.5 Has the Occupational Therapy Department completed a seating/mobility assessment during the past year?

1) Yes
0) No

3.6 How does the patient transfer from bed to chair?

1) Transfers self independently
2) Transfers self with staff supervision
3) Assisted by one person
4) Assisted by two or more people
5) Assisted by mechanical lifter

3.7 a. Does the patient appear to experience pain on a regular basis?

1) Yes
0) No

b. Does pain prevent the patient from doing things he/she enjoys?

1) Yes
0) No

c. Rate the usual severity of the patient's pain?

0	1	2	3	4	5	6	7	8	9
none					moderate				severe

d. What approaches are being used presently to manage the patient's pain? (check all that apply)

1) Medication
2) Acupuncture
3) Hypnosis
4) Relaxation therapy
5) Distraction
6) Massage
7) Other (please specify) ______________

3.8 What is the patient's ability to dress?

1) Dresses independently
2) Dresses with an assistive device (specify: ______________________________)
3) Dresses with staff supervision
4) Dresses with some assistance from staff
5) Dressed completely by staff

3.9 What is the patient's ability to bathe?

1) Bathes independently
2) Bathes using an assistive device (specify: ______________________________)
3) Bathes with staff supervision
4) Bathes with some assistance from staff
5) Bathed completely by staff

3.10 What is the patient's ability to eat?

1) Feeds self and eats independently (i.e. nurse provides tray and walks away)
2) Feeds self with staff supervision (i.e. nurse sets up tray and walks away)
3) Eats with some assistance from staff (i.e. patient receives fair amount of verbal encouragement and is partially fed)
4) Manually fed by staff
5) Tube fed (specify type and product: ______________________________)

3.11 What chewing difficulties, if any, does the patient have?

1) None
2) Dental problems
3) Motor problems
4) Other (specify: ______________________________)
5) Not applicable (eg. tube fed)
6) #2 + #3
7) #3 + #4
8) #2 + #3 + #4

3.12 What type of teeth does the patient actually <u>use</u>?

1) Own teeth
2) Dentures
3) Both teeth and dentures
4) No teeth or dentures
5) Not applicable (e.g. tube fed)

Nurse 3.13 Please rate the patient's ability to swallow his/her meals?

1) No Difficulty
2) Some Difficulty
3) Moderate Difficulty
4) A Great Deal of Difficulty
5) Completely Unable
6) Not Applicable

not used If yes, was a referral initiated to SWAT within the last 12 mo

1) Yes
0) No

Nutrition 3.15 What is the texture of the patient's meals? (**specific to diet**

1) Full
2) Dental soft
3) Modified minced
4) Minced
5) Modified pureed
6) Pureed
7) Fluids
8) Thickened Fluids (specify:______________________)

Nutrition 3.16 Does the patient have special nutritional requirements? Please circle all that are relevant.

1) No special nutritional requirements
2) Yes-diabetic
3) Yes-overweight
4) Yes-swallowing difficulties
5) Yes-underweight/poor eater
6) Yes-tube feeding
7) Nutritional supplement (specify: ______________________
8) Other (specify:______________________

____

Nutrition 3.17 For the following areas, what is the level of nutritional risk?

Diagnosis	No Risk	Potential Risk	Nutritional Risk
1) Diet	1	2	3
2) Body Mass	1	2	3
3) Appetite	1	2	3
4) Allergies/Intolerances	1	2	3

4. CONTINENCE

4.1 What is the patient's level of bowel continence?

1) Complete voluntary and elective control (**If patient asks, is considered voluntary control**)
2) Occasionally incontinent (**Patient is usually under voluntary control**)
3) Requires aids and/or assistance to maintain control (**e.g. Patient taken to bathroom every 3 hours**)
4) Incontinent despite aids and assistance (**Patient has no control**)

4.2 What is the patient's level of urinary continence?

1) Complete voluntary and elective control
2) Occasionally incontinent
3) Requires aids and/or assistance to maintain control
4) Incontinent despite aids and assistance

5. SKIN AND FOOT

5.1 What is the patient's skin condition?

1) Normal
2) Open sores
3) Other dermatological problems (e.g., psoriasis, eczema)

(specify: ______________________________)

4) Open sores and other dermatological problems

5.2 Where are the skin breakdowns located, if any?

1) Buttocks
2) Heel/ankle
3) Elbow
4) Hip
5) Shoulder
6) Other (Specify: ______________________________)

5.3 Is the patient using any pressure relief devices?

1) Yes (specify: ______________________________)
0) No

5.4 Does the patient have special requirements for foot care?

1) Yes (specify: ______________________________)
0) No

5.5 Are there any special ointments, dressings, or medications that are part of the patient's regular skin and foot care program?

1) Yes (specify: ______________________________)
0) No

6. COMMUNICATION, HEARING, VISION AND ENVIRONMENTAL CONTROLS

Speech Aug. Comm. 6.1 What is the patient's primary method of communication?

1) Verbal
2) Written
3) Sign language or gesture
4) Word/picture display
5) Electronic communication aid
6) None (**Question further:** ______

7) Other (specify: ______
(eg. grunting or rudimentary noises)

Nurse 6.2 Can this patient be interviewed at a later date? understand and be able to appropriately answer questions?)

1) Yes
0) No

Speech Aug. Comm. 6.3 How does the patient write?

1) Handwriting
2) Typewriter
3) Computer
4) Dictates to another person
5) Does not write

Aug. Comm. 6.4 Does the patient have independent control/use of the following?

a) Telephone

1) Yes with adaptations
2) Yes, no adaptations
0) No

b) Lights

1) Yes with adaptations
2) Yes, no adaptations
0) No

c) Television

1) Yes with adaptations
2) Yes, no adaptations
0) No

d) Call Bell

1) Yes with adaptations
2) Yes, no adaptations
0) No

6.5 Does the patient have difficulty expressing his/her feelings and thoughts through his/her primary method of communication (i.e. **speech, writing, gestures, communication display/aid**)?

1) Yes
0) No

6.6 Does the patient demonstrate difficulty in understanding the speech and language of others (**e.g., can the patient follow directions**)?

1) Yes
0) No

6.7 Compared to "normal" hearing abilities, what is the patient's level of hearing without hearing aids?

1) No impairment
2) Slight impairment (**hear almost everything, some things must be repeated**)
3) Moderate impairment (**need face-to-face for communication**)
4) Severe impairment (**extremely difficult to communicate**)
5) Deaf (**rarely hear even loud noises**)

6.8 Does the patient understand verbal directions (no gestures)and respond appropriately?(**This question deals with the patient's ability to hear**).

1) Normal conversation at six feet with no visual clues
2) Normal conversation at six feet with visual clues
3) Normal conversation at three feet with no visual clues
4) Normal conversation at three feet with visual clues
5) Loud speech at six feet
6) Loud speech at one foot
7) None of the above
8) Not applicable (e.g. severe dementia)

6.9 a. Does the person use hearing aids?

1) Yes
0) No

b. If <u>yes</u>, does the patient's level of hearing improve with the use of aids?

1) Yes
0) No

c. If <u>no</u>, why not?

1) Not required
2) Uncomfortable
3) Does not own a hearing aid
4) Hearing aid broken
5) Hearing aid lost
6) Flat batteries
7) Patient refuses to wear hearing aid

Nurse 6.10 What is the patient's visual acuity?

1) Restricted without corrective lenses (does not wear corrective lenses)
2) Adequate without corrective lenses
3) Adequate with corrective lenses
4) Restricted with corrective lenses
5) Blind with or without corrective lenses

7. BREATHING

Nurse 7.1 a. Does the patient have any difficulties with breathing?

1) Yes
0) No

b. If yes: does the patient require any of the following in order to breathe adequately:

1) Suction
2) Oxygen
3) Respirator
4) Tracheotomy

Nurse 7.2 Is the patient a smoker?

1) Yes
0) No

What is the person's overall mental status? **(Do not average the previous questions. Instead, consider the impression of characteristics like mental functioning, psychosocial abilities, freedom from impairments, and perceptual abilities in this rating)**

0	1	2	3	4	5	6	7	8	9
completely impaired				moderately impaired					no impairment

BEHAVIOUR PROBLEMS

9.1 If the patient exhibits any of the following behaviours, circle the category for its frequency.

	Never	Less Than once a Month	At least once per month	At least once per week	At least once per day
Asks same question repeatedly	1	2	3	4	5
Loses, misplaces, or hides things	1	2	3	4	5
Lack of interest in daily activities	1	2	3	4	5
Makes unwarranted accusations	1	2	3	4	5
Paces/wheels up and down	1	2	3	4	5
Repeats the same action over and over	1	2	3	4	5
Is verbally abusive, curses	1	2	3	4	5
Cries or laughs inappropriately	1	2	3	4	5
Refuses to be helped with personal care	1	2	3	4	5
Hoards things for no apparent reason	1	2	3	4	5
Moves arms or legs in a restless or agitated way	1	2	3	4	5
Empties drawers or closets	1	2	3	4	5
Wanders in the hospital at night	1	2	3	4	5
Refuses to eat	1	2	3	4	5
Overeats	1	2	3	4	5
Wanders aimlessly outside or in the hospital during the day	1	2	3	4	5
Makes physical attacks on others (hits, bites, scratches)	1	2	3	4	5
Screams or moans for no apparent reason	1	2	3	4	5
Makes inappropriate sexual advances	1	2	3	4	5
Exposes private body parts	1	2	3	4	5
Destroys property or clothing	1	2	3	4	5
Throws food	1	2	3	4	5
Disrobes or dresses inappropriately	1	2	3	4	5
Makes unwarranted requests for attention or help	1	2	3	4	5
Complains	1	2	3	4	5
Hurts self or others	1	2	3	4	5

10. MOOD

10.1 Please check all statements that were true for the patient in the **Nurse** week, if applicable.

a. Easy interactions with others	
b. At ease doing planned or structural activities	
c. At ease doing self-initiated activities	
d. Establishes own goals	
e. Pursues involvement in life of facility (e.g. makes/keeps friends; involved in group activities; responds positively to new activities; assists at religious services)	
f. Accepts invitations into most group activities	
g. Covert/open conflict with and/or repeated criticism of staff	
h. Unhappy with roommate	
i. Unhappy with residents other than roommate	
j. Openly expresses conflict/anger and family or friends	
k. Absence of personal contact with family/friends	
l. Recent loss of close family member/friend	

10.2 Please check all statements that were true for the patient during **Nurse** last month, if applicable.

a. Verbal Expressions of Distress (e.g. sadness, sense that nothing matters, hopelessness, worthlessness, unrealistic fears, vocal expressions of anxiety or grief)	
b. Demonstrated (observable) signs of mental distress	
c. Tearfulness, emotional groaning, sighing, breathlessness	
d. Motor agitation such as pacing, handwringing or picking	
e. Failure to eat	
f. Refusal to take medications	
g. Withdrawal from self-care or leisure activities	
h. Pervasive concern with health	
i. Recurrent thoughts of death (e.g. believes he/she about to die, or have a heart attack	
j. Suicidal thoughts/actions	

11. RELATIONSHIPS

Chart 11.1 What is the patient's marital status?

1) Single
2) Married
3) Widowed
4) Separated/Divorced

Nurse 11.2 How many living children does the patient have?____________________

The number of living children is independent of marital status. That is, married, widowed, separated, divorced or *single* patients who have no children are classified as having zero children.

Nurse 11.3 Are either of the patient's parents alive?

1) Yes
0) No

Nurse 11.4 Does the patient have any other relatives (other than children) living <u>in the area</u>?

1) Yes (specify:____)
0) No
2) Unknown

Nurse 11.5 How frequently does the patient receive personal mail from family or friends?

1) Once a day
2) Once a week
3) Once a month
4) Once a year
5) Less often or never

Nurse 11.6 a)How frequently does the patient either initiate phone calls to, or receive phone calls from family or friends?

1) Once a day
2) Once a week
3) Once a month
4) Once a year
5) Less often or never

Comp b)Does patient rent a phone? 1=YES 0=NO

Comp c)How many outgoing calls per month does the patient make?

Comp d)What is the average length of the outgoing call?

Comp e)Does patient require operator/switchboard assistance to place a call? 1=YES 0=NO

Comp f)Are there any special devices on their telephone?
1=YES 0=NO
Specify: ____________________________

11.7 Who is the patient's key contact person (**check if more than one**) and how frequently is the patient usually visited by his/her contact person(s)?

	Contact?		AT LEAST ONCE PER: Day	Week	Month	Year	Less Often or Never
a) Spouse	Y	N	1	2	3	4	5
b) Child	Y	N	1	2	3	4	5
c) Sibling	Y	N	1	2	3	4	5
d) Grandchild	Y	N	1	2	3	4	5
e) Friends	Y	N	1	2	3	4	5
f) Volunteer	Y	N	1	2	3	4	5
g) Other (specify:) ______	Y	N	1	2	3	4	5

11.8 How would you describe the relationship between the patient and his/her <u>key</u> contact person(s)?

a. contact person #1 (specify:______________________)
(as indicated on chart)
1. excellent
2. good
3. fair
4. poor
5. little or no contact

b. contact person #2 (specify:______________________)
(as indicated on chart)
1. excellent
2. good
3. fair
4. poor
5. little or no contact

11.10 What is the age category of the patient's volunteer?

1) Teenager
2) 20-29 years
3) 30-39 years
4) 40-49 years
5) 50-59 years
6) 60-69 years
7) 70 plus

Volunteer Coordinator	11.11	What is the gender of the patient's volunteer? 0) Male 1) Female
Volunteer Coordinator	11.12	How long has the volunteer been spending time with the patient? 1) 0-6 months 2) 7-12 months 3) 13-18 months 4) 19-24 months 5) more than 25 months
Volunteer Coordinator	11.13	In what area does the volunteer assist? 1) Rehabilitation (**includes friendly visitors, companion portering, OT, PT, RT, Augmentative Communication**) 2) Pastoral Care 3) Portering to Church services 4) Social Work 5) Coffee Break 6) Barber/Beauty Shop 7) Other (specify:________________
Volunteer Coordinator	11.14	How many minutes are spent in direct contact with the patient each week? 1) 0-60 minutes 2) 61-120 minutes 3) 121-180 minutes 4) more than 180 minutes (three hours)
Volunteer Coordinator	11.15	How many minutes are spent writing or speaking about the patient per week (indirect)? 1) 0-10 minutes 2) 11-20 minutes 3) 21-30 minutes 4) more than 31 minutes
Humanities	11.16	In the past six months, which of the following stressful events has the patient experienced? Please check if more than one.
Social work, Pastoral care, Psycho-social nursing)		_____ Death of spouse _____ Death of close family member or close friend _____ Health change _____ Health concerns for other person _____ Conflict-laden or severed relationship _____ Temporary discharge to other hospital _____ Change of rooms _____ None _____ Other (specify: ________________)

11.17 How often does the patient engage in the following personal activites outside the hospital?

	AT LEAST ONCE PER:				
	Day	Week	Month	Year	Less Often or Never
a) Shopping	1	2	3	4	5
b) Visiting	1	2	3	4	5
c) Work	1	2	3	4	5
d) School	1	2	3	4	5
e) Entertainment	1	2	3	4	5
f) Family Functions (e.g. weddings, funerals, birthdays)	1	2	3	4	5
g) Financial and Legal Affairs	1	2	3	4	5
h) Other (specify:________	1	2	3	4	5

12.1 Please check the activities in which the patient has participated in during Feburary, March and April 1994. Indicate the function, day and time of each activity. (See below for explanations of codes to be used for function, day and time. Refer to activity list to clarify what each activity category includes.)

Activity	Participate? (Y/N)	Function	Day	Time
Art Therapy	Y N			
Cards/Games	Y N			
Ceramics	Y N			
Community Group	Y N			
Computer	Y N			
Discussion Group	Y N			
Adapted Sports	Y N			
Horticulture Programs	Y N			
Kitchen Group	Y N			
Leisure Education	Y N			
Model Railway Club	Y N			
Music Programs	Y N			
Out-Trips	Y N			
Pet Therapy	Y N			
Remotivation Therapy	Y N			
Silk Painting	Y N			
Swimming	Y N			
Seniors Education Program	Y N			
Woodworking	Y N			
Young & Resourceful	Y N			
One to One Program	Y N			
Other ______	Y N			

CODES

1) **Function** 0 = Socialization
1 = Therapeutic

2) **Day** 1 = Monday 3 = Wednesday
2 = Tuesday 4 = Thursday
5 = Friday
6 = Saturday
7 = Sunday

12.2 How often does the physician usually review the patient's status?(e.g., **indirect assessment, discussion with nursing staff**)

1) Emergencies
2) Once a week
3) Once a month
4) Once every 3 months
5) Once every 6 months
6) Once every year

12.3 How often does the physician directly assess the patient? (**i.e.,not checking progress notes only direct contact**)

1) Emergencies
2) Once a week
3) Once a month
4) Once every 3 months
5) Once every 6 months
6) Once every year

12.4 In the last 30 days how many times has the physician changed the resident's orders?

0) No changes
1) # of changes is ____________________.

12.5 Please circle any devices used by the patient and describe the purpose of each device used (e.g., **preventing falls, maintaining posture**).

Type	0=Falls 1=Posture 2=Both 3=Other
a) Seatbelt or Lapbelt	
b) Magnetic Belt (in Bed)	
c) Table	
d) Side Rails (in Bed)	
e) Bumper Pads	
f) Pillow	
g) Other________________________	

ASSESSMENTS (all departments)

Is the patient currently under active treatment, monitoring, or intervention by the following disciplines? If under active treatment, how many direct and indirect hours has the person received each month, on average, for last three months? If not under active treatment, please indicate the reason.

Discipline	UNDER ACTIVE TREATMENT			NOT UNDER ACTIVE TREATMENT			
	Under Active Treatment (Y/N)	Average Direct Hours	Average Indirect Hours	On Waiting List	Discharged from Treatment	Treatment Not Necessary	Has Not Yet Assessed / Referred
Physiotherapy	Y N			2	3	4	5
Occupational Therapy	Y N			2	3	4	5
Speech Therapy	Y N			2	3	4	5
Augmentative Communication	Y N			2	3	4	5
Audiometry	Y N			2	3	4	5
Recreation Therapy	Y N			2	3	4	5
Respiratory Therapy	Y N			2	3	4	5
Social Work	Y N			2	3	4	5
Swallowing Assessment Team	Y N			2	3	4	5
Psychosocial Nursing	Y N			2	3	4	5
Pastoral Care	Y N			2	3	4	5
Neuro-psychology	Y N			2	3	4	5
Placement and Community Resources	Y N			2	3	4	5
Pharmacy	Y N			2	3	4	5

14. Questions 14.1 - 14.10 are for the 1993 Sample Only. All other questions are for everyone.

Patnt.14.1 Records

Why is the patient no longer included in the Program Needs Sample?

1) Death
2) Discharge
3) Other (Specify:____)

Patnt.14.2 Records

For patients who were discharged:

a. To where was the patient discharged?

1) Acute hospital
2) Nursing Home/Home for the Aged
3) Community
4) Other (Specify: ____)

b. What was the date of discharge?

____
YY / MM / DD

Patnt.14.3 Records

For patients who died:

a. What were the ICD-9 codes for the

primary cause of death ___________________________________?

secondary cause of death _________________________________?

complications ____?

____

____

b. What was the patient's date of death?

____
YY / MM / DD

c. Was C.P.R. attempted in the week before the patient's death?

1) Yes
0) No

Ptnt. care **14.4** Which of the following incidents have occurred for this patient during the past year? Please speciy the number of incidents and the date of the first instance of each incident (between June 1, 1993 and May 31, 1993).

Incident	Number of Incidents in Previous Year	Date of First Occurrence(YY/MM/DD)
a) Falls		
b) Medication Errors		
c) Cuts and Bruises		
d) Wandering		
e) Other:__________ ____________		

Comp 14.5 Was this patient vaccinated for influenza during the past year?

1) Yes
0) No

Nurse 14.6 Did the patient contract influenza or influenza-like illness during the "flu" season (Nov-Mar)?

1) Yes
0) No

Nurse & Computer 14.7 Which influenza-like symptoms did the patient develop? (Check all that apply)

_____ None

_____ High Temperature

_____ Pain

_____ Cough

_____ Congestion

_____ Increased Sputum

_____ Lethargy

_____ Other (specify:______________________________

Nurse 14.8 If the patient developed influenza or influenza-like symptoms, what was the overall severity?

1) None
2) Mild
3) Moderate
4) Severe

14.9 a.Did the patient develop a urinary tract infection during the past year?

1) Yes
0) No

b.If yes, how many times did a urinary tract infection occur?
______times

c.What was the date of the first urinary tract infection?

____
YY / MM / DD

14.10 a.Did the patient develop a respiratory tract infection during the past year?

1) Yes
2) No

b.If yes, how many times did a respiratory tract infection occur?

_______ times

c.What was the date of the first respiratory tract infection?

____
YY / MM / DD

Appendix 4: Falls Education Program for Intervention Study (Chapter 6)

Falls Education Program

The falls prevention education segment of the intervention program was approximately two to three hours in length. The segment was designed with the main intent of group participation and group discussion.

At the onset of the program, a film entitled ***Head over Heels***, which was developed by the University of British Columbia, was viewed by the participants.. The presenter (author of thesis) then talked to each of the groups about the seriousness of the issue of falls, by presenting statistics on falls and fall-related injuries and deaths. The presenter then lead the group in discussing various risk factors for falls, causes of falls, injuries resulting from falls, and risk factors for increased trauma resulting from fall. Graphic presentations and case scenarios were utilized to prompt group discussion. Lastly, modifications (e.g., environmental) that could be adopted into the lifestyle behaviours of the participants to reduce the risk and/or additional falls were discussed. The identification and subsequent modification of environmental hazards within their home environments is beneficial and of importance for the following reasons: (1) modification has the potential to decrease seniors' risk of accidental injury, with particular emphasis on fall prevention; and (2) to improve the ability for seniors to safely perform activities of daily living. Josephson et al. (1991) suggest that these two factors should provide seniors with an increased sense of security, control, independence, and further, have the potential for decreasing further declines in disability from accidents incurred within the home.

Slides (adapted from Frank et al., video; Josephson et al., 1991; Kane et al., 1989; Occupational Therapy Department from Seven Oaks General Hospital; Tideiksaar, 1989; 1990) and case scenarios (adapted from Tideiksaar, 1990) that were used in the presentation follow the description of the falls intervention. Handouts were also provided so that a record of means by which falls could be reduced or prevented were available for future reference. The handouts, from the Occupational Therapy Department at the Seven Oaks General Hospital in Manitoba, summarized the slides that were utilized during the class.

OUTLINE: FALLS PREVENTION & EDUCATION

- **Magnitude of Problem: How Many Seniors Fall Each Year**
- **Causes of Falling**
- **Risk Factors for Falling: What Factors Place Seniors at Risk of Falling**
- **Changing Your Environment to Prevent Falls**
- **Using Medication Wisely**
- **What to Do if a Fall Occurs?**
- **Maintaining Balance and the Importance of Exercise**

FALLS: HOW MANY PEOPLE ARE AFFECTED?

- falls are the leading cause of injury and the 6th leading cause of death in individuals over the age of 65

- 1/3 to 1/2 of seniors are prone to falling each year

- approximately 5% of these falls result in fractures

- an additional 5% result in soft tissue injuries

FALLS: HOW MANY PEOPLE ARE AFFECTED?

- 50% of seniors that are admitted to a hospital after a fall are alive 1 year later
- about 600 Ontario seniors died each year between 1985 and 1990
- falls and their subsequent complications frequently lead to hospitalization, illness or death
- falls are preventable

HOW AGING CONTRIBUTES TO INSTABILITY AND FALLS

CHANGES IN POSTURE

- slower reflexes
- decreased muscle tone

CHANGES IN GAIT

- feet not picked up as high
- men develop flexed posture and wide-based, short stepped gait
- women develop narrow-based, waddling gait

MEDICAL CONDITIONS

- degenerative joint disease
- fractures
- muscle weakness
- diseases or deformities of the feet
- impaired vision
- impaired hearing
- forgetfulness and dementia
- other diseases

POTENTIAL CAUSES OF FALLS

ACCIDENTS

- true accidents (trips, slips)
- environmental hazards

SYNCOPE (sudden loss of consciousness)

DROP ATTACKS (sudden leg weakness without loss of consciousness)

DIZZINESS

ORTHOSTATIC HYPOTENSION

POTENTIAL CAUSES OF FALLS

DRUG-RELATED

- diuretics
- sleeping pills and tranquilizers
- antihypertensives
- alcohol

SPECIFIC DISEASES

- acute illness of any kind
- cardiovascular disease

NEUROLOGICAL CAUSES

- stroke
- seizure disorder
- Parkinson's disease

RISK FACTORS FOR FALLING AMONG SENIORS

HISTORY OF PREVIOUS FALLS

LIFESTYLE (e.g., recreation, socialization, alcohol consumption)

DEMOGRAPHIC FACTORS

- age
- gender
- marital status/living arrangements

ENVIRONMENTAL FACTORS

- from footwear to obstructions

MEDICATIONS

RISK FACTORS FOR FALLING AMONG SENIORS

NOCTURIA

NEED FOR PROFESSIONAL SUPPORT SERVICES

PHYSIOLOGICAL IMPAIRMENT OR FUNCTIONAL DISABILITY

MOBILITY IMPAIRMENTS & STABILITY PROBLEMS

GAIT DISORDERS

INACTIVITY

COGNITIVE IMPAIRMENTS

POTENTIAL ENVIRONMENTAL HAZARDS

- cracked and uneven sidewalks
- uneven stairs and inadequate railings
- inadequate lighting or glaring
- throw rugs
- frayed carpets
- electrical cords and wires
- slippery floors and bathtubs

POTENTIAL ENVIRONMENTAL HAZARDS

- unavailability of grab bars
- beds and toilets of inappropriate heights
- unstable and low-lying furniture
- poorly maintained walking aids and equipment
- ill-fitting footwear

INJURIES RESULTING FROM A FALL

MAJOR INJURIES THAT MAY BE INCURRED:

- head injury
- spinal cord injury
- internal injury
- fractures

MINOR INJURIES THAT MAY BE INCURRED:

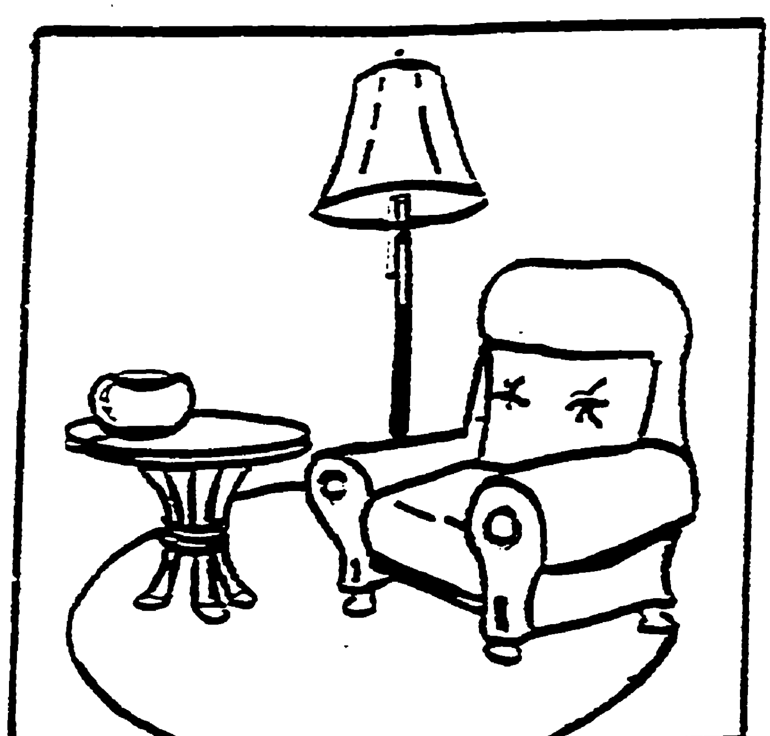
- sprains
- strains
- cuts and bruises

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

INSIDE THE HOME

- keep pathways in the home clear

- floor surfaces that are non-slip and solid in color are preferable



- repair loose floor tiles and secure loose carpeting

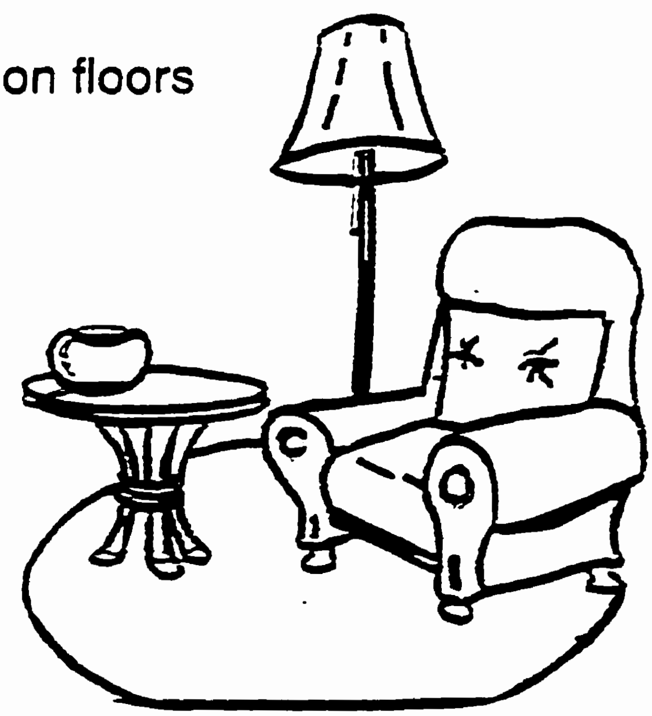
- remove scatter/throw rugs or apply back with adhesive tape

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

INSIDE THE HOME

- dense short-pile carpets are ideal

- use nonskid wax on floors



- reduce glare in home by adjusting lighting

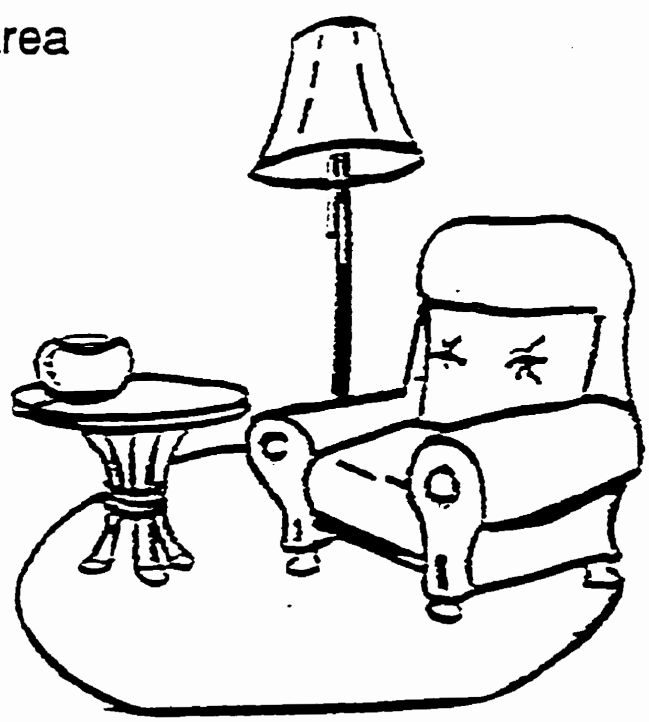
- keep phones in reach throughout the home & have a list of emergency numbers by the phone

- consider installing telephone emergency alert system

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

LIVING ROOM

- establish safe traffic area



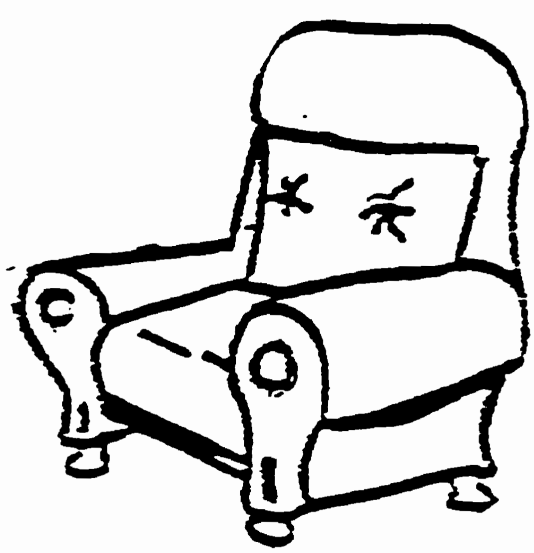
- choose chairs and sofas with supportive backs and suitable heights

- install "touch on" adapters or "clappers" to lamps with metal bases

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

CHAIRS

- avoid chairs with wheels



- chairs with armrests provide leverage during sitting/rising

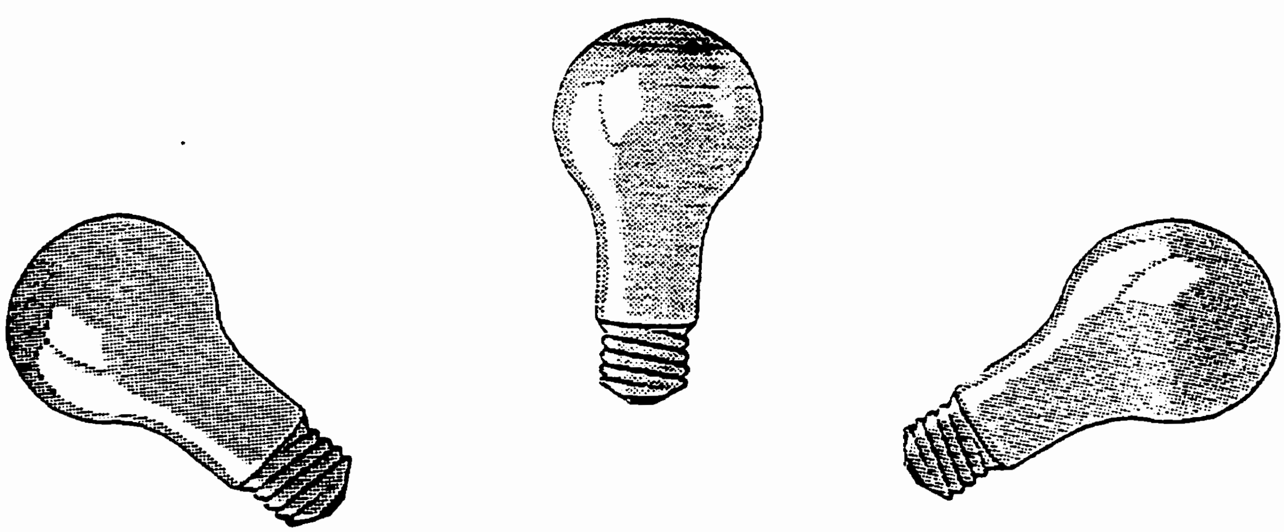
- avoid soft, low chairs or sofas

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

LIGHTING

- improve lighting in high-risk areas, especially in the bathroom and bedroom

- install "touch on" adapters or "clappers" to lamps with metal bases

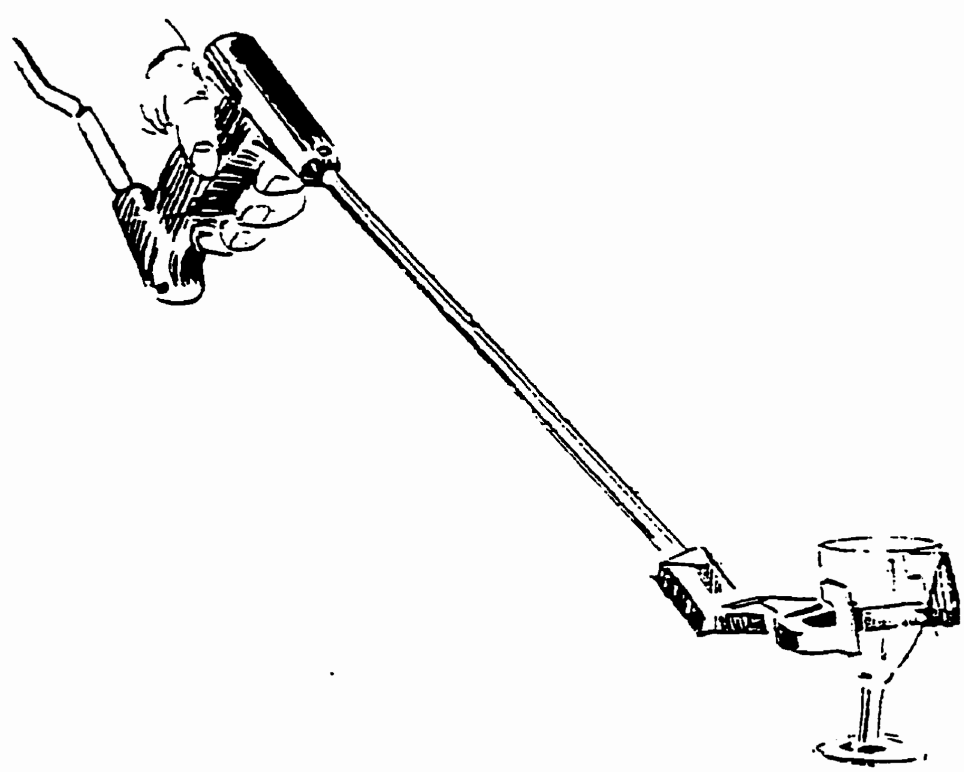


CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

SHELVES

- rearrange shelves to avoid excessive reaching or bending for frequently used items

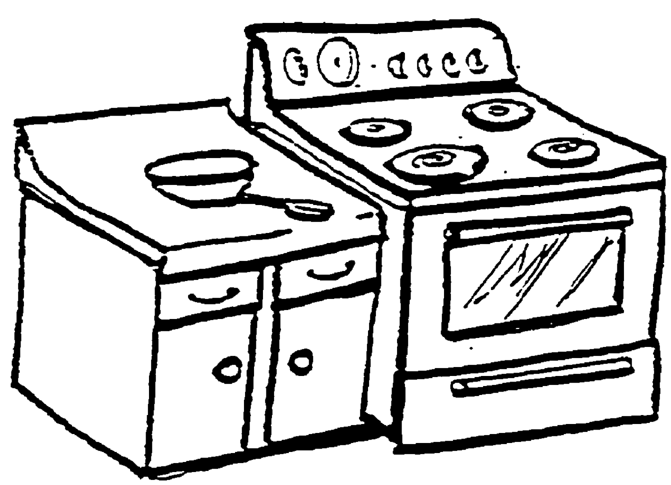
- consider purchasing hand-held reaching tools



CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

KITCHEN

- ensure easy access to commonly used dishes and avoid storage in hard-to-reach cupboards that require climbing or stretching

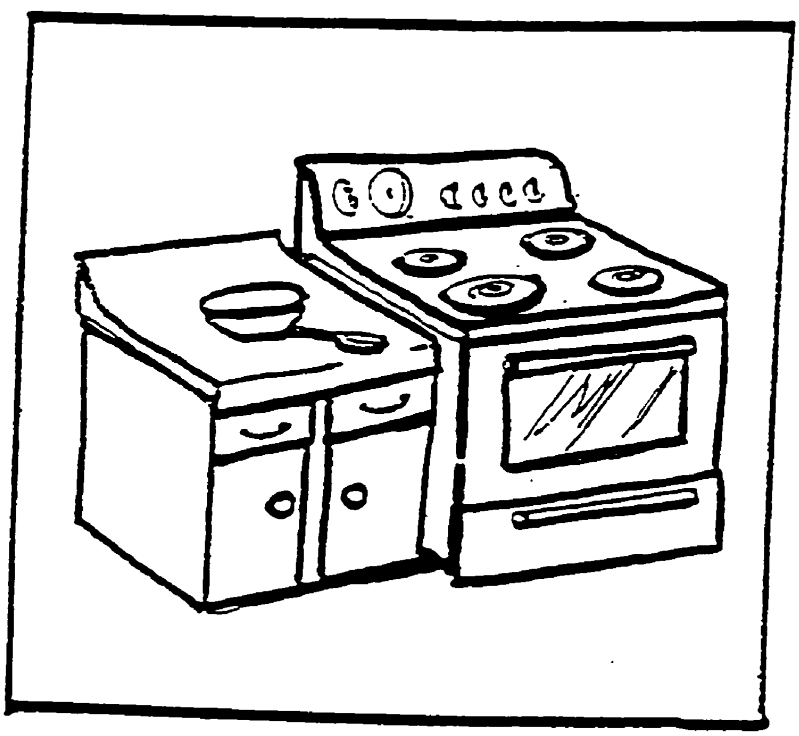


- if need to use footstool, use one with a handrail

- ensure maximum mobility in cooking and eating areas

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

KITCHEN



- remove any wheels from kitchen chairs or stools

- clean up water spills as soon as possible

SCENARIO

Mr. Anderson would like to maintain his independence and continue living in his own home; however, he has recently experienced several falls while preparing meals in the kitchen.

What can Mr. Anderson do to try and prevent any further falls from occurring within the kitchen?

POSSIBLE SOLUTION

- clean up all spills as soon as possible

- a non-skid mat can be placed by the sink

- commonly used utensils should be made easily accessible ... storage in hard-to-reach cupboards that require climbing or storage should be avoided.

- a secure step stool should be used when reaching for objects

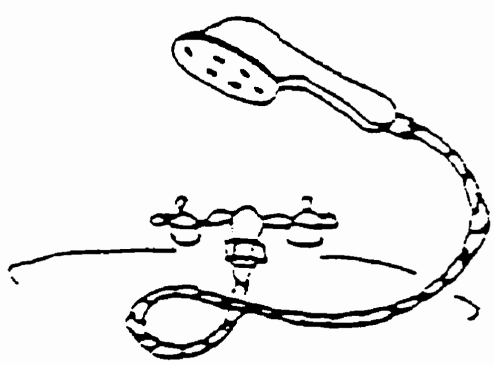
- wheels should be removed from any chairs or stools. Rubber tips may be secured to the tips of chairs and stool legs to prevent slipping.

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

BATHROOM

- use rubber mats within the tub and out of the tub

- install shower head extenders or use a hand-held shower hose



- place non-slip adhesive treads/suction cup mats in bathtub

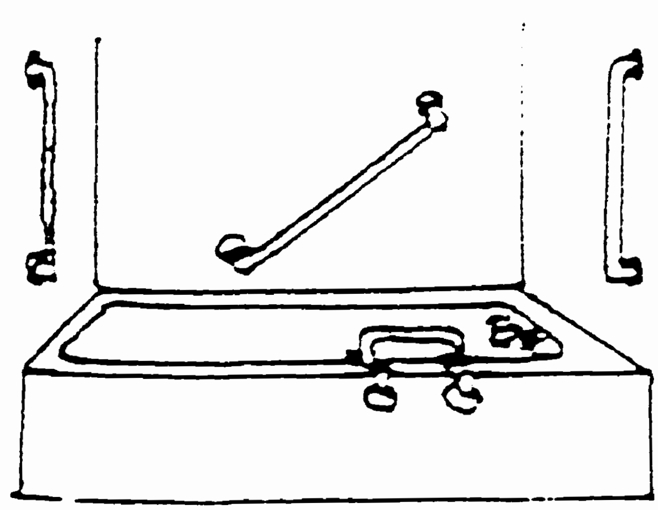
- clean up water spills (e.g., near tub, sink) as soon as possible

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

BATHROOM

- to avoid standing in the shower, use a bath seat or shower chair with a back and nonskid tips

- position grab bars in the shower and tub



- install grab bars by toilet & obtain raised seat for the toilet

- use grab bars for support (not shower curtain rod, towel rack)

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

BATHROOM

- keep a night light on in the bathroom
- leave door unlocked

SCENARIO

During the night, Mrs. Smith has fallen several times while on her way to the bathroom. She does not have any medical condition to explain her falls.

What advice would you give Mrs. Smith to help her prevent any further episodes of falling.

POSSIBLE SOLUTION

- Mrs. Smith may want to keep a night light on in the bathroom and/or hallway.

- Mrs. Smith may also want to have a clear pathway between the bed and the bathroom in order to avoid tripping over objects

- Mrs. Smith should get up slowly and wait until any dizziness goes away before walking to the bathroom

SCENARIO

Mr. Brown lives alone and is afraid that he may fall in the bathtub while he is taking a shower.

What can Mr. Brown do to prevent himself from falling?

POSSIBLE SOLUTION

- place rubber mats or nonslip adhesive strips in the bathtub and on the bathroom floor to avoid slipping

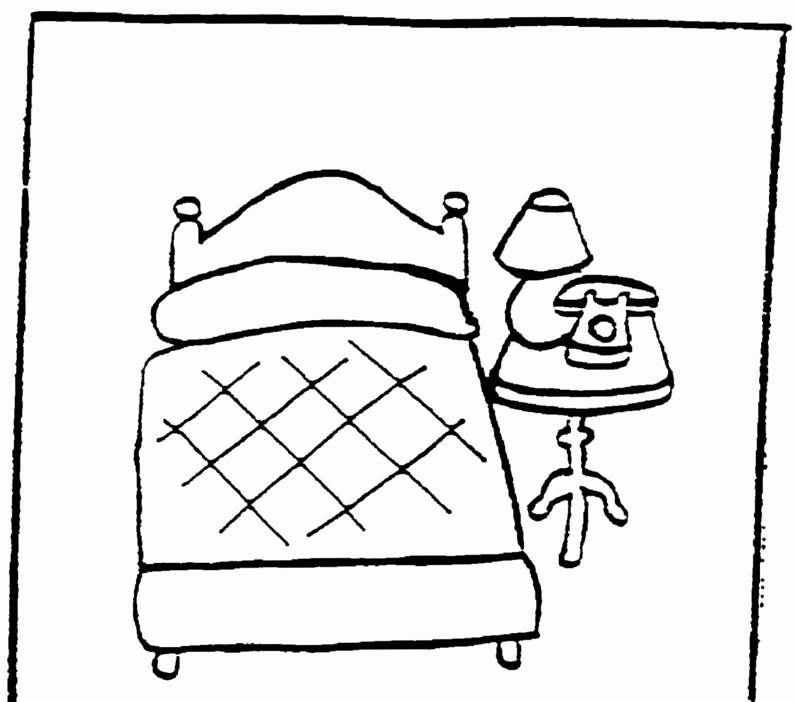
- a grab bar may be placed on the bathtub rim to aid in transfers

- may want to consider using a chair in the bathtub

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

BEDS AND BEDROOM

- place telephone by the bed



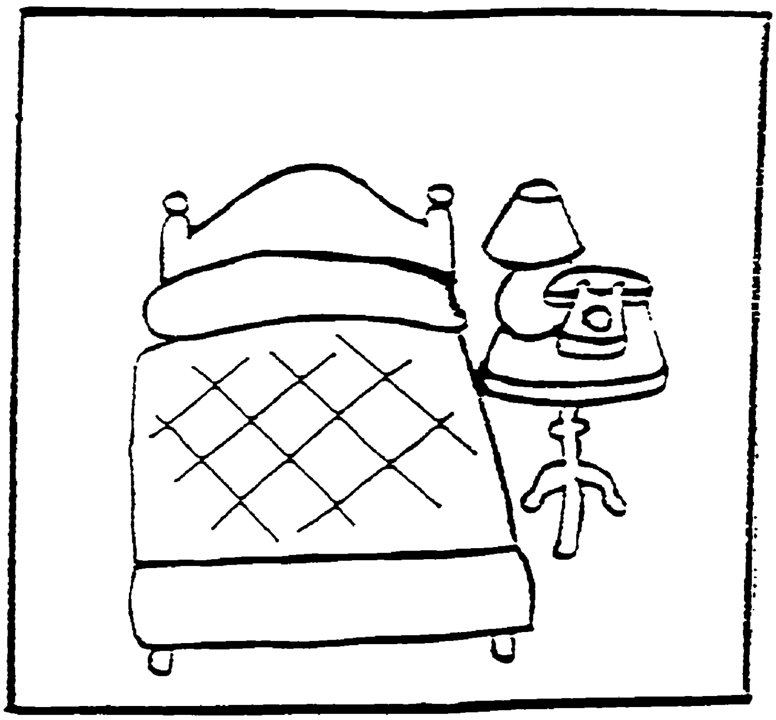
- keep a night lamp on or in close proximity to the bed table

- keep floor free from clutter and ensure a safe pathway to the bathroom

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

BEDS AND BEDROOM

- ensure that bed mattress is firm enough to support a seated person on the edge of the bed



- consider use of bedrails & bedside commode or urinal

- sit up slowly when getting out of bed and wait until any dizziness goes away before standing

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

GENERAL TIPS

- establish safe traffic areas
- remove scatter/throw rugs or apply backs with adhesive tape
- rearrange shelves to avoid excessive reaching or bending for frequently used items
- avoid soft or low chairs and sofas
- always have at least one hand free to hold onto the railing

CHANGING YOUR ENVIRONMENT TO PREVENT FALLS

FOOTWEAR

- avoid loose shoes or slippery soled shoes

- avoid the following:

  (1) ill-fitting shoes

  (2) shoes with worn soles and heels

  (3) heels that are too high or narrow

  (4) shoes that are too tight

  (5) shoes that are left unbuckled or untied

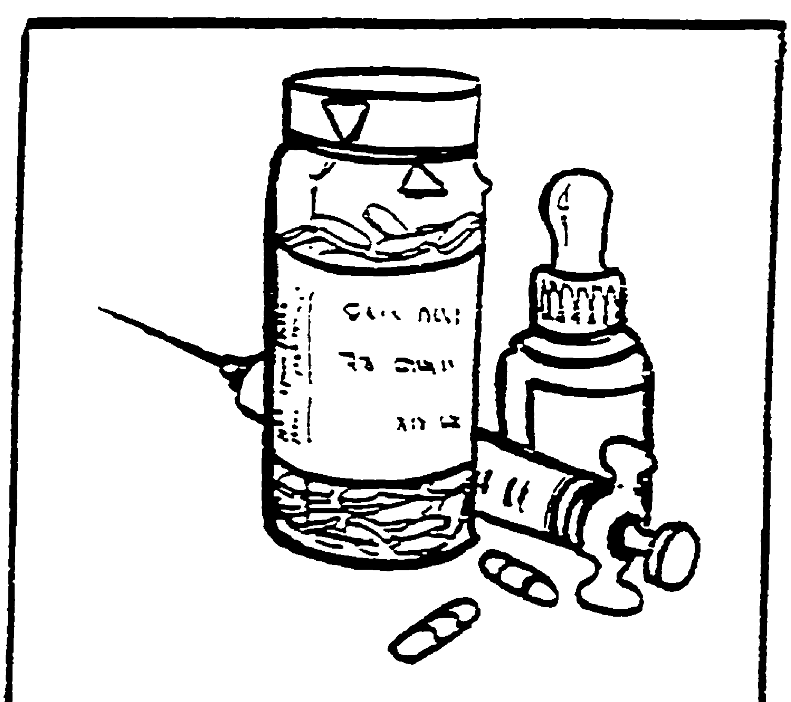
  (6) slippers without soles or backs

- the ideal footwear should fit properly, be low heeled and have non-slippery soles

USING MEDICATION WISELY

Various Forms of Medicines:

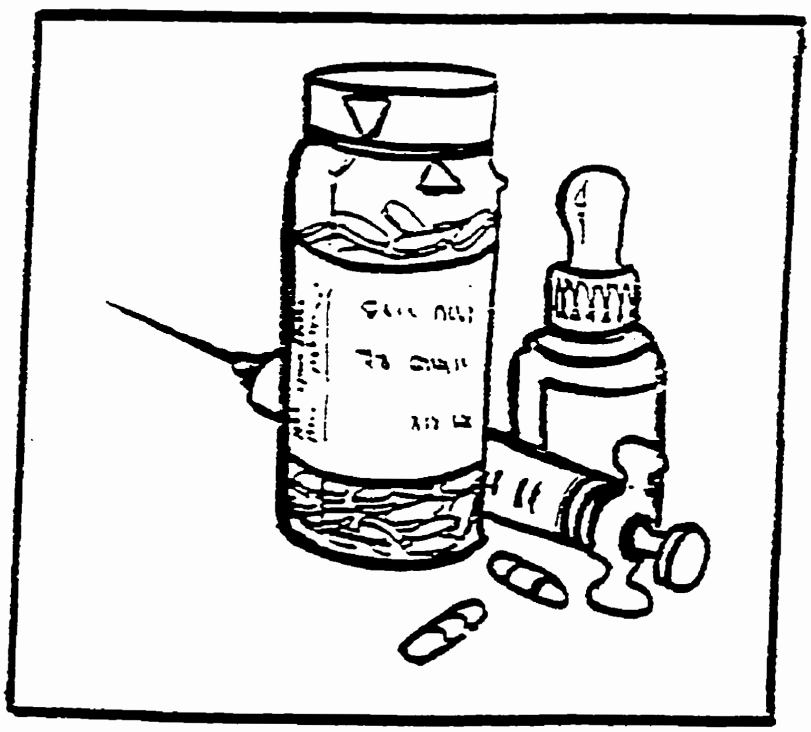
pills
liquids
eye drops
inhalers
needles



USING MEDICATION WISELY

Things you **should not** do:

- do not take medicine in the dark or you may take the wrong medication.



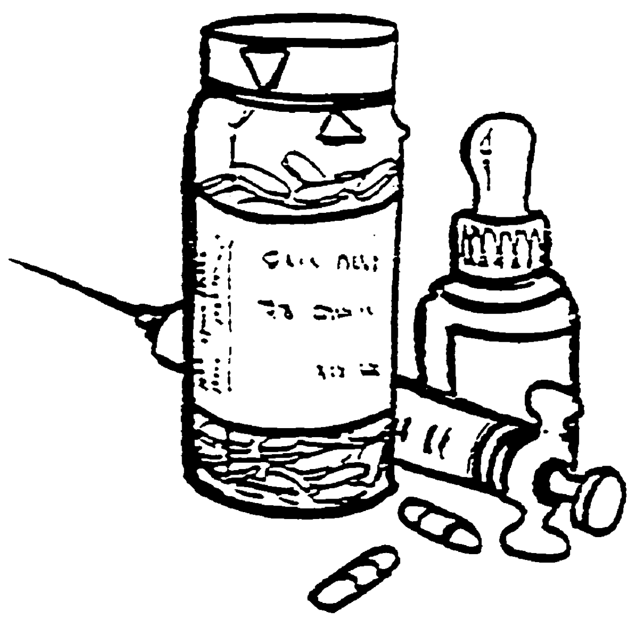
- do not share your medicine with another person and do not take another person's medication

- if you forget to take one dose, do not double the next dose you take. Consult your pharmacist.

USING MEDICATION WISELY

Things you **should not** do:

- do not keep or save any medications that you have taken and not finished. Old medications may harm you and also may no longer work.



- never mix medications together in one bottle. You may not remember which pills are for what purposes. You may also not remember the correct dosage that is to be taken.

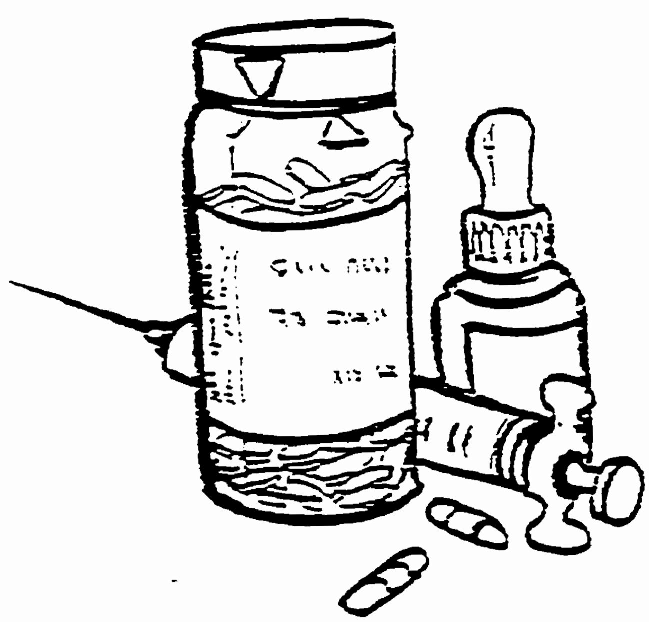
- never leave your medications in places children can reach them

USING MEDICATION WISELY

<u>Things you should do</u>:

- medication dosettes can be used to help you remember when to take your medications

- talk to your doctor and your pharmacist about potential side-effects for which you should be aware



- take medications that are out of date to your pharmacist for proper disposal

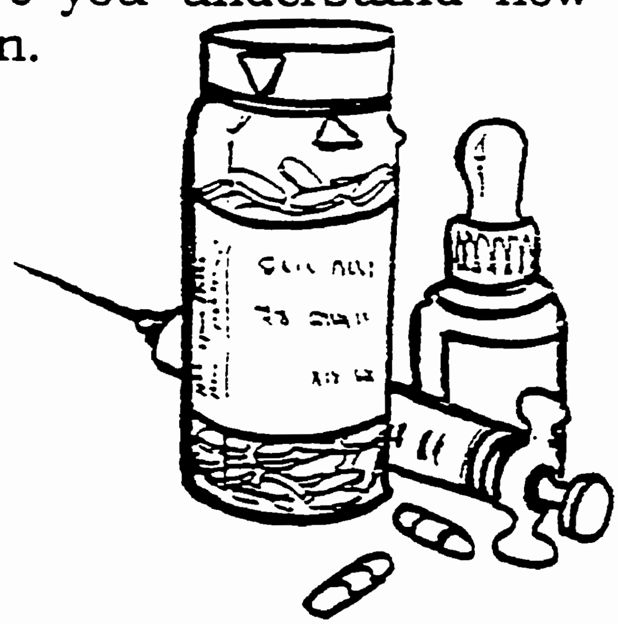
- always read the labels of the medicine you are taking and follow the doctor's instructions for taking the medication

USING MEDICATION WISELY

Things you **should do**:

- always complete the medication given to you by your doctor, unless he tells you otherwise

- make sure you understand how to take your medication.



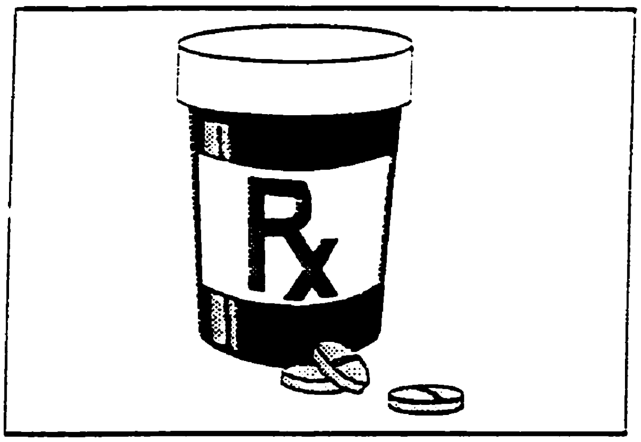
- if you cannot read the instructions of the medication, use a magnifying glass or ask the pharmacist to give the instructions in large print.

- keep your medications separate from other people's medicines

Medications and Substances Affecting Balance

Medications that Reduce Alertness:

- hypnotics
- sedatives
- tranquilizers (e.g., Valium)
- alcohol



Medications that Affect Postural Control:

- diuretics
- some medications that affect the heart (such as digitalis and some beta blockers)
- some medications used to control high blood pressure

SCENARIO

Mrs. Brown is a 77 year old widow who lives alone. She currently suffers from depression and is taking anti-depressants for her treatment. Additionally, she regularly takes antihistamines for relief of her allergies. Both drugs have been prescribed by the same doctor.

INCIDENT

While visiting her son and his family, she gets the bacterial throat infection that her son had. Her son, gives his mother some of the penicillin he had been prescribed, since he figured that the infection was similar and it would not harm her if she took the medication.

Is there a problem with this logic?

ANSWER TO PENICILLIN QUESTION

- Mrs. Brown should not take the penicillin for the following reasons:

  (A) the penicillin may interact with the medication she is currently taking, and cause an adverse reaction

  (B) Mrs. Brown may require a different medication and/or a different dose of the medication to treat the infection because of her age, health, and the medication she has currently been prescribed

INCIDENT

While visiting her sister (Mrs. Clark) over the Christmas holidays, Mrs. Brown was having trouble sleeping. Mrs. Clark gave Mrs. Brown some of her prescribed sedatives, so that she could get some rest.

Should Mrs. Brown take Mrs. Clark's sedatives? Why or why not?

ANSWER TO SEDATIVE QUESTION

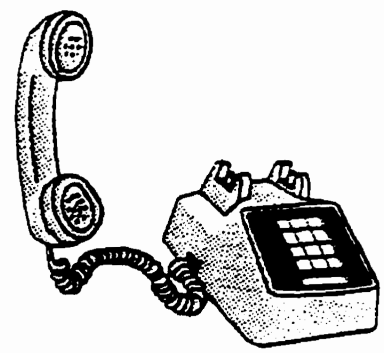
- Mrs. Brown should not take her sister's sedative

- the sedative may interact with the medication she is currently taking and cause an adverse reaction, namely, further sedation which could lead to a fall or other problem

- Mrs. Brown may require a different sedative to avoid drug interactions, and may also require a different dose, given her current state of health

WHAT TO DO IF A FALL OCCURS

In the case of a serious fall:



- You must not panic.

- Relax and rest for a few minutes. Try to determine where you are hurt. Move your arms and legs if you can.

- Try to get up by holding on to a stable object for support. If you are still unable to get up, press the soles of your feet against a solid object in order to try and regain some tone in your legs.

- If this does not work, crawl to the phone and pull the phone to the floor by pulling on the cord. You should have telephones that are located on tables, rather than mounted to the wall. Also, you should have telephones in your bedroom and living room.

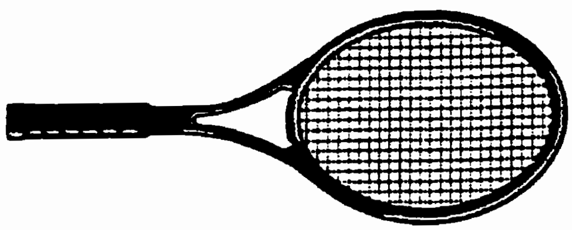
WHAT TO DO IF A FALL OCCURS

- Dial 911 and tell the operator you need assistance. Give the operator your name and number. Your should keep a list of important phone numbers by your phone or have them programmed into the phone.

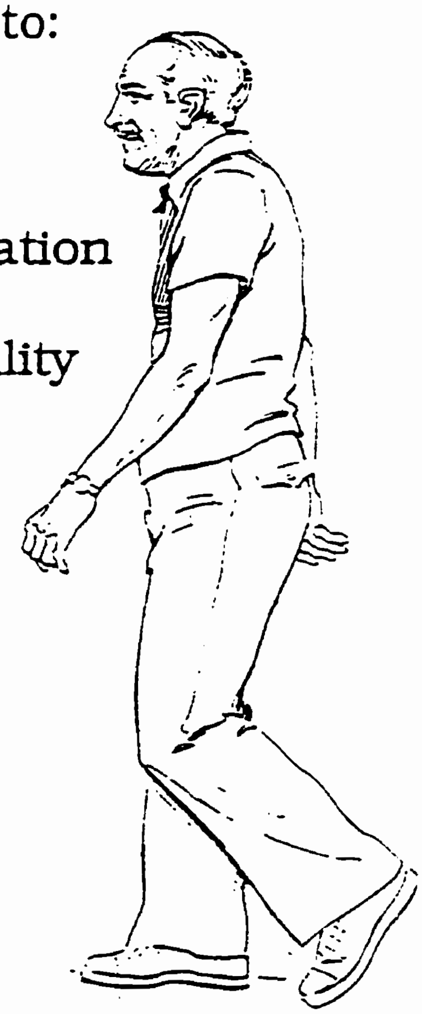
- If you live in an apartment, you may try banging on the floor or walls and calling out for help. You may be able to get someone's attention.

- If you are a frequent faller, you may consider using Lifeline or obtaining the services of the Emergency Medical System.

TIPS FOR AVOIDING FALLS



1. Keep physically active. Exercise to:
   - keep the senses tuned
   - maintain total body co-ordination
   - maintain strength and flexibility



2. Stay alert. Watch for:
   - low lying obstacles
   - loose carpets
   - slippery and uneven surfaces

TIPS FOR AVOIDING FALLS

3. Be cautious. Try to:

   - avoid unnecessary risks
   - maximize your balance through the use of handrails or a widened stance
   - inquire about side-effects of medications
   - seek alternatives to sleeping pills and tranquilizers

4. Priority Environmental Tips. Ensure:

   - adequate lighting
   - availability of grab bars and railings (if needed)
   - secure rugs and carpets

POSSIBLE PHYSIOLOGICAL BENEFITS OF EXERCISE

Cardiovascular Benefits

- **increased aerobic capacity**
- **increased stroke volume**
- **decreased resting heart rate**
- **decreased resting blood pressure**

Improves Balance Control System

POSSIBLE PSYCHOSOCIAL BENEFITS OF EXERCISE

- increased sense of well-being
- increased perceived health
- increased life satisfaction
- increased self-confidence
- decreased depression
- decreased anxiety

Appendix 5: Balance Control Exercise Program for Intervention Study (Chapter 6)

Exercise Intervention Program

Background Information: Benefits of Exercise

McPherson (1990) and Webster (1988) report that participation in exercise can result in several possible physiological and psychosocial benefits, and improve the quality of life and performance in leisure or work-related activities in later life. Additionally, Deobil (1989) contends that regular participation in physical activity may postpone the deterioration in functional capacity that occurs with age, through the maintenance or improvement of cardiovascular endurance, lean body mass, flexibility and muscular strength. Each of these areas will be addressed in turn.

A. Maximum Oxygen Consumption

According to the American College of Sports Medicine (ACSM) (1991) maximal oxygen uptake steadily declines with age because of changes that occur in the myocardium and various peripheral vascular changes in the body; however, much of the literature concerning maximum oxygen uptake with seniors has shown that improvement or maintenance is possible with regular exercise. For example, Seals et al. (1984) found that maximal oxygen uptake could be improved by 25% after a six month low intensity training program for seniors. Further improvements were found after an additional six month program at a high intensity level. Several other researchers have reported similar results (see, for example, Adams & deVries, 1973; de Vries, 1970; Hopkins et al., 1990; Sidney et al., 1977).

B. Body Composition

Increases in body mass attributable to fat accumulation occurs with age, in the absence of a training program (ACSM, 1988; Blumberg et al., 1987; Durnin, 1985; Kane et al., 1989), while lean body tissue and minerals are lost (Blumberg et al., 1987; Durnin, 1985; Kane et al., 1989; Sidney et al., 1977). Sidney et al. (1977) report that an appropriate exercise program for seniors can lead to replacement of fat with lean tissue, and mineral loss that occurs in bone can be reversed or arrested. After one year of participation in four one-hour sessions per week of a supervised and individualized exercise program, seniors had an average 17% reduction of their skinfold thickness. Also, an apparent cessation of normal age-related loss of bone calcium was reported (Sidney et al., 1977). Similar improvements in specific body fat measurement reductions were obtained in several additional studies, dependent on the type of training employed (see for example, Buccola et al., 1975; Hopkins et al., 1990; Kohrt et al., 1992; Seals et al., 1984).

C. Muscular Strength and Endurance

Between the ages of 22 and 65, there is about a 20% reduction in muscular strength due to the effects of advancing age and disuse of the muscles (ACSM, 1988). Changes that occur within the muscles contribute to loss of flexibility and mobility that many seniors encounter as they age. Fortunately, regular strength training can result in increased strength and mild to moderate muscle hypertrophy (elevated size of the muscle due to an increased number of muscle tissue elements or increased size of the muscle cells (ACSM, 1988). For example, in a study by Brown and Holloszy (1991), seniors that participated in a low intensity exercise program improved significantly on measures of muscular strength, flexibility and standing balance. Similarly, Hopkins et al. (1990) found significant improvements in muscular strength and endurance after a 12 week low-impact aerobic dance program for seniors.

D. Flexibility

Alterations that occur in connective tissue within muscles, ligaments, joint capsules and tendons often account for a loss of flexibility and mobility in seniors (ACSM; 1988; Fox et al., 1987; Shephard, 1987). Although flexibility declines with increasing age (ACSM, 1988; Webster, 1988) regular participation in exercise programs, specifically programs that include a flexibility component, have been associated with significant improvements in seniors (see for example Buccola et al., 1975; Frekany & Leslie, 1975; Hopkins et al., 1990; Stacey et al., 1985; Stones et al., 1985). Frekany and Leslie (1975) contend that improved levels of flexibility enable seniors to maintain increased levels of self-sufficiency in the performance of routine tasks.

Exercise Intervention Program

Exercise Prescription

According to the ACSM (1991) the exercise prescription should be designed to: (1) promote health by decreasing the risk of future development or recurrence of disease (or in this case occurrence of falls); (2) promote physical fitness; and (3) ensure that the safety of individuals participating in the exercise programs is maintained; however, these purposes for designing exercise prescription do not carry equal weight for all programs. Therefore exercise prescription should reflect the intended outcomes of the program (ACSM, 1991). For example, in some programs physical fitness enhancement may be the primary goal, while in other cases, a decrease of the risk factors for certain diseases or conditions (e.g., falls) is the main concern.

This falls prevention intervention program has been designed with the primary goal of decreasing or preventing the occurrence of subsequent falls in a population of community-based seniors that have already fallen. Some of these seniors may have existing problems with mobility or activities of daily living. Given the composition of the participants, the program has not been designed with the main objective of increasing cardiovascular fitness, but rather to improve the various aspects of fitness and health that are beneficial in falls prevention.

The Exercise Session

Upon the recommendation of the ACSM (1991), each exercise session is comprised of (1) a five to ten minute warm-up period that includes walking and light stretching exercise (for an example of exercises that will be completed in the warm-up, see the diagrams located at the end of intervention description) (Payne & Hahn, 1989); (2) an endurance or aerobic phase (in this case, exercises specifically designed to challenge balance control, flexibility and muscular strength and endurance, replaces the aerobic phase) approximately thirty minutes in length; and (3) a cool-down period that includes stretching, relaxation activities, breathing exercises, and slow walking.

The warm-up provides individuals with the ability to tolerate the exercise session and assists in avoiding negative attitudes often faced with exercising in the early stages. Also, a proper warm-up increases the temperature of the muscles, which allows them to stretch more easily and perform with greater efficiency (Fox et al., 1987).

The cool-down is an essential element of an exercise program. It allows individuals to recover from exercise and allows for the body's cardiovascular system and muscles of the body to return to their pre-exercise state (Fox et al., 1987).

Description of the Exercise Portion of the Intervention Program for Falls Prevention

Two different exercise groups were designed as an intervention for the prevention of falls. All of the exercise sessions were conducted on-site within a gymnasium or an aquatic pool, depending on the intervention group. Subjects in the each of the exercise groups exercised two times per week for a period of ten weeks. Each exercise program was designed to challenge balance control and to improve overall strength and flexibility.

Exercises used in this phase of the intervention have been described by their intended function. The exercises that were completed within the gymnasium will be reviewed first.

Gymnasium Exercises

A. Exercises to Challenge the Balance Control System

The balance portion of the program, based on an exercise program by Sharratt et al. (1992), has been designed to: (1) improve muscular co-ordination for the control of balance and walking, (2) to challenge the visual, vestibular and kinesthetic sensory systems as they contribute to the control of balance, and (3) to increase the strength and endurance, particularly strength of the hip girdle muscles and the range of motion at the hip joint . Balance control deteriorates with age (Horak et al., 1989) and is further compromised by inactivity (Sharratt et al., 1992). Research has shown that balance control in older adults can be improved through physical activity, specifically with an exercise prescription that challenges the balance control system, and does not demand intensities necessarily designed to increase cardiorespiratory fitness (see, for example, Hopkins et al., 1990; Sharratt et al., 1992). Rikli & Busch (1986) found that women that possessed higher levels of physical activity, particularly women that participated in lifelong physical activity, possessed more favourable scores for measures of reaction time, sit and reach flexibility, shoulder flexibility and balance measures.

Specific exercises that were selected to challenge the balance control system, that may require some explanation, include:

Stride Walking: (explanation: forward stride steps with swinging arms and co-ordinated lateral rotations of the head). This exercise demands control over large shifts of the centre of body mass, which is often needed when attempting to recover from a loss of balance. Additionally, co-ordinated rotations of the head increase the demand on the vestibular systems sense for monitoring the motion of the head, and in the co-ordination of monitoring of the head and eyes in the maintenance of a stable gaze (Sharratt et al., 1992). Side-to-side stepping was a modification of this exercise that was incorporated into the exercise classes; and

Upright Leaning: (explanation: passing a large ball to a partner positioned so as to require a maximum reach at full lean). Upright leaning requires control over shifts of the body's centre of mass, when it is forced to the limits of stability for upright stance. Also, there is a demand placed on the kinesthetic sense during the monitoring of the inclination of the body (Sharratt et al, 1992). This exercise was completed either in a seated position, or passing the ball while standing behind a chair (in order that some support was available if needed).

Additional exercises included: rocking onto heels and then the toes (with added overhead reaching with one, then both arms) or toe-toe-heel-heel variation; shifting the body weight from one foot to the next with feet shoulder-width apart; marching with knees high and the arms swinging in a variety of motions; walking or standing still, while pretending to reach for objects on a top shelf, middle shelf, and low shelf; lifting one leg up and down (repeat)(variations included lifting knee up in front of the body, or lifting the heel up behind the body) and then holding for a few seconds; balancing on one foot; walking with big steps and arms swinging; kicking leg up in front of body and touching with the opposite hand; side steps while walking (arms moving); marching in one place with the hands moving. Variations of these exercises were be employed, but did not exceed the difficulty level of the exercises mentioned above.

B. Exercises to Improve Flexibility

A lack of flexibility, the range of motion that is possible at a joint or a series of joints (ACSM, 1988), is prevalent among seniors and contributes to reductions in the ability to perform various activities of daily living (ACSM, 1991). Thus, the flexibility portion of the program was designed to improve the range of motion around the joints of the body. Given that flexibility is joint specific, flexibility exercises have to be completed at a number of muscle groups and their associated joint structures (ACSM, 1991; Fox et al., 1987). According to the ACSM (1991), flexibility exercises should be performed slowly and with a gradual progression to greater ranges of motion. Slow dynamic movements should be followed-up by static stretches that are sustained for ten to thirty seconds. Approximately three to five repetitions of each exercise have been recommended (ACSM, 1991). Specific flexibility exercises chosen include: wrist stretching, digit manipulation tasks (i.e., touch each finger with your thumb), neck rotations, shoulder girth rotations, shoulder stretches, chest and shoulder stretches, behind the back arm raises, shoulder girth stretches, lateral flexion, side lunges, lower leg stretches, achilles stretches, anterior thigh stretches, sit and reach stretches, sitting toe touches, quadriceps stretch, back stretches, knee tucks and trunk rotations (Anspaugh et al., 1991; Fitness and Amateur Sport Canada; Fox et al., 1987). Modifications of these stretches were employed; however, the difficulty level did not exceed the level of the exercises explained above.

C. Exercises to Improve Muscular Strength and Endurance

The maintenance of muscular endurance and strength is an important issue with seniors, given that aging is associated with a loss of lean weight. Additionally, the maintenance or enhancement of this component of physical fitness, enables individuals to perform tasks with less physiological stress (ACSM, 1991). The portion of the program, designed to increase muscular endurance and strength has been comprised of a number of exercises. Exercises designed specifically to strengthen the hip girdle musculature, can be described as follows: the first exercise is completed sitting in a chair. Each participant wiggled forward or backward with alternating movements of the hips (Sharratt et al., 1992). Examples of other exercises designed for improvement of overall muscular endurance and strength include: tricep "push-offs" from chair, bicep curls with arms raised in front and to the side (no weights), abdominal exercises, single knee tucks, slight knee bends behind chair, side leg raises, leg lifts, front knee lifts, front to side lifts and alternative leg raises (Anspaugh et al., 1987; Fitness and Amateur Sport Canada; Fox et al., 1987). Once again, modifications of these exercises were employed.

Although improving cardiovascular or endurance physical fitness is not the focus of the program, various walking and marching exercises was used. These exercises aimed to improve muscle tone in the legs, to increase vigour and to promote relaxation, in addition to developing heart-lung endurance (Fitness and Amateur Sport Canada).

Aquatic Exercises

The second exercise intervention group had exercise classes within a rehabilitation pool. The rationale behind the use of the pool is threefold: (1) exercises performed in the water offer individuals "weight relief". This means that exercisers feel lighter in the water, move easier and feel less weight on their joints because of buoyancy (Bates & Hanson, 1992) - buoyancy is the upward force created by water displacement.; (2) the injury potential (e.g., additional falls) that may be associated with exercising in the gymnasium is eliminated; and (3) virtually every exercise performed in the water challenges balance control and body equilibrium (Bates & Hanson, 1992) because of the water pertubations the body experiences with any movement in the water. According to Weinstein (1986), aquatic activities are particularly beneficial for older adults with chronic arthritis, painful joints, weak leg muscles, and chronic back and knee problems, since they can move more easily in the water than on land. Further, seniors embarking into fitness programs can gradually ease in to an aquatic program with less strain and minimal risk of injury. Additionally, aquatic classes for seniors have been found to result in an increase or maintainance of joint flexibility, increase in muscular strength, and an improvement in co-ordination which helps to improve the ability to perform activities of daily living (Weinstein, 1986). Unfortunately, the use of aquatic classes to prevent falls has not been tested before with senior populations. Thus, no prior research results are available that indicate the possible success of a program of this nature.

The exercises described above, that could be modified to use in the pool were used. Additional exercises were also used.

A. Exercises to Challenge the Balance Control System

Exercises that were used to challenge the balance control system include stride walking, and upright leaning. These two exercises have been described above. Further, rocking on the heels to the toes; toe-toe-heel-heel exercises; shifting the body weight from one foot to the next, with the feet shoulder-width apart; marching with the knees high; balancing on one leg; walking with big strides; kicking the leg out behind the back as walking; kicking the leg up in front of the body; side steps while walking; cross-over side steps; and marching in one place will be utilized within the water. Other exercises that were used to challenge balance control in the water include walking, marching and lunging exercises (and modifications of these exercises). For example, forward, sideways, or backward walking with the toes pointed in or out, or with the legs straight or bent are various types of walking that were employed (Sova, 1992). Further, upper-body movements were also varied during walking. Backstroke, figure eights, punching or jogging arms were examples of types of upper-body movements that used. Similar modifications were utilized with the marching and lunging exercises. Diagrams of these exercises are depicted following the explanation of the intervention program (Bates & Hanson, 1992).

B. Exercises to Improve Flexibility

For the flexibility section of the classes within the water, neck rotations, shoulder girth rotations, shoulder stretches, chest and shoulder stretches, behind the back arm raises, shoulder girth stretches, lateral flexion, side lunges, lower leg stretches, achilles stretches, knee tucks while standing and anterior thigh stretches were completed.

C. Exercises to Improve Muscular Strength and Endurance

Exercises completed to improve muscular strength and endurance include: side leg lifts (completed standing up and holding on to the edge of the pool), front leg lifts and wall push-ups. Other exercises that will be employed include: front arm pulls; breast stroke; straight arm pulls; pendulum exercises; sawing; crosses; pelvic tilts; pelvic curls; hip abduction/adduction; hip flexion and hip extension (Bates & Hanson, 1992). A number of these exercises could be included under the other sections (e.g., balance control, flexibility), since the water challenges a number of the systems.

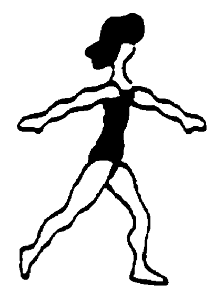
Qualifications of Instructors and Safety Precautions with Seniors

The instructors utilized for the exercise programs were certified instructors. Further, all the instructors were certified in first aid and cardiopulmonary resuscitation. The aquatics instructor was a certified lifeguards, with previous experience in conducting exercise classes. Instructors were informed to advise the participating seniors that any pain experienced during the workout should result in the senior stopping the exercise, walking slowly in place and alerting the attention of the instructor. Additionally, instructors were constantly watching for any senior that displayed the following signs of overexertion: nausea, extreme weakness, profuse sweating, red face, breathlessness, excessive fatigue, chest pain or discomfort, lightheadedness or dizziness, focussed musculoskeletal discomfort, unsteady gait, or confusion (Sova, 1992). Prior to participation all seniors received medical consent from their physicians in order to screen for individuals that should not be participating in exercise programs for health reasons.

BALANCE EXERCISES (FOR THE POOL)

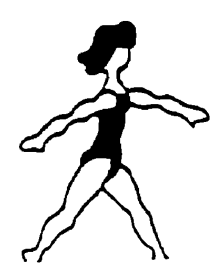
BALANCE EXERCISES

Forward Walking:
Standing upright and looking straight ahead, slowly bend the hip and knee exaggerating hip & knee flexion. Lower the foot down to the ground, landing on the heel. Gently push off with the toe. Alternate and repeat.



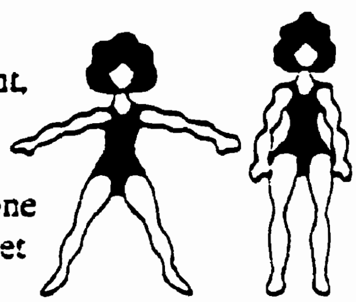
Backward Walking:
Standing upright and looking straight ahead, slowly bend the hip and knee while sending the leg behind your body. Press the foot down to the ground landing on the toe. Gently roll onto the heel. Alternate and repeat.

Lunge Walking:
Keeping the trunk upright, walk forward using large steps. Bend knee of the lead leg while keeping the knee of the trailing leg straight. Trunk stays upright and abdominals are tight.



Stiff Leg Walking:
Standing upright with little or no knee flexion, walk forward

BALANCE EXERCISES



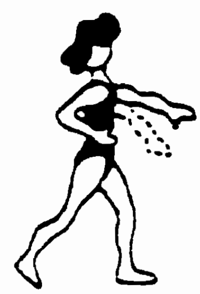
Side Stepping: Standing upright, and looking straight ahead, slowly step to one side bringing feet together with a straight leg. Alternate and repeat, then repeat in opposite direction.

Hopping: Standing upright, flex at hip and knee. Jump forward using arms. Land on both feet bending at knees to absorb impact.

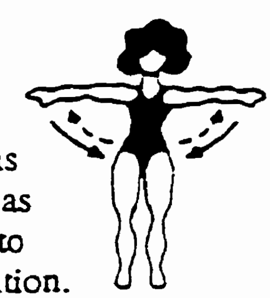
Knee Lift Stretch: Stand tall with feet together and arms at your sides. Lift one knee as high as you can, grasping it with your hands under the knee and pulling it to your body. Gently flex spine forward. Hold, alternate and repeat.

MUSCULAR STRENGTH AND ENDURANCE EXERCISES

Front Arm Pull:
Reach forward and pull back with bent elbow. Alternate and repeat.

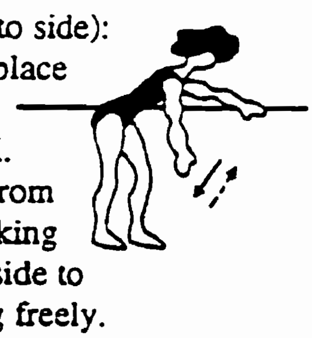


Breast Stroke:
Reach forward with both arms, abduct horizontally until arms are in the same plane as the body, then return to forward reaching position. Repeat.

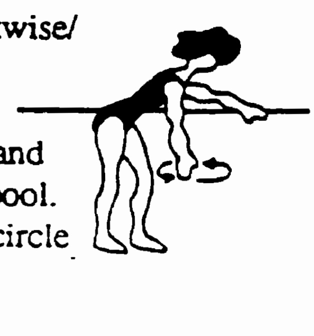


Pendulum Exercises:

a. Pendulum (side to side): Lean forward and place uninvolved hand on the edge of pool. Gently move arm from side to side. by rocking body weight from side to side. Let arm swing freely.



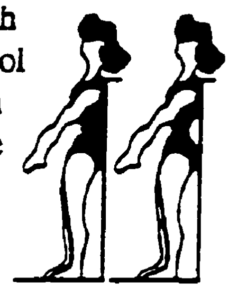
b. Pendulum (clockwise/ counter clockwise): Lean forward and place uninvolved hand on the edge of the pool. Let arm move in a circle



MUSCULAR STRENGTH AND ENDURANCE EXERCISES (FOR THE POOL)

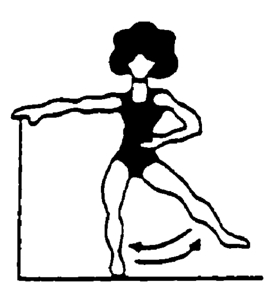
MUSCULAR STRENGTH AND ENDURANCE EXERCISES

Pelvic Tilt: Standing with your back against the pool wall, feet shoulder width apart, and knees over the toes. Contract the lower abdominals, pulling the pubic bone forward and up toward the navel. Hold, relax and repeat.

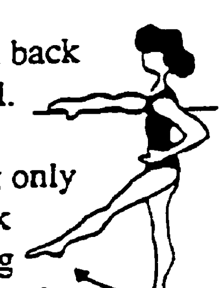


Pelvic Curls: With your back against the pool wall and arms holding onto the edge, slowly lift legs off the floor until the knees are at 90 degrees and the lumbar spine is flat against the pool wall. Slowly lift the tailbone and sacrum off the wall by tightening abdominal muscles. Keep the hips and knees in a fixed position, so that they do not flex or extend. Slowly release the contraction until the sacrum has touched the wall. Repeat.

Hip Abduction/ Adduction: Stand facing pool wall with feet together, holding wall with both hands arms length away. Gently raise (abduct) straight leg out to the side. Return to starting position (midline) and repeat.

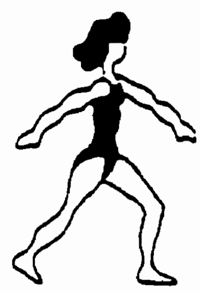


Hip Flexion: Stand with back or side against pool wall. Gently raise straight leg out to the front, bending only from the hip. Keep trunk upright and head looking straight ahead. The knee of the support leg should be slightly bent. Return to starting position and repeat.

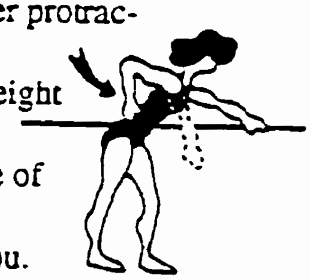


MUSCULAR STRENGTH AND ENDURANCE EXERCISES

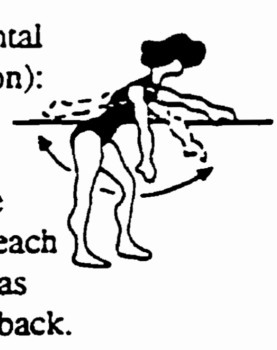
Straight Arm Pull:
Keeping elbow straight, reach forward and pull back with one arm and then the other. Alternate and Repeat. [Change palm position to alter resistance.]



Saws (shoulder protraction/retraction):
Support body weight with uninvolved hand on the edge of pool, and reach out in front of you. Pull arm back retracting shoulder blades.



Crosses (horizontal abduction/adduction):
Supporting body weight with uninvolved hand on the edge of the pool, reach across body as far as you can, then pull back. Palm of hand faces thigh.



Appendix 6: Explanation of Balance (Chapter 6)

Instability and Balance

Introductory Comments

The maintenance of postural stability or balance is a complex process that requires the participation of several body systems, namely the musculoskeletal system, cardiovascular system and the visual, vestibular and proprioceptive systems. The musculoskeletal system provides the body with joint flexibility, foot support, and effective muscle strength, while the cardiovascular system provides autonomic control of blood pressure during changes in the body's posture. The visual, vestibular and proprioceptive systems are the systems that are largely responsible for balance control (Blake, 1992; Tideiksaar, 1990). For example, postural sway, the natural anteroposterior motion of an erect body caused by gravity forces, is controlled through the body's corrective responses when the visual, vestibular and proprioceptive systems are operating smoothly. Unfortunately, with advancing age postural sway increases. The increases in sway that occur with age appear to be the result of age-related changes and presence of diseases or drugs that affect the three systems, thus contributing to a decrease in balance control (Kiel, 1993; Tideiksaar, 1990). Consequently, seniors that slip, trip or lose balance during transfers or other activities of daily living, are less probable to recover their equilibrium in time to prevent a fall from occurring (Tideiksaar, 1990). Evidence in the literature substantiates the association between poor balance or increased sway, and falling in seniors (see, for example, Overstall et al., 1977).

Explanation of the Systems Controlling Balance and Stability

Given that the elements in the maintenance of postural stability are overlapping and compensatory, it is plausible that a fall may not occur until several elements of this system are impaired. The maintenance of postural stability is dependent upon input from the sensory systems, the central integrative processing of the information from the sensory systems, and effector components of the body, with the exclusion of cases of syncope resulting in instability (Kiel, 1993). The sensory system includes the following: (1) visual system which is responsible for visual acuity, dark adaptation, and accommodation; (2) the proprioceptive system which includes the peripheral nerves, mechanoreceptors in the apophyseal joints, the posterior columns, and connections with the central nervous system (Kiel, 1993); and (3) the vestibular system which is comprised of the organs of equilibrium, namely the semi-circular ducts and the otolith organs (saccule and utricle) in the middle ear (Kandel, 1991). The sensory systems constitute the afferent sensory inputs that convey information concerning the external environment, as well as the internal, anticipatory reflex pathways that are important in the stabilization of individuals through the activation of proximal muscles during specific postural tasks. The processing and integration of the external and internal information occurs primarily at the reflex level and subsequently leads to a complex output of postural motor responses that go to the head, neck and limbs (Waterson, 1991). The central nervous system (CNS) is divided into six main segments which consist of the following: (1) the spinal cord (cervical, thoracic, lumbar and sacral regions); (2) the medulla; (3) the pons with the overlying cerebellum; (4) the midbrain; (5) the diencephalon (thalamus and hypothalamus); and (6) the cerebral hemispheres (Kandel, 1991). Although there are several functions of the main segments of the CNS, the main role of the CNS in terms of balance control, is to serve as the integrating system for the multiple sensory inputs and the resulting effector mechanisms. The remaining systems involved in balance control consists of the effector system. The effector system includes the muscular system, efferent nervous system, joints, and the feet. Within each of these systems, several deficits may result which contribute to instability and consequently falls (Table 1). It is essential to understand that any systemic disorder may contribute to falling, either by acting solely or on a combination of the elements comprising postural stability (Brummel-Smith, 1989; Kiel, 1993).

The relationship between the various components of the balance control system and the roles they play in the maintenance of stability has been depicted in Figure 1 (Patla et al., 1992). This system is considered to be stable if it is able to return to its original position, or an alternative stable state of posture or motion, after the body has been perturbed in some manner; however, should the system not return to a stable position, disequilibrium results (Patla et al., 1992). Disruptions of any of the systems involved in balance control can result in a decline in balance, and thus postural instability. Figure 2 expands on the concepts in Figure 1, and illustrates the forces that affect standing and movement of the body. The CNS integrates all relevant incoming sensory information and subsequently determines the appropriate position of the body, and further sends appropriate neural impulses to the musculoskeletal system (Rhymes & Jaeger, 1988). All movements of this system are perceived, and any necessary corrections are made. If the body and its segments are not kept in direct alignment, a fall will result (Patla et al., 1992; Rhymes & Jaeger, 1988). The activity of this closed-loop system in the prevention of falls is not only present during movement or in the presence of disturbing forces, but also during quiet standing (Rhymes & Jaeger, 1988).

Table 1: Examples of Deficits within the Balance Control Systems

Sensory Systems

Visual System Deficits:

- cataracts or age-related changes in the lens
- macular degenerations
- alterations of depth perception attributed to unequal changes between the eyes

Proprioceptive System:

- peripheral neuropathies (e.g., vitamin B_{12} deficiency; diabetes)
- unsteadiness due to cervical degenerative disease (e.g., cervical spondylosis which affects cervical mechanoreceptors)

Vestibular System:

- dizziness due to age-related changes in the otoconia or to saccular degeneration
- loss of stability in the dark due to reliance on visual system
- ear surgery or ear infection

Central Nervous System

- dementia
- Parkinson's disease

Effector System

Muscular System:

- age-related decline in muscle mass and strength
- myopathy
- myasthenia gravis

Efferent Nervous System:

- motor neuron disease
- nerve root compression from degenerative disk disease

Joints:

- osteoarthritis of the knees
- joint replacement with loss of usual range of motion

Foot Disorders:

- untrimmed nails
- bunions
- callouses

(adapted from Kiel, 1993)

Figure 1: **Schematic Diagram of the Various Components of the Balance Control System and their Roles in the Maintenance of Stability**

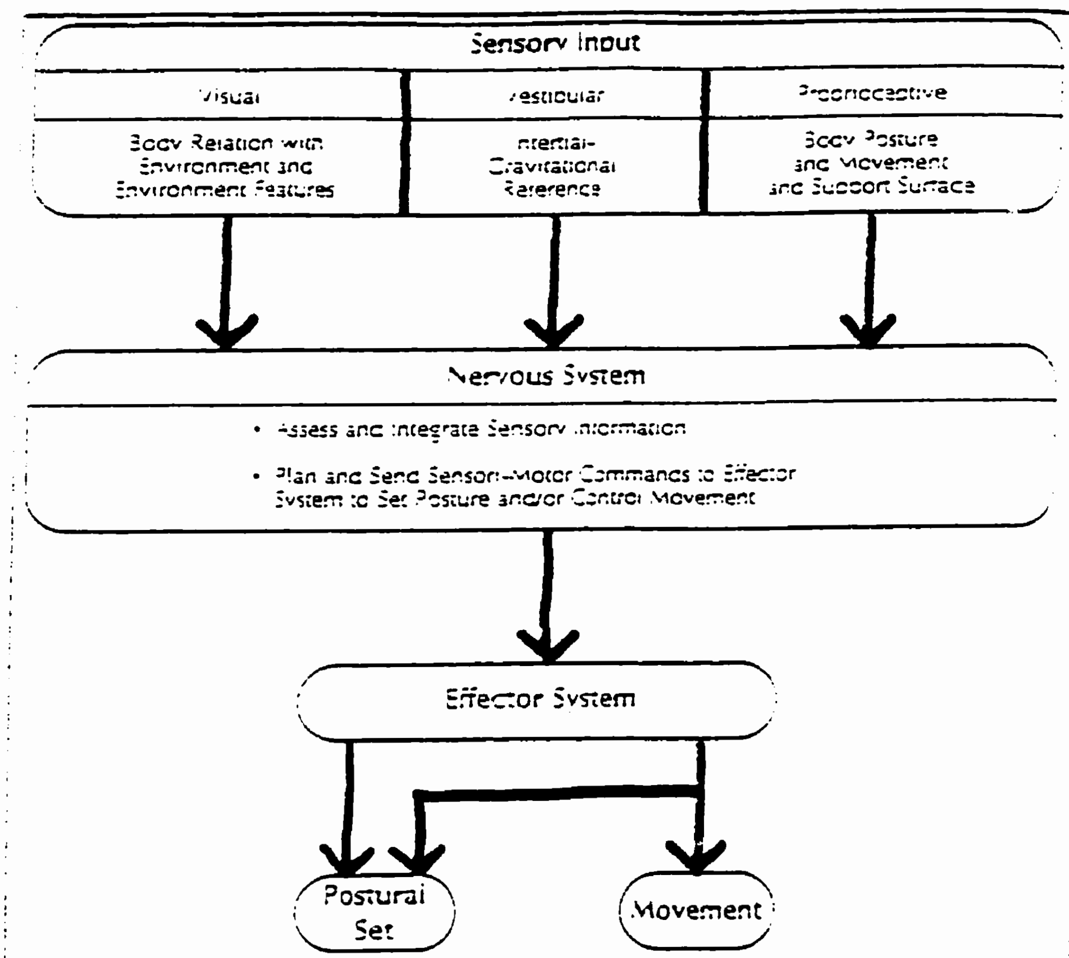
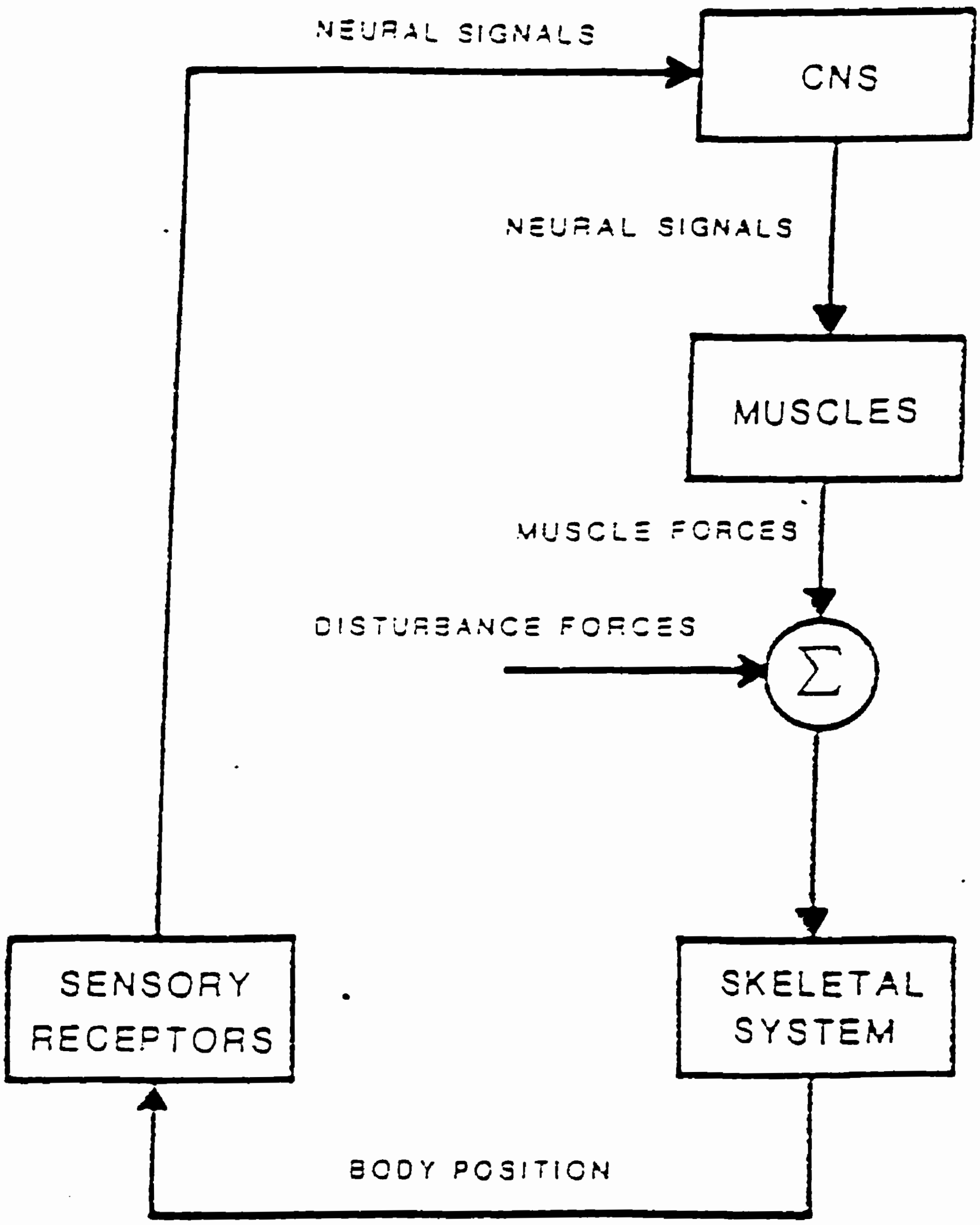


Figure 1. A schematic diagram showing the various components of the balance control system and the roles they play in the maintenance of stability.

(adapted from Patla et al., 1992)

Figure 2: The Forces Affecting Standing Balance



Note: The CNS integrates the sensory input, determines the appropriate position of the body, and issues appropriate neural impulses to the musculoskeletal system.

(adapted Rhymes & Jaeger, 1988)

Appendix 7: Consent Form for Intervention Study (Chapter 6)

CONSENT FORM

I have been assigned to the ________________________ group and am interested in participating in this research project. I understand that I will be assessed on several health and fitness measures, and must complete health questionnaires prior to participation, after 10 weeks of participation, and at the end of the project. I also realize that I will be expected to complete a one-page weekly health information questionnaire from October 1995 until March 1996.

I do not hold Grand River Hospital: Freeport Site, the University of Waterloo, the Breithaupt Centre or the researchers and instructors responsible for any injury that I may incur while participating within the intervention. I also understand that I may withdraw from the study at any time, should I wish to do so. My withdrawl from the study will not have an impact on any future associations that I may have with Grand River Hospital: Freeport Site, or the Breithaupt Centre.

Additionally, I understand that any information that the researchers obtain from me or from my participation in the project will be kept confidential and I will not be identified personally in any report from this research.

This project concerning health and wellness for seniors has receive ethics approval from the Office of Research at the University of Waterloo. Consequently, any comments or complaints that I may have regarding my involvement within the project can be directed towards this office.

____
(Participant's Name ... please print)

____
(Participant's Signature)

____
(Witness Signature)

____
(Date)

Appendix 8: Medical Consent for Intervention Study (Chapter 6)

GRAND RIVER HOSPITAL

Dear Physician:

Your patient, ________________, would like to participate in an exercise program that will be conducted at his/her place of residence. Grand River Hospital's Research Department, the University of Waterloo and the Living Younger Foundation from the Breithaupt Centre have collaborated to conduct a health and wellness program for seniors in the Kitchener-Waterloo region. The exercise portion of the project will be conducted in 10 weeks, with classes being conducted biweekly for approximately 45 minutes per session. The cost of the exercises classes, which will begin in October 1995, has been paid for by the researchers. Please read over the explanation of the program in order to determine whether you feel that your patient is able to participate.

Explanation of Exercise Classes

All of the exercise classes will be conducted within a gymnasium. A certified fitness instructor will be leading the classes. Each of the classes has been designed to challenge balance control, improve flexibility, and to improve muscular strength and endurance.

A. Exercises to Challenge the Balance Control System

The balance portion of the program, based on an exercise program by Sharratt et al (1992), has been designed to: (1) improve muscular co-ordination for the control of balance and walking, (2) to challenge the visual, vestibular and kinesthetic sensory systems as they contribute to the control of balance, and (3) to increase the strength and endurance, particularly strength of the hip girdle muscles and the range of motion at the hip joint. Balance control deteriorates with age (Horak et al., 1989) and is further compromised by inactivity (Sharratt et al., 1992). Research has shown that balance control in older adults can be improved through physical activity, specifically with an exercise prescription that challenges the balance control system, and does not demand intensities necessarily designed to increase cardiorespiratory fitness. Exercises to be included within this portion of the program are: rocking onto the heels and then the toes; shifting the body weight from one foot to the next with feet shoulder-width apart; marching with knees high and the arms swinging in a variety of motions; walking or standing still, while pretending to reach for objects on a top shelf, middle shelf, and low shelf; lifting one leg up and down (repeat) and then holding for a few seconds; balancing on one foot; walking with big steps and arms swinging; kicking the leg out behind the back, as the foot is touched with the opposite hand; kicking leg up in front of body and touching with the opposite hand; side steps while walking (arms moving); cross-over side steps (arms moving); and marching in one place with the hands moving.

B. Exercises to Improve Flexibility

The flexibility portion of the program was designed to improve the range of motion around the joints of the body. Given that flexibility is joint specific, flexibility exercises have to be completed at a number of muscle groups and their associated joint structures (ACSM, 1991; Fox et al., 1987). Specific flexibility exercises chosen include: neck rotations, shoulder girth rotations, shoulder stretches, chest and shoulder stretches, behind the back arm raises, shoulder girth stretches, lateral flexion, side lunges, lower leg stretches, achilles stretches, anterior thigh stretches, sit and reach stretches, sitting toe touches, straddle stretches, quadriceps stretches, back stretches, modified hurdler stretches, alternative groin stretches, knee tucks and trunk rotations (Anspaugh et al., 1991; Fitness and Amateur Sport Canada; Fox et al., 1987).

C. Exercises to Improve Muscular Strength and Endurance

The maintenance of muscular endurance and strength is an important issue with seniors, given that aging is associated with a loss of lean weight. Additionally, the maintenance or enhancement of this component of physical fitness enables individuals to perform tasks with less physiological stress (ACSM, 1991). This portion of the program, designed to increase muscular endurance and strength, has been comprised of a number of exercises. Exercises designed specifically to strengthen the hip girdle musculature can be described as follows: (1) the first exercise is completed sitting on the floor with the legs out-stretched. Each participant will wiggle forward or backward with alternating movements of the hips; and (2) side leg lifts will be completed while in a side-lying position (Sharratt et al., 1992). Examples of other exercises designed for improvement of overall muscular endurance and strength include: wall push-aways, abdominal exercises, single knee tucks, side leg raises, leg lifts, front knee lifts, front to side lifts and alternative leg raises (Anspaugh et al., 1987; Fitness and Amateur Sport Canada; Fox et al., 1987).

It is important to point out that these exercises may be modified to be completed entirely seated in a chair or holding onto a bar for support, depending upon the stability and health levels of the senior. Although improving cardiovascular or endurance physical fitness is not the focus of the program, various walking and marching exercises will be used. These exercises aim to improve muscle tone in the legs, to increase vigour and to promote relaxation, in addition to developing heart-lung endurance (Fitness and Amateur Sport Canada).

Should any minor service charge ($20.00 or less) be associated with the completion of this form, please send a bill to Paula Fletcher, along with the completed Physician's Recommendation Form, to the Research Department at Grand River Hospital-Freeport Site, or return the completed form to your patient. Please send this completed form by September 25, 1995, if possible.

If you have any questions concerning any facet of the research project, inquiries can be directed towards Ms. Paula Fletcher, M.A. (725-0984) or J.P. Hirdes, Ph.D. (888-4567 extension 2007). This research project has received ethics clearance from the University of Waterloo.

Thank you for your time and we look forward to hearing from you.

Sincerely,
Paula Fletcher

Paula Fletcher, M.A.

PHYSICIAN'S RECOMMENDATION FORM

I have read the description of the exercises that are a part of the research study that will be conducted by Paula Fletcher and John P. Hirdes, Ph.D. from Grand River Hospital's Research Department, the University of Waterloo and the Breithaupt Centre.

Please circle one of the following:

- My patient, __________________, may participate without restriction in all exercises involved in the program conducted by Paula Fletcher, M.A. and John P. Hirdes, Ph.D.

- My patient, __________________, may participate in the program conducted by Paula Fletcher, M.A. and John P. Hirdes, Ph.D., with the following restrictions:

- My patient, __________________, may NOT participate in the program conducted by Paula Fletcher, M.A. and John P. Hirdes, Ph.D.

Physician's Name: ____________________________
(please print)

Physician's Signature: ____________________________

Date: ____________________________

Appendix 9: Questionnaire Developed for Intervention Study (Chapter 6)

BACKGROUND INFORMATION QUESTIONNARIE

The following questionnaire deals with issues that pertain to yourself, your background, your general health status and lifestyle, and your participation in physical activity. Personal information collected from this questionnaire will be kept confidential adn you will not be identified personally in any reports arising from this research. Information that is used will be presented in group form. Participation in completing this questionnaire is voluntary, and you may refrain from answering any questions that you deem to be uncomfortable. Thank you for your time and help.

Questions about YOU... **Please circle the correct response letter where appropriate or complete your response on the designated lines.**

1. Are you:

    (A) male
    (B) female

2. What is your date of birth? (year/month/day) ____________________

3. What is your marital status:

    (A) married (including a common-law relationship)?
    (B) widowed?
    (C) divorced?
    (D) separated?
    (E) single (never married)?

4. What has your life-time occupation(s) been? (Name up to three if applicable).

    (A) ____________________
    (B) ____________________
    (C) ____________________

5. What is the highest level of education that you have attained?

    (A) elementary or less?
    (B) some secondary school?
    (C) secondary diploma?
    (D) some post-secondary?
    (E) community college?
    (F) one or more university degrees?

continued ...

6. Do you have any family members that you feel close to, and that you can talk to about any private issues, or that you can call if you are in need of assistance?

   (A) Yes → How many? ______________________
   (B) No

7. Do you have any friends that you feel close to, and that you can talk to about any private issues, or that you can call if you are in need of assistance?

   (A) Yes → How many? ______________________
   (B) No

Your LIFESTYLE... Please circle the correct response letter where appropriate or complete your response on the designated lines.

8. How long do you usually spend sleeping each night?

   ______________ hours

9. Do you regularly have trouble going to sleep?

   (A) Yes
   (B) No

9B. Do you regularly have trouble staying asleep?

   (A) Yes
   (B) No

continued ...

10. Which of the following describes your experience with tobacco?

    (A) I have never smoked.
    (B) I stopped smoking cigarettes/cigars ___________ months/years ago.
    (C) I smoke cigarettes/cigars occasionally.
    (D) I smoke _________ cigarettes/cigars per day.

11. Which of the following describes you experience with alcohol (beer or wine or liquor) the best?

    (A) I never drink alcohol.
    (B) I drink alcohol less than once a week.
    (C) I drink _______ servings of alcohol per day.
    (D) I drink _______ servings of alcohol per week.

12. Compared to other people your age, would you say that you are physically...

    (A) more active?
    (B) as active?
    (C) less active?
    (D) do not know?

NOTE: physical activity in question 12.1 pertains to activites that you complete at work, at home, and in your leisure time. It may include activities such as walking, gardening, washing windows, dancing, golfing...

Your HEALTH... **Please circle the correct response letter where appropriate or complete your response on the designated lines.**

The next group of questions deal with your health and issues that pertain to your health.

13. How would you describe your general state of health?

    (A) excellent?
    (B) good?
    (C) fair?
    (D) poor?

14. Do you presently have:

• osteoporosis?	(A) No	(B) Yes → for _____ years
• skin allergies?	(A) No	(B) Yes → for _____ years
• asthma?	(A) No	(B) Yes → for _____ years
• persistent back pain?	(A) No	(B) Yes → for _____ years
• arthritis or rheumatism?	(A) No	(B) Yes → for _____ years
• other problems with joints?	(A) No	(B) Yes → for _____ years
• emphysema or bronchitis?	(A) No	(B) Yes → for _____ years
• epilepsy?	(A) No	(B) Yes → for _____ years
• high blood pressure?	(A) No	(B) Yes → for _____ years
• circulation problems?	(A) No	(B) Yes → for _____ years
• heart disease?	(A) No	(B) Yes → for _____ years
• diabetes?	(A) No	(B) Yes → for _____ years
• urinary or kidney problems?	(A) No	(B) Yes → for _____ years
• digestive problems?	(A) No	(B) Yes → for _____ years
• goiter or thyroid problems?	(A) No	(B) Yes → for _____ years
• eye problems? (e.g. cataracts, glaucoma)	(A) No	(B) Yes → for _____ years
• cancer?	(A) No	(B) Yes → for _____ years
If yes, what kind of cancer?	______________________________	

15. Do you have any other long-term illness(es) or impairment(s) not listed above?

    (A) No.
    (B) Yes. Please specify the condition(s):

    ____

continued ...

16. Can you see well enough with glasses or contact lenses (if needed) to recognize a friend on the other side of the street?

    (A) Yes
    (B) No

17. How many times a night do you get up to go to the bathroom?

    (A) 0 times
    (B) 1 time
    (C) 2-4 times
    (D) 5 or more times

18. Are you currently taking any of the following medications (circle where applicable):

    (A) aspirin or similar pain relievers (includes arthritis medicine)
    (B) tranquilizers, such as Valium
    (C) diet pills or stimulants
    (D) anti-depressants
    (E) codeine, demoral, morphine
    (F) medications for the heart or blood pressure
    (G) cough or cold remedies
    (H) penicillin or similar antibiotics
    (I) allergy medicine, such as sinutab
    (J) anti-depressants
    (K) insulin or similar diabetic medicine
    (L) sleeping pills
    (M) diuretics
    (N) vitamins

continued ...

19. In the past 12 months, were you injured in an accident **around your home**?

    (A) Yes
    (B) No

19.1 Thinking about the most recent accident, what injuries did you experience (circle all that apply):

    (A) cuts or bruises
    (B) concussion
    (C) dislocations
    (D) fractures
    (E) sprains/strains
    (F) swelling
    (G) tenderness

20. In the past 12 months, were you injured in an accident **away from your home**?

    (A) Yes
    (B) No

20.1 Thinking about the most recent accident, what injuries did you experience (circle all that apply):

    (A) cuts or bruises
    (B) concussion
    (C) dislocations
    (D) fractures
    (E) sprains/strains
    (F) swelling
    (G) tenderness

22. How often would you say you have fallen within the past year?

    (A) 0 times
    (B) 1 time
    (C) 2 times
    (D) 3-4 times
    (E) 5 or more times

Appendix 10: SHARP (Chapter 6)

The SHARP

The following questions are about how things have been going for you lately. Please circle "Yes" or "No" to indicate your response.

During the past months have you felt...

1. In high spirits?

   (A) yes
   (B) no

2. Particularly content with your life?

   (A) yes
   (B) no

3. Depressed or very unhappy?

   (A) yes
   (B) no

4. Flustered because you did not know what was expected of you?

   (A) yes
   (B) no

5. Bitter about the way your life has turned out?

   (A) yes
   (B) no

6. Generally satisfied with how your life has turned out?

   (A) yes
   (B) no

The SHARP (continued)

The next questions deal with your general life experiences:

(7) I am just as happy as when I was younger.

(A) yes
(B) no

(8) As I look back on my life, I am fairly well satisfied.

(A) yes
(B) no

(9) Things are getting worse as I get older.

(A) yes
(B) no

(10) Little things bother me more this year.

(A) yes
(B) no

(11) Life is hard for me most of the time.

(A) yes
(B) no

(12) I am satisfied with my life today.

(A) yes
(B) no

Appendix 11: Tinetti's Balance Measure (Chapter 6)

PERFORMANCE-ORIENTED ASSESSMENT OF BALANCE

Maneuver	Normal	Adaptive	Abnormal
Sitting balance	Steady, stable	Holds onto chair to keep upright	Leans, slides down in chair
Arising from chair	Able to arise in a single movement without using arms	Uses arms (on chair or walking aid) to pull or push up and/or moves forward in chair before attempting to arise	Multiple attempts required or unable without human assistance
Immediate standing balance (first 3–5 s)	Steady without holding onto walking aid or other object for support	Steady, but uses walking aid or other object for support	Any sign of unsteadiness (e.g., grabbing objects for support, staggering, more than minimal trunk sway)
Standing balance	Steady, able to stand with feet together without holding object for support	Steady, but cannot put feet together	
Balance with eyes closed (with feet as close together as possible)	Steady without holding onto any object with feet together	Steady with feet apart	Any sign of unsteadiness or needs to hold onto an object
Turning balance (360°)	No grabbing or staggering; no need to hold onto any objects; steps are continuous (turn is a flowing movement)	Steps are discontinuous (patient puts one foot completely on floor before raising other foot)	Any sign of unsteadiness or holds onto an object
Nudge on sternum (patient standing with feet as close together as possible; examiner pushes with light, even pressure over sternum 3 times; reflects ability to withstand displacement)	Steady, able to withstand pressure	Needs to move feet, but able to maintain balance	Begins to fall, or examiner has to help maintain balance
Neck turning (patient asked to turn head side to side and look up while standing with feet as close together as possible)	Able to turn head at least halfway side to side and be able to bend head back to look at ceiling; no staggering, grabbing, or symptoms of lightheadedness, unsteadiness, or pain	Decreased ability to turn side to side to extend neck, but no staggering, grabbing, or symptoms of lightheadedness, unsteadiness, or pain	Any sign of unsteadiness or symptoms when turning head or extending neck
One leg standing balance	Able to stand on one leg for 5 s without holding object for support		Unable
Back extension (ask patient to lean back as far as possible, without holding onto object if possible)	Good extension without holding object or staggering	Tries to extend, but range of motion is decreased or needs to hold object to attempt extension	Will not attempt or no extension seen or staggers
Reaching up (have patient attempt to remove an object from a shelf high enough to require stretching or standing on toes)	Able to take down object without needing to hold onto other object for support and without becoming unsteady	Able to get object but needs to steady self by holding onto something for support	Unable or unsteady
Bending down (patient is asked to pick up small objects, such as pen, from the floor)	Able to bend down and pick up the object and able to get up easily in single attempt without needing to pull self up with arms	Able to get object and get upright in single attempt but needs to pull self up with arms or hold onto something for support	Unable to bend down or unable to get upright after bending down or takes multiple attempts to upright self
Sitting down	Able to sit down in one smooth movement	Needs to use arms to guide self into chair or not a smooth movement	Falls into chair, misjudges distances (lands off center)

(Tinetti 1986)

Appendix 12: ABC Measure (Chapter 6)

The Activities-specific Balance Confidence (ABC) Scale*

Administration

The ABC can be self-administered or administered via personal or telephone interview. Larger typeset should be used for self-administration, while an enlarged version of the rating scale on an index card will facilitate in-person interviews. Regardless of method of administration, each respondent should be queried concerning their understanding of the instructions, and probed regarding difficulty answering any specific items.

Instructions to Participants

For each of the following, please indicate your level of confidence in doing the activity without losing your balance or becoming unsteady by choosing one of the percentage points on the scale from 0% to 100%. If you do not currently do the activity in question, try and imagine how confident you would be if you had to do the activity. If you normally use a walking aid to do the activity or hold onto someone, rate your confidence as if you were using these supports. If you have any questions about answering any of the items, please ask the administrator.

Instructions for Scoring

The ABC is an 11 point scale and ratings should consist of whole numbers (0 to 100) for each item. Total the ratings (possible range = 0 to 1600) and divide by 16 to get each subject's ABC score. If a subject qualifies his/her response to items #2, #9, #11, #14, or #15 (different ratings for "up" vs "down" or "onto" vs "off"), solicit separate ratings and use the lowest confidence of the two (as this will limit the entire activity, for instance likelihood of using stairs).

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*Powell LE & Myers AM. The Activities-specific Balance Confidence (ABC) Scale. J Gerontol Med Sci 1995; 50 (1):M28-34.

The Activities-specific Balance Confidence (ABC) Scale*

For each of the following activities, please indicate your level of self-confidence by choosing a corresponding number from the following rating scale:

0% No Confidence	10	20	30	40	50	60	70	80	90	100% Completely Confident

"How confident are you that you will not lose your balance or become unsteady when you....

1. ... walk around the house? _____%
2. ... walk up or down stairs? %
3. ...bend over and pick up a slipper from the front of a closet floor? _____%
4. ...reach for a small can off a shelf at eye level? _____%
5. ...stand on your tip toes and reach for something above your head? _____%
6. ...stand on a chair and reach for something?_____%
7. ... sweep the floor?_____%
8. ... walk outside the house to a car parked in the driveway?_____%
9. ... get into or out of a car?_____%
10. ... walk across a parking lot to the mall?_____%
11. ... walk up or down a ramp?_____%
12. ... walk in a crowded mall where people rapidly walk past you?_____%
13. ... are bumped into by people as you walk through the mall?_____%
14. ... step onto or off of an escalator while holding onto a railing?_____%
15. ... step onto or off an escalator while holding onto parcels such that you cannot hold onto the railing?_____%
16. ... walk outside on icy sidewalks?_____%

Appendix 13: Diary Collection Sheet for Intervention Study (Chapter 6)

Diary for the Week of

Please complete this information sheet and return it to

Name:____

Please begin by describing how you felt the last week.

1. How would you rate your health in the last week? Would you say it was:

   (A) Excellent
   (B) Good
   (C) Fair
   (D) Poor
   (E) Very Poor

2. In the last week would you describe yourself as:

   (A) Happy and interested in life
   (B) Somewhat happy
   (C) Somewhat unhappy
   (D) Very unhappy

3. In the last week, how would you describe your usual ability to remember things?

   (A) Able to remember most things
   (B) Somewhat forgetful
   (C) Very forgetful
   (D) Unable to remember anything at all

For the purpose of the next questions, please note that a fall refers to "an instance when you landed on the ground or against an object. This does not include times you fell because of a sudden health problem (e.g., heart attack), or being pushed over by a person, heavy object or a violent blow"

Please circle the responses that apply:

4. Did you fall this week:

   (A) Yes. Please complete the sections below.
   (B) No. Please mail in your questionnaire.

please turn over...

4.1 Circle the day(s) on which you fell and indicate the approximate time of day.

(A)	Sunday	_______ am or	______ pm
(B)	Monday	_______ am or	______ pm
(C)	Tuesday	_______ am or	______ pm
(D)	Wednesday	_______ am or	______ pm
(E)	Thursday	_______ am or	______ pm
(F)	Friday	_______ am or	______ pm
(G)	Saturday	_______ am or	______ pm

5. If you fell, where was the location of the fall (e.g., in the bedroom, at the store)?

(A)	Sunday location:	____________________
(B)	Monday location:	____________________
(C)	Tuesday location:	____________________
(D)	Wednesday location:	____________________
(E)	Thursday location:	____________________
(F)	Friday location:	____________________
(G)	Saturday location:	____________________

6. For the day(s) you fell, describe any injuries you experienced (e.g., bruise, cut, fracture).

(A)	Sunday:	______________________________
(B)	Monday:	______________________________
(C)	Tuesday:	______________________________
(D)	Wednesday:	______________________________
(E)	Thursday:	______________________________
(F)	Friday:	______________________________
(G)	Saturday:	______________________________

7. As best as you can, please describe each fall, any symptoms you felt prior to and after each fall, and the reasons why you think you fell (for example, if you tripped or slipped on a throw rug, or if you felt dizzy before the fall). You may use additional paper if necessary.

____

____

____

____

____