Evaluating the effectiveness of a home-based multifactorial fall prevention program for community-dwelling older adults
by Shawna Marie Yates

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Health and Human Development
Montana State University

Abstract:
Falls are a serious public health concern for older adults, with nearly 30 percent of adults over the age of 65 falling each year. Previous research has shown falls to be related to the number of fall-related risk factors. A number of investigations have been conducted to reduce the risk of falls in seniors. However, no published studies have investigated a multifactorial fall prevention program, targeting enhanced physical activity, proper nutrition, and environmental hazards education. Therefore, the purpose of this study was to determine if a home-based multifactor fall prevention program reduces select fall-related risks in a sample of rural dwelling seniors in southwest Montana. The researcher hypothesized that an intervention program targeting enhanced physical activity, proper nutrition, and environmental hazard education would positively change select fall-related risk factors: balance, upper body flexibility, ankle flexibility, bicep endurance, lower extremity power, mobility, environmental hazards, depression, falls efficacy, nutritious behavior, and nutritious locus of control.

A randomized, controlled 10 week intervention study was conducted on 37 subjects. Paired t-tests were done to determine mean change scores within groups for each dependent variable. Unpaired t-tests were run to determine mean difference between groups. Last, simple regression models were used to determine if group designation predicted change in outcome variables.

The analysis revealed statistically significant changes for the intervention group on balance, arm strength, leg strength, reduction of environmental hazards, and reducing the total number of fall-related risk factors in each of the statistical tests: t-test within group, t-test between group, and simple regression. The intervention was found to be predictive of changes in balance (R2=35.4%), bicep endurance (R2=29.6%), mobility (R2=9.1%), lower extremity power (R2=22.9%), nutritious behavior (R2=I4.0%), and number of environmental hazards (R2=I9.6%). Most importantly, the intervention explained almost half of the variance in the number of total fall-related risks (R2=47.4%).

In conclusion, the fall prevention intervention consisting of exercise programming, nutrition counseling, and environmental hazards education reduced six of the eleven fall-related risk factors evaluated.

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APPROVAL

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Shawna Marie Yates

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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VITA

Shawna Marie Yates, daughter of Michael and Terrie Button, was born in Butte, Montana, on November 16, 1973. She attended public schools all over Montana, and graduated from Plains High School, in Plains, MT in 1992.

Ms. Yates graduated from Montana State University-Bozeman in 1996 with a B.S. in Sociology and an emphasis in Bio-Chemistry. She was also a graduate of the University Honors Program.

Ms. Yates entered graduate school at Montana State University-Bozeman in September, 1996, as a student in the Health, Exercise and Wellness option in the Department of Health and Human Development. She received her Master of Science degree in January, 1999.

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TABLE OF CONTENTS

TABLE OF CONTENTS–Continued

TABLE OF CONTENTS–Continued

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Falls are a serious public health concern for older adults, with nearly 30 percent of adults over the age of 65 falling each year. Previous research has shown falls to be related to the number of fall-related risk factors. A number of investigations have been conducted to reduce the risk of falls in seniors. However, no published studies have investigated a multifactorial fall prevention program, targeting enhanced physical activity, proper nutrition, and environmental hazards education. Therefore, the purpose of this study was to determine if a home-based multifactor fall prevention program reduces select fall-related risks in a sample of rural dwelling seniors in southwest Montana. The researcher hypothesized that an intervention program targeting enhanced physical activity, proper nutrition, and environmental hazard education would positively change select fall-related risk factors: balance, upper body flexibility, ankle flexibility, bicep endurance, lower extremity power, mobility, environmental hazards, depression, falls efficacy, nutritious behavior, and nutritious locus of control.

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In conclusion, the fall prevention intervention consisting of exercise programming, nutrition counseling, and environmental hazards education reduced six of the eleven fall-related risk factors evaluated.

CHAPTER 1

INTRODUCTION

Humans are unique in their bipedal strategy for locomotion. Our complex postural control system helps us to walk upright and maintain balance in many challenging situations. However, problems can and do occur with this system. Our balance and gait can become disrupted. As one ages, the complex postural control system is often compromised, making it more and more difficult to avoid falls. Approximately 30 percent of the non-institutionalized people over the age of 65 fall each year (Sattin, Lambert Huber, & DeVito, 1990; Tinetti, Speechley, & Ginter, 1988). One-third of those who fall suffer moderate to severe injuries (Alexander, Rivara, & Wolf, 1992). Nearly 200,000 Americans fracture their hips each year, usually as a result of a fall (Wylie, 1977). The National Safety Council (1993) has cited death due to unintentional injury, such as falls, as the sixth leading cause of mortality among those 65 and older. Consequently, falls have serious repercussions for older adults due to their frequency and the morbidity associated with them.

Medical attention is often needed for fall-related injuries. A study done by Kiel, O'Sullivan, Teno, & Mor (1991) found a greater use of the health care system by those older adults who had fallen. Falls impinge on the economics of the health care system and the victims of falls. Urton (1991) reported that between $75 and $100 billion are

associated directly or indirectly with the cost of falls each year. Other costs include physical suffering, mental anguish, days in the hospital, transfers to extended care facilities and loss of an independent lifestyle.

Once an older person falls, a downward spiral often begins. They may live in constant fear, become less active, less independent, and less confident. One of the most common fears among the elderly is the "fear of falling" (Redford, 1991). Fear may result in tremendous impact on quality of life and physical decline (Walker & Howland, 1991).

This health concern is continually growing because America's population is aging. Due to the baby-boom during the middle third of this century, the age group over 65 is the fastest growing segment of society. Today there are 31 million people over the age of 65, comprising 12% of the U.S. population. By the year 2040, there will be a projected 66.6 million people over the age of 65 in the United States (Gelman, et al., 1985).

Significance of the Study

There is broad public consensus about the importance and need for fall prevention programming. The United States Public Health Service (1990) has joined in the campaign to prevent seniors from falling. In the Healthy People 2000: National Health Promotion and Disease Prevention Objectives, the policy makers have outlined a plan to reduce falls by the year 2000 (Kennedy & Coppard, 1987). Some of these objectives includes:

- reduce hospitalization for hip fractures in women over 85 years by 20%

- reduce mortality rate from falls in the 65-84 age group from 18 to 14.4 per 100,000

- reduce mortality rate from falls in the 85+ age group from 131 to 105 per 100,000

In order to reduce the consequences of falls for both the individual and society, it is imperative that preventive steps be taken to reduce the risk of falling for older adults. Studies have shown that incidence of falls is related to the number of fall-related risk factors (Cutson, 1994; Tinetti, et al., 1988). Reducing just one fall-related risk factor can have a great impact on the frequency and morbidity of falls. Reducing the incidence of falls among older adults will help reduce high health care costs for the individuals, their families, and the United States taxpayers. Most importantly, by reducing the falls suffered by older adults, their quality of life can be improved. They can become empowered to continue living an active and independent lifestyle.

The following fall prevention program is designed to inform and empower older adults about fall-related risk factors. It provides seniors with tools to begin an in-home exercise program, assess their nutritional health, and make changes to environmental hazards. The program is designed to motivate and educate the older adult about their role in fall prevention; and to reduce their overall risk of falling.

Statement of the Problem

The purpose of this study is to determine if a home-based multifactor fall prevention program reduces select fall-related risks in a sample of older adults from rural Montana communities.

Research Hypothesis

A home-based multifactor fall prevention program, targeting enhanced physical activity, proper nutrition, and environmental hazards education will positively change select fall-related risk factors in a sample of older adults.

Definition of Terms

For purposes of this study the following definitions will be observed:

Fall will be defined as "an event which results in a person coming to rest inadvertently on the ground or other lower level and other than as a consequence of the following: sustaining a violent blow; loss of consciousness; sudden onset of paralysis, as in a stroke; or an epileptic seizure" (Kennedy & Coppard, 1987).

Older adults will be defined as those persons over the age of sixty-five.

Multifactor will be defined as targeting more than two fall-related risk factors. Multiple risk factors will be observed.

Community-dwelling will be defined as those persons independently living in their own homes or apartments, but not those in nursing or assisted-living facilities.

Rural The Office of Management and Budget definition includes any county with less than 100,000 people and no cities with more than 50,000 people (Office of Management and Budget, 1983). Montana has only two counties that qualify as urban (Metropolitan Statistical Areas): Cascade and Yellowstone. The remaining 54 counties are considered to have rural populations.

Limitations

1.) The study was limited by the self-reported nature of the data. This posits a limitation in that there can be under-reporting and over-reporting of health characteristics and falls.

2.) Results of this study are only generalizable to populations similar to Gallatin County, Montana.

3.) Recruiting subjects was difficult, thus the sample size (N = 37) was small.

4.) The researcher, who conducted all aspects of the study, may have introduced bias through diverse interactions with the subjects.

Delimitations

1.) Data was limited to the survey questions and statements used in the investigation (See Appendix E).

2.) Physical measures were limited to the fitness tests for upper body bicep endurance, shoulder and ankle flexibility, gait speed, balance, and lower body power.

3.) Psychometric measures were limited to a depression scale, a falls efficacy scale, locus of control for nutrition, and nutritious behavior scale.

4.) Information on background characteristics was limited to age, gender, marital status, living arrangement and education.

5.) Information on self-rated health characteristics was limited to vision, hearing, alcohol use, tobacco use, sedative use, high blood pressure, hospitalization in the last year, physical activity, foot problems, and the average number of prescription medications.

Assumptions

The investigator assumes the subjects were truthful and accurate on all information

reported throughout the study. The number of fall-related risk factors were presumed to increase a persons chances of falling, therefore a decrease in the number of risk-factors will decrease a person's risk of falling.

CHAPTER 2

REVIEW OF LITERATURE

> *For older people any loss of functional capacity can increase the risk of losing independence. This risk, coupled with the tendency to become more sedentary with age, leads to a population with much to lose- and much to gain.*
> (The United States Public Health Service, 1992)

Falls for older adults can be caused by any number of fall-related risk factors. Many of the risk factors are considered as a natural part of aging, however, many adults are learning that physical activity over the length of the life-span can prevent many of the risk factors associated with falling. This chapter will review; 1) conceptual models surrounding falls and fall prevention, 2) select fall-related risk factors, and 3) previous fall reduction research conducted on senior populations.

Conceptual Models

For the past 40 years, researchers and physicians have been struggling to find an efficacious fall prevention model for the elderly. To this end, a number of conceptual models have been developed. The first is called the single cause model. The single cause model was developed on the intuition that a person's fall is based upon a single cause, such as a dangerously placed throw rug. However, the risk is typically multi-dimensional

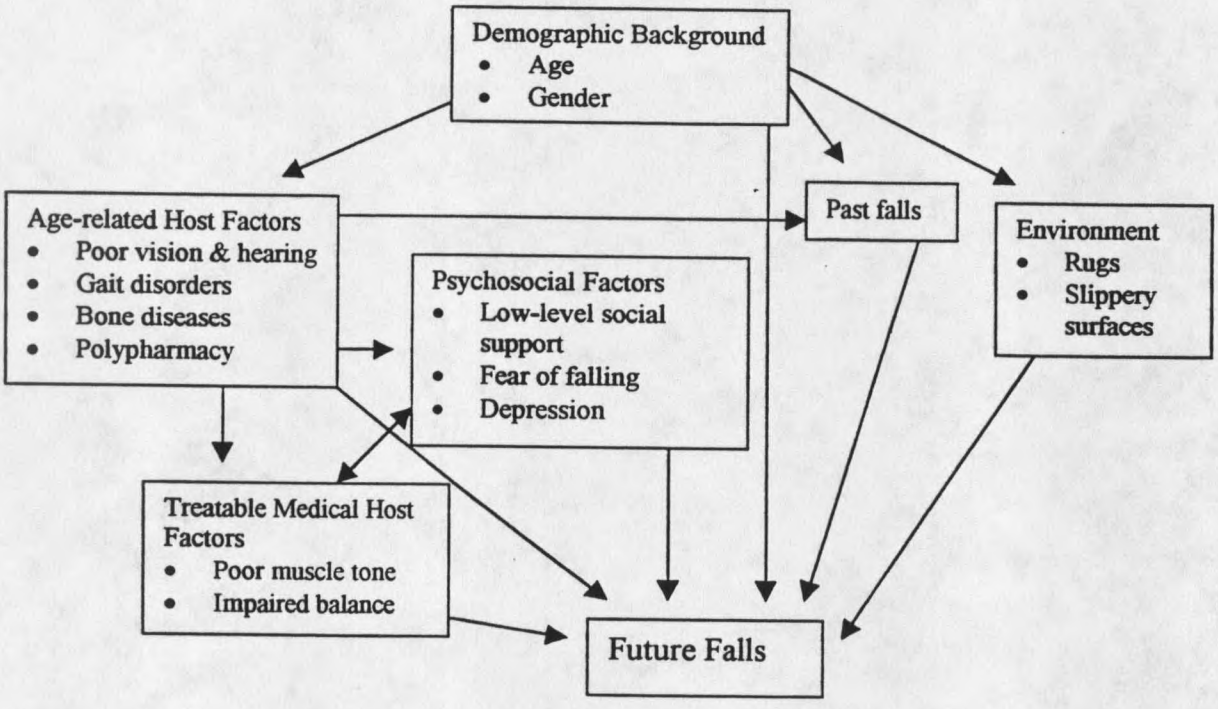
and may include problems with vision, strength, and balance; but the only cited cause for the fall was the rug. Therefore, Buchner (1997b) concluded that the single cause model did not adequately address the complexities associated with a comprehensive fall prevention program.

A more appropriate model for understanding falls is called the host-agent-environmental model, which is based upon injury control research (Fabrega, 1975). Hogue (1984) described this model in the institutional setting and called it the ecological model. He emphasized the interaction between the older person and the environment is divided into two phases. The first phase is the pre-injury phase and includes the risk factors associated with a fall. The second phase is the injury phase and includes risk factors for an injury. Conceptually, the phases provide a two step pathway that requires a host and environmental risk factor for a fall (poor balance & slippery surface) and a second set of risk factors for injury (weak bones & falling on a hard surface). The ecological model also takes into account that older persons are influenced by experiences of other older adults and attitudes expressed by health care professionals. For example, the knowledge of someone falling will dictate how one copes with the future possibility of falling. Based upon the ecological model a fall prevention plan must incorporate current beliefs about falls and treatment of an array of host-environment risk factors.

Because falls are associated with a heterogeneous group of events with complex causal pathways, investigators have also viewed fall prevention from a social epidemiological model (Cwikel & Fried, 1992). This model (Figure 1) incorporates many causal pathways that are associated with falls. For example, the model shows that past

falls alone can be an indication of future falls. Also, it incorporates the notion that age, gender, physical decline, depression and environment may all be related to future falls. Consequently, this model seems to be the most comprehensive approach to date and a logical framework to use in the development of fall prevention programming.

Figure 1: Schematic of social epidemiological model.

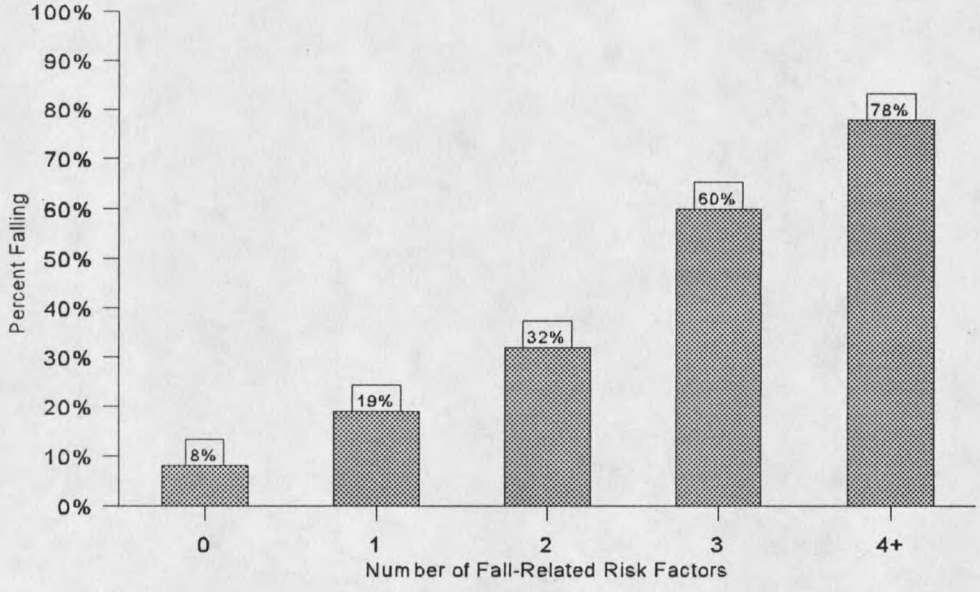


Review of Fall-Related Risk Factors

A number of studies have been conducted to identify fall-related risk factors (Clark, Jackson, & Cohen, 1996; Cutson, 1994; Dunne, Bergman, Rogers, Inglin, & Rivara, 1993; Hindmarsh & Estes, 1989; Nevitt, Cummings, & Hudes, 1991; Sudarsky, 1990; Tinetti, et al., 1988; and Tinetti, McAvay, & Claus,1996). Tinetti et al. (1988)

found the risk of falling increased linearly with the number of risk factors, from 8 percent with no risk factors to 78 percent with four or more risk factors (Figure 2). In order to study the risk factors associated with falling, the researchers conducted a one-year prospective study using 336 persons 75 years and older who were living in the community. The risk factors studied included sedative use, cognitive impairment, lower-extremity disability, palmomental reflex, foot problems, and balance-and-gait abnormalities. It was concluded that a simple clinical assessment can identify those who are at a greater risk of falling and interventions targeting these risk factors can help reduce a person's risk of falling.

Figure 2: Occurrence of Falls According to the Number of Fall-Related Risk Factors



Based upon the results of a variety of studies, a number of modifiable risk factors have been identified (Figure 3). Because these fall-related factors are the areas that are