An Abstract of the Thesis of

NANCY ELISABETH GRAY for the degree of MASTER OF SCIENCE in Physical Education presented on September 29, 1994.

TITLE: THE RELATIONSHIP BETWEEN THE SCORES ON THE UP AND GO TEST AND THE TINETTI GAIT SCALE IN TWO GROUPS OF ELDERLY

Abstract Approved: _____

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The purpose of this study was to determine if there is a relationship between scores on the Up and Go Test and the Tinetti Gait Scale between two groups of elderly. Subjects for this study were 29 elderly residents of Emporia Presbyterian Manor, a continuous care retirement facility in Emporia, KS. There were 4 male and 25 female subjects, ranging in age from 76 to 98 years old, with 7 subjects in a history of falls group and 22 subjects in a no history of falls group. Each subject completed the Up and Go Test and the Tinetti Gait Scale. All data were analyzed at the $p>.05$ level of significance through the use of a t-test and a Pearson product-moment correlation. A very high negative correlational relationship was found between the scores on the Up and Go Test and the Tinetti Gait Scale. No significant difference was found on scores on the Up and Go Test of subjects with a history of falls compared with subjects with no history of falls. A slight, but not significant, difference was found in scores on the Tinetti

Gait Scale of subjects with a history of falls compared with subjects who had no history of falls.

THE RELATIONSHIP BETWEEN THE SCORES ON THE UP AND GO TEST AND THE TINETTI GAIT SCALE IN TWO GROUPS OF ELDERLY

A THESIS

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MASTER OF SCIENCE

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by

Nancy Elisabeth Gray

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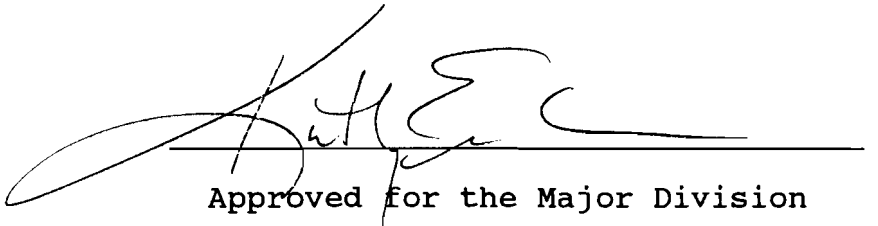

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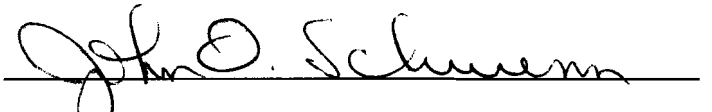

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THE RELATIONSHIP BETWEEN SCORES ON THE UP AND GO TEST AND THE TINETTI GAIT SCALE IN THE ELDERLY

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CHAPTER I
INTRODUCTION

Falls are the leading cause of accidents and death due to injury in those persons 65 and older (Urton, 1991). According to a 1987 study done by the National Safety Council, individuals who are 65 and over accounted for 74% of deaths caused by falls (Zylke, 1990b). Numerous factors, both biological and environmental, work together to produce falls. These factors include visual and musculoskeletal abnormalities, ill-fitting shoes, poor lighting conditions, medication, judgement and low levels of physical fitness (Zylke, 1990a).

For the elderly, independence is a key ingredient in attaining a quality of life. Branch, Guralnik, Foley, Kohout, Wetle, Ostfeld and Katz (1991) defined an active life as the period of life in which a person remains free from disabilities in activities of daily living (ADL). Obviously, falls that cause some type of injury may either temporarily or permanently hamper independence. Often repeated falls are the reason for previously independent elderly persons to be admitted to long-term care facilities (Urton, 1991). Non-injury falls can also interfere with independence. The psychological "fear of falling" may cause some elderly to avoid activities, even though they are capable of doing them.

Until 1990, the majority of research on falls in the elderly focused on two areas: the epidemiology of falls and identifying risk factors. The current areas of research on falls focus on fall prevention and injury-free fall prevention.

The fundamental objective in studying fall prevention is the identification of predisposing characteristics (Tinetti, 1986). The instruments utilized in research that test target characteristics related to mobility, gait and balance are the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Scale of Performance-Oriented Assessment of Mobility (Tinetti, Williams & Mayewski, 1986). Both are highly useable assessments since both instruments require minimal equipment and administration.

The Up and Go Test (Podsiadlo & Richardson, 1991) is a modified version of the Get Up and Go Test (Mathias, Nayak & Isaacs, 1986). The test requires subjects to stand up from a chair, walk a short distance and return to the chair. The Up and Go Test (Podsiadlo & Richardson, 1991) was designed as a quick, uncomplicated examination to check basic functional mobility and to predict subjects' ability to go outside alone safely.

The second instrument is the Tinetti Scale of Performance-Oriented Assessment of Mobility, also known as the Tinetti Gait Scale (Tinetti, et al., 1986). Similar to the Up and Go Test (Podsiadlo & Richardson, 1991), subjects

are asked to complete eleven tasks. These tasks range from rising from a chair to reaching for an object. This test was also designed to measure functional mobility as a predictor of falls.

Both instruments use activities of daily living as the test components. Both tests attempt to predict elderly subjects' ability to function independently without injury. While the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986) measure similar elements of mobility in the elderly, there has been no research done to correlate the two instruments.

Purpose

The purpose of this study was to determine the relationship between scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986). A subproblem of this study was to determine if there is a difference on the scores of the Up and Go Test (Podsiadlo & Richardson, 1991), the Tinetti Gait Scale (Tinetti, et al., 1986) and the medical status of the elderly subjects.

Hypotheses

The following hypotheses served as a basis for this investigation:

1. There is no relationship between the scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and

the Tinetti Gait Scale (Tinetti, et al., 1986).

2. There is no difference between fallers'/nonfallers' scores on the Up and Go Test (Podsiadlo & Richardson, 1991).
3. There is no difference between fallers'/nonfallers' scores on the Tinetti Gait Scale (Tinetti, et al., 1986).

Definitions

The following definitions are provided to clarify frequently used terms and to establish a common basis for discussion of terms throughout the study.

ADL - Activities of daily living include activities such as walking, washing, dressing and toileting. Instrumental ADLs are self-reliant functions in a given environment. Examples include shopping, cooking and cleaning.

Balance - To bring to a state of equipose or state of equilibrium; to stabilize; to poise evenly; steadiness.

Elderly - Any person who has advanced beyond middle age. For this study, an elderly person includes anyone over the age of 65.

Fall - An unintentional change in position, occurring under circumstances in which a "fit" person could have resisted the hazard, if one was present.

Gait - Manner of walking, running or moving on foot.

History of falls/repeated falls - Any subjects who fell at least once in the past six months.

Mobility - The ability to get around in one's environment.

Tinetti Gait Scale (Tinetti, et al., 1986) - This test includes eight position changes (sitting balance, rising from a chair, immediate/prolonged standing balance, withstanding a nudge on the sternum, balancing with eyes closed, turning balance and sitting down); and five gait observations (initiation, path, missed step, turning, and step over obstacle).

Up and Go Test (Podsiadlo & Richardson, 1991) - A modified, timed version of the Get Up and Go Test (Mathias, et al., 1986). Subjects are asked to rise from a standard arm chair, walk to a line on the floor 3m away, turn, return and sit down again.

Delimitations

All subjects in this study were residents at Emporia Presbyterian Manor, a continuous care retirement community in Emporia, Kansas. This center provides independent living via apartments and duplexes, and intermediate and skilled care. Subjects were both male and female (N=29) and ranged in age from 76 to 98 years. Seven subjects had a history of falls and 22 subjects had no history of falls. Additionally, 11 subjects resided at the Jones Health Center

at Emporia Presbyterian Manor, while 19 subjects lived in apartments or duplex homes on the Emporia Presbyterian Manor property.

Limitations

In any study involving people and perceptions, certain limitations exist. The findings of this study were limited by the following facts:

1) All subjects used were volunteers.
2) Both males and females were used as subjects. Since falls are more of a significant problem in women than in men (Lipsitz, Jonsson, Kelley & Koestner, 1991), the fact that male and female subjects were used is a limiting factor.

Assumptions

It was assumed all medical records for the subjects were accurate and complete in relation to falls reported and recorded. Additionally, it was assumed all subjects were honest and candid in their response to the study questions.

CHAPTER II
REVIEW OF LITERATURE

Older adults are at risk of falls for a myriad of reasons. Some of these reasons are the loss of agility, predisposition to dizziness and side effects from medications. The injuries sustained from the falls may result in a loss of mobility and independence and an increased risk of death (Podsiadlo & Richardson, 1991). Non-injury falls can also cause loss of independence through a development of the psychological fear of subsequent falls. This fear may result in an elderly person limiting his/her normal daily activities.

Research on the elderly involves more than determining ways these individuals can avoid death and disease. Quality of life issues, which include being able to do things independently, are important to examine. Since falls may affect an elderly person's quality of life, it is critical to be able to predict the likelihood of a fall. Four instruments currently used to predict falls in the elderly are: 1) the Get Up and Go Test (Mathias, et al., 1986), 2) the Tinetti Gait Scale (Tinetti, et al., 1986), 3) the Up and Go Test (Podsiadlo & Richardson, 1991), and 4) the Functional Reach Test (Duncan, Weiner, Chandler & Studenski, 1990).

The review of literature will examine three major areas related to falls in the elderly. These areas include an

overview of physiological and psychological changes as a result of ageing, reasons for falls in the elderly, and the instruments used to test for falls in the elderly.

Physiological Changes in the Elderly

As a person ages, a general and gradual decrease in work capacity, muscle strength and muscle size occurs. However, this decrease may not be due to ageing per se, but to inactivity (Brown & Cundiff, 1988). The decrease in muscular strength is more pronounced at longer muscle lengths, i.e., those muscles used in climbing stairs or rising from a chair or walking. A study by Smith and Gilligan (1983) showed functional changes between the ages of 30 and 70 of 25% to 30% decreases in work output, muscle mass, hand grip strength and flexibility. It should be noted that these are gradual decreases; inactivity speeds up these declines and makes one more susceptible to disease or injury. Cress, Thomas and Johnson (1991) also found that as a person ages s/he loses strength and muscle fiber. Additionally, fast-twitch motor units are not recruited for service. This lack of recruitment makes muscle contraction slower and less forceful.

In advanced age, the normal patient's gait is characterized by smaller steps, decreased step height, shuffling, and increased time on both feet (Israel & Caranasos, 1991). The strength of the hip muscles is decreased and there is loss of elasticity in muscles,

tendons, and joints. When muscles atrophy from inactivity, muscle size and muscle fibers decrease, with a concommitent decrease in the number of nerve cells in the musculoskeletal system (Alter, 1988). Through disuse, collagen builds up in the muscle fiber, making muscles more rigid. The once elastic muscle fibers lose their resilience and begin to fragment and fray. This rigid muscle system absorbs less energy than a flexible muscle.

Rowe and Kahn (1987) found that the ageing process can result in severe losses in bone density that can result in fractures after only minimal trauma. Osteoporosis is a condition that results from the decline in bone mineral content, makes bones susceptible to fracture, and accounts for over one million fractures a year in the United States. By age 81, one-third of women and one-sixth of men will have suffered a hip fracture. These injuries can all be modifiable and possibly prevented.

Another change that occurs as a result of ageing is reaction time. Precise input from proprioceptive, vestibular and visual pathways is needed for normal stance and gait, and each of these pathways can be affected by ageing and disease (Israel & Caranasos, 1991). Older persons seem to show greater caution than the young. If an extended period of time is given to accomplish a task, older persons work more slowly, but are more accurate than younger persons at the same task (Boucher, Denis & Landriault,

1985). When a time limit is given to complete a task, younger subjects are more accurate than the elderly. The elderly rely more heavily on visual information to make decisions, thus taking more time.

Balance and Movement Time

The older adult does not move as fast, or react as quickly, as he/she once did. Along with physiological decrements due to ageing, the elderly appear to monitor their responses. Older people tend to look more at what they are doing, to be more cautious in reacting, and to sacrifice speed for accuracy.

When analyzing falls, the older adult can be characterized as lacking the speed and coordination necessary to ensure recovery of stability (Woollacott, Shumway & Nashner, 1986). While it is not the sole reason behind falls, the ability of the body to regain balance quickly is a critical factor in preventing falls.

Another theory on a person's ability to maintain balance is related to changing control strategies used to handle situations: predictive and reactive. Predictive strategies involve anticipating an upcoming situation and adjusting accordingly. Reactive strategies are used once a situation has already occurred, or is occurring, and decisions are made based upon events happening at that moment. As one ages, reactive strategies are used more frequently. When performing a voluntary movement, a younger

person will predict and adjust his/her center of gravity so as not to be off-balance when the movement occurs. The elderly do not make this adjustment; thus they are at an increased risk of postural instability. To compound this unstable condition, once the elderly person is aware off this crisis, he/she will sacrifice swift action for "correct" action. Often times this correct decision is too late to avoid a fall and/or an injury.

Getting Old

No one automatically becomes "old." The same social, economic, and physiological problems that affect people when they are young can affect them throughout their later years as well. While it is true that the body will not function in the same capacity as one ages, there are more important factors than inevitableness that will determine conditions in later years.

One definition of physical ageing is the adaptability to changes in one's environment. Further, the degree of bodily deterioration is not decided by one's age, but more so by one's activity level, diet and living arrangements.

Falls in the Elderly

Research on causes of falls in the elderly began with neuromuscular investigations. Scientists were interested in the biomechanical differences between elderly persons with histories of falls and those with no history of falls.

Cress, et al. (1991) used a 50-week exercise program with 27 healthy women aged 68-78. The subjects were divided into an exercise group (N=17), and a control group (N=10). A strong correlation was found between thigh strength and two crucial ADLs, walking and climbing stairs. In background research done for the study, Cress, et al. (1991) found nursing home dwellers with a history of falls had only 62% of the thigh strength when compared to dwellers with no history of falls, and just 37% of the thigh strength when compared to similar-aged independent living elderly.

Gehlsen and Whaley (1990) used history of falls as a guideline to study two groups of healthy elderly retirees. One group included 25 subjects with a history of falls. The other group contained 20 subjects with no history of falls. The researcher presumed that loss of muscular strength would limit functional capacity and contribute to falls in the elderly. Furthermore, elderly persons witness a decline in joint flexibility, accompanied by a decrease in stability and mobility, and an increase in joint deformity.

Subjects were tested on balance, strength and flexibility. The balance test involved a static balance test in which subjects stood on one foot with eyes open and closed, and a dynamic balance test in which subjects walked backwards on a line. There was a significant difference between the static tests with eyes open and closed. Results of this portion of the testing indicated that static balance

was a significant factor in distinguishing fallers and nonfallers. This finding has implications for the importance of vision and the elderly. An elderly individual who has declining vision also has fewer visual cues to utilize when making decisions about balance.

The subjects' muscular leg strength was measured with a Cybex dynamometer. A significant difference in muscular strength was found between men and women. Men had greater muscular strength than women. The subjects' flexibility was measured with a goniometer, a device that measures range of motion in the knee, hip and ankle. Hip flexion and ankle dorsiflexion was found to be significantly greater in the nonfallers. It was concluded that flexibility at the hip and ankle may be related to falls, with ankle weakness a more important underlying factor in poor balance.

Whipple (1987) compared the strength of knees and ankles of nursing home residents with a history of falls and no history of falls and found a significant difference. The fallers were four times as likely to have lower extremity weakness than the nonfallers.

While neuromuscular investigations provide a wealth of information on specific areas of muscular weakness, this type of data does not always reflect a person's mobility. Tinetti and Ginter (1988) compared relevant neuromuscular findings with performance during four ADL mobility maneuvers: 1) getting up from a chair, 2) sitting down,

3) turning while walking, and 4) raising the feet while walking. The subjects were 336 elderly persons living in the community. Many subjects who performed poorly on mobility maneuvers did not have corresponding neuromuscular abnormalities. The relationship between neuromuscular findings and functional mobility was not predictable enough to rely on neuromuscular findings to identify mobility problems. A simple assessment that reproduces routine daily mobility maneuvers was suggested in care of elderly patients to test for fallers/nonfallers.

Environmental hazards are also associated with falls in the elderly. Hazards normally observed with falls are slippery and uneven surfaces, ill-fitting shoes, poor lighting, cluttered environment and poorly designed stairways (Urton, 1991). A study by Campbell, Borrie, Spears, Jackson, Brown & Fitzgerald (1990) of 761 subjects ages 70 and over indicated that 20% of falls reported were associated with trips and slips. A dilemma in preventing falls due to environmental hazards is the limited income of the elderly. Installing adequate lighting and repairing walking surfaces may not be within the resources of an elderly person. Restricted income may make even the buying of a new pair of shoes difficult for some elderly.

Two research designs presently being studied are approaches toward preventing injury from a fall, rather than preventing the fall. The first fall-intervention system is

called Fall-Safe and involves the use of a braking device attached to an overhead trolley mounted on a track on the ceiling. Developed by Colvin, the system's goal is to "keep people independent longer" (Zylke, 1990b). The individual is attached by tether to the trolley, via a vest which enables stress to be evenly distributed over the torso in the event of a fall. In testing so far, it has been shown that 98% of the energy of the fall is absorbed. A second benefit to this device is its encouragement of the elderly to exercise, since the fear of falling is not a factor while connected to Fall-Safe.

Colvin's research teams have also developed "active air bags" much like those found in cars that are inserted into a special garment. The carbon dioxide cartridges eject gas into air bags around the hips and knees when the onset of a fall is sensor-detected. These devices are still being tested and it is predicted that these bags will absorb two-thirds of the energy of a fall.

Chronic illnesses affect 86% of American elderly (Heitmann, 1982). Lipsitz, et al. (1991) evaluated the falls that occurred in a three year period in 126 residents of two nursing homes. The average age of the subjects was 87 years. Only independent or partially independent and ambulatory residents were used as subjects. The most common causes for falls were impairment caused by stroke, Parkinsonism, arthritis, visual defects and hypotension.

Fallers were more likely to be taking antidepressants or analgesics than were nonfallers. Another study by Dunn, Rudberg, Furner & Cassel (1992) also noted a difference in repeated fallers versus nonfallers. The differences that were examined were chronic diseases and disability. Chronic conditions mentioned as contributing to falls included arthritis, hypertension, visual and hearing deficits, stroke, diabetes, cancer, and thinness. The first three conditions were the most prevalent in fallers.

Israel and Caranasos (1991) also noted arthritis as "probably the most common cause of gait problems in elderly persons" (p. 440). Hip pain can cause an antalgic gait, where the body's center of gravity shifts away from the foot touching the ground. Further findings indicated that foot pain, another common elderly ailment, hampered balance and increased the chance of falling.

In a case-control study among 184 matched pairs of patients 65 years and older in a long-term care facility, Myers (1991) found medications associated with falls or injuries. Taking diuretics was also positively associated with falls or injuries in the group of fallers. In a related study, Cumming, Miller, Kelsey, Davis, Arfken, Birge & Peck (1991) found certain medications to be important risk factors for multiple falls. These drugs included diazepam, diltiazem, and laxatives.

Finally, the fear of falling can interfere with the independence of the elderly. This fear can result in a loss of confidence, which in turn, leads to a decrease in activity, and ultimately, to a loss of independence. Fear, rather than actual postural defects, was noted as a cause for poor postural performance on tests of posture (Maki, Holliday & Topper, 1991). In addition, elderly persons may develop a tendency to hold onto objects and take irregular, unsteady and abrupt steps. This disordered gait actually increases the possibility of falling (Israel & Caranasos, 1991).

The literature indicates that biological, psychological and environmental factors are associated with falls in the elderly. It appears that elderly individuals differ in how they cope with certain disabilities. While risk factors in a medical history provide clues to potential falls, this data alone is not sensitive enough to predict falls in the elderly. Nevitt stated:

> "...prevention of falls must span the spectrum of ages and health states within the older population and address the diversity of causes of falls, yet do so without unnecessarily compromising quality of life and independence." (Zylke, 1990b).

Quality of life and independence are two areas trying to be sustained in the elderly. ADLs are a good indication of independence. Following this avenue of application, tests

were developed to predict falls which involved tasks associated with normal daily routine activities.

Testing for Falls in the Elderly

The Functional Reach Test (Duncan, et al., 1990) is designed to measure the margin of stability. Functional reach is the maximum distance a person can reach forward beyond arm's length while keeping the feet in one spot. It does not require expensive equipment. Volunteers (N=128) ages 20 to 87 were tested and a high correlation was found between scores on the FRT and the scores on the Center of Positive Excursion (COPE) test. This test was suggested to have predictive value for those most at risk of falls. However one limitation to this test is that it only measures instability forward and backward, not to the side.

The Get Up and Go Test requires subjects to stand up from a chair, walk a short distance, turn around, return and sit down again (Mathias, et al., 1986). Forty subjects ages 52 to 94 were videotaped while completing the task using a straight-backed high-seat office chair. The videos were viewed by observers from different medical backgrounds. Observers scored each subject for balance on a five-point scale: 1) normal, or no evidence of being at risk to fall, 2) very slightly abnormal, 3) mildly abnormal, 4) moderately abnormal, and 5) severely abnormal, or subject appeared at risk of falling. Intermediate scores were based on presence of undue slowness, hesitance, staggering or stumbling. The

same patients underwent laboratory tests on gait and balance. A strong correlation was found with the scores on tests and the lab tests, as well as the observers' scores.

Podsiadlo & Richardson (1991) used the timed, modified version of the Get Up and Go Test (Mathias, et al., 1986) on a group of elderly (N=60) ages 70 to 84. All subjects were asked to do the same tasks as the Get Up and Go Test (Mathias, et al., 1986), but they were timed on the tasks. The scores on the test were reliable and correlated highly with other tested measures of balance, gait speed and functional capacity. A score of less than 20 seconds indicated a tendency to be independently mobile. A score of 30 seconds or more implied a tendency to need assistance from others. Advantages to the modified version of the test are it is a rapid and reliable indicator of a person's functional mobility and it can easily be included in the routine office visit of an elderly patient.

Tinetti, Williams & Mayewski (1986) discussed nine risk factors in a fall risk index. One of these factors was the mobility score. This score was derived from the Performance-Oriented Assessment of Mobility. This assessment was noted as "the best single predictor of recurrent falling" (p. 429) because it is simple, recreates fall situations and provides integrated assessment of mobility.

Seventy-nine subjects, ranging in age from 61 to 92 years, in three intermediate care facilities in New York, were tested on the Gait Scale. This scale has two sections: balance and mobility. Balance was evaluated in eight positions. Each position change stressed stability. Gait observations were done serially using simple criteria. Maximum score for the balance section was 15 and 13 for the gait section. The mobility score was the sum of the scores of the two sections. Difficulty with rising and sitting, instability upon first standing, staggering when turning, and short discontinuous steps were key items in separating fallers from nonfallers. Mean mobility scores for recurrent fallers was 14 ± 6 versus 21 ± 4 for nonfallers.

The Gait Scale successfully recreated situations in which falls are likely to occur (rising from a chair, immediate standing, turning) and assessed the functional effect of existing neuromuscular disabilities in mobility. It was concluded that the mobility test, along with knowledge obtained from routine medical history items accurately identified potential fallers.

Tinetti (1986) completed a pilot study on 15 ambulatory residents in a long-term care facility and found 90% agreement on scoring individual items by two observers. Tinetti concluded that further research was needed to improve the reliability of the Tinetti Gait Scale (in progress). She also noted that the care of the elderly

needs to shift from diagnosing and treating diseases to "recognizing and optimizing function" (p. 126).

Summary

Keeping the elderly independent and mobile is key to their quality of life. So far the research into functional mobility, namely preventing falls, has involved epidemiology and risk factors. Predicting predisposition to falls will greatly improve the elderly's prognosis of independence. The Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986) are instruments that attempt to predict problems in mobility in the elderly. Both tests are similar in nature in that both use congruent ADLs as tasks to complete. To date, no correlational research has been done between the two instruments.

CHAPTER III
METHODOLOGY

Subjects

Subjects (N=29) were residents of Emporia Presbyterian Manor in Emporia, Kansas (Spring 1994). The subjects ranged in age from 76 to 98 years (mean age 88.5 years). The subjects had a history of falls, men (N=01), women (N=06); or no past history of falls, men (N=03), women (N=19). The subjects were also ambulatory and did not have severe intellectual impairment, as measured by the Short Portable Mental Status Questionnaire (SPMSQ).

Procedures

Permission to conduct this study was obtained from the Institutional Review Board for Treatment of Human Subjects at Emporia State University (see Appendix B). Oral permission was also obtained from the Director of Nursing at Emporia Presbyterian Manor.

The director of nursing at Emporia Presbyterian Manor identified residents at the facility from a master list that fit the basic criteria for the study. She then approached each resident individually. She briefly explained the purpose of the study and asked if they would be interested in taking part. If the resident agreed, but did not have his/her own power of attorney, the director then contacted the responsible party and informed him/her of the study

and asked for permission to include this person in the study.

The researcher's first contact with the subjects was during preliminary meeting at Emporia Presbyterian Manor in February, 1994. The director, or one of the other nurses at the facility, was also present in each meeting. At this meeting the researcher provided a more thorough explanation of the study with each subject. Any questions the subjects had about the study were answered by the researcher. If the resident was still willing to participate, s/he was asked to sign a consent form (see Appendix C). The subject was also assigned a code number for use throughout the study to ensure confidentiality. During this initial meeting the SPMSQ was administered to the subject. If the subject made less than eight errors and did not score in the "severe intellectual impairment" level, the subject was accepted as a subject in the study. None of the initial volunteers were disqualified as subjects due to their score on the SPMSQ. An appointment was made to administer the tests. This preliminary meeting lasted about twenty minutes per subject.

The administration of the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986) was conducted in the hallway adjacent to the Physical Therapy office on the lower level of Emporia Presbyterian Manor. The hallway was carpeted with industrial carpet with no padding beneath. A restorative

nurse aided the researcher at all times during the testing. The researcher made sure the assisting nurse was trained in all study procedures.

One subject was tested at a time. Once the subject arrived, he/she was provided with a brief explanation of the testing procedures. At this time a gait belt was placed around the subject's midsection as a safety precaution.

The Up and Go Test (Podsiadlo & Richardson, 1991) was the first test to be administered. The subjects were seated in a standard highback office chair with arms. The subjects were asked to get up from the chair, walk forward to a line 3m away, turn around, walk back and return to a seated position. Subjects were timed from the point of initial rising from the chair until they were seated in the chair. A subject's score is the time, in seconds, taken to complete the task. The researcher was standing within arm's length of the seated subject on one side. The restorative nurse was in an equal position on the opposite side of the subject. The nurse walked next to each subject as s/he proceeded forward and back to the chair. The researcher stayed next to the chair and timed the task with a stopwatch.

The second test to be administered was the Tinetti Gait Scale (Tinetti, et al., 1986). There are two sections to the test: balance and gait. The balance section was administered first.

The subjects were required to complete tests to assess:

1. Seated balance
2. Arise from a chair
3. Immediate standing balance (first five seconds)
4. Side-by-side standing balance
5. Nudge (subject at maximum position with feet as close together as possible, examiner pushes lightly on subject's sternum with palm of hand three times)
6. Pull test (subject at maximum position, examiner stands behind and exerts mild pull back at wrist)
7. Turn 360°
8. Reach up (examiner holds 5 lb weight at height of subject's fully extended reach)
9. Bend over (place 5 lb weight on floor and ask subject to pick it up)
10. Sit down

The gait portion of the Tinetti test required the subjects to walk a distance of 15 ft, turn around and walk back. This test was administered in the hallway. Subjects were to complete the task two times. During the first trial, the researcher observed the following items:

1. Initiation of gait
2. Path
3. Missed step
4. Turning

On the second trial, a cylindrical container (two feet in length, four inches in diameter) was placed as an obstacle in the subject's path and he/she was asked to step over the obstacle.

During the trials, the nurse walked next to each subject, while the researcher stood at the starting point and observed the subject. When subjects attempted to step over the obstacle, both the researcher and nurse were on either side of the subjects.

For both the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986), subjects used customary walking aids if needed. Subjects wore their normal walking shoes.

Scoring on the two tests was evaluated individually using the following guidelines:

Table 1:

Results of the Up and Go Test

SCORE	EVALUATION
20 seconds or less	Independently mobile
21 to 30 seconds	Borderline
30 seconds or more	Needs assistance

Results of the Tinetti Gait Scale

SCORE	EVALUATION
21 points or more	Mobile
17 to 20 points	Borderline
16 points or less	Dependent

Instrumentation

Two instruments were used in this study: the Up and Go Test (Podsiadlo & Richardson, 1991), and the Tinetti Gait Scale (Tinetti, et al., 1986).

The Up and Go Test (Podsiadlo & Richardson, 1991) was developed by Podsiadlo and Richardson as a modification of the Get Up and Go Test (Mathias, et al, 1986). This timed version was quicker to administer than the original Get Up and Go (Mathias, et al, 1986) and could easily be incorporated into routine medical examinations to test basic mobility skills.

The study population was 60 consecutive patients in a Geriatric Day Hospital. Subjects were men (N=23) and women (N=37), who ranged in age from 60 to 90 (mean age 79.5 years). Ten healthy, active volunteers over 70 years old made up the control group. The subjects in the control group included men (N=6) and women (N=4), who ranged in age from 70 to 84 (mean age 75 years).

Reliability testing was performed on patients attending the Day Hospital over a 2-month period. Inter-rater and intra-rater reliability was tested, as well as patients' scores over time. Using the intraclass correlation coefficient (ICC), there was high agreement in time scores obtained both between raters (ICC 0.99) and within same raters on two consecutive visits (ICC 0.99).

Since the Up and Go Test (Podsiadlo & Richardson, 1991) is a new instrument, validity testing involved a hypothesis that the timed Up and Go score would correlate with the subject's balance, gait speed and functional capacity. The Berg Balance Scale was used to measure balance. Gait speed was measured by time taken to walk the middle 15m of a 20m walk. Functional capacity was estimated using the Barthel Index of ADL. After the clinician tested these three components, the clinician assigned each subject to 1 of 3 categories: 1) could walk outside independently and safely; 2) walked outside independently but was unsafe; and 3) dependent on assistance to go outside.

The Pearson correlation coefficient was used to assess the relationship between the Up and Go Test (Podsiadlo & Richardson, 1991) and balance, gait speed and functional capability. Results showed the time scores on the Up and Go Test (Podsiadlo & Richardson, 1991) were correlated with balance ($r=-0.72$), gait speed ($r=-0.55$) and functional capability ($r=-0.51$). Correlations became stronger when scores on the Berg Balance Scale, gait speed and the Barthel Index of ADL were log-transformed ($r=-0.81$, -0.61 and -0.78, respectively).

The Up and Go Test (Podsiadlo & Richardson, 1991) is a test that is reliable between raters and over time. It has content validity because it evaluates daily routine maneuvers. Concurrent validity was demonstrated with strong

correlations to other measures of balance, gait speed and functional capacities.

Tinetti, et al. (1986) studied risk factors characteristically associated with falls and elderly persons. Subjects (N=79) were selected from three intermediate care facilities in New York. Mean age of subjects was 79 years (range 61 to 92 years). A total of 79 subjects, women (N=53), men (N=26) were tested. Nine risk factors were analyzed: mobility, morale, mental status, distant vision, hearing, postural blood pressure, results of back examination, postadmission medications and admission ADL score.

The study consisted of a 40-item self-perception questionnaire, a brief medical exam, and balance and gait evaluations (first form of the Tinetti Gait Scale). Maximum score on balance was 15, gait was 13; mobility score was the addition of the balance and gait results. Difference in balance and gait scores by two observers during a pretest on 10 subjects was less than 10% in all cases.

The balance and gait maneuvers were "the most useful" (p. 431) in identifying recurrent fallers. The mean total mobility score for recurrent fallers was 14+6 versus 21+4 for those with no history of falls. Mobility score was correlated with lower extremity strength (r=0.55), back extension (r=0.45), neck examination (r=0.37) and self-perceived mobility (r=0.34).

A limitation noted by Tinetti, et al. (1986) is that reliability testing by several investigators is necessary before recommending this test for use in clinical research. The mobility evaluation adds content validity to the risk factor study in that it involves ADLs. Also noted in the study was the fact that other studies identified many of the same significant factors as Tinetti's work, supporting the study's conclusions.

In summary, inter-rater reliability was shown, but reliability of the mobility test over time is yet to be demonstrated. Content validity is evident.

Analysis of Data

The scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986) were analyzed through the use of Pearson product-moment correlation (Hypothesis 1). The scores on the Up and Go Test (Podsiadlo & Richardson, 1990) and the medical status of the subjects were analyzed through the use of a t-test (Hypothesis 2). Finally, the scores on the Tinetti Gait Scale (Tinetti, et al., 1986) and the medical status of the subjects were analyzed through the use of a t-test (Hypothesis 3). All data were analyzed at the $p>.05$ level of significance.

Summary

The purpose of the study was to determine if there was a correlation between scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986). A subproblem of the study was the comparison of the scores on the tests with the medical status of the subjects. Subjects were elderly residents of Emporia Presbyterian Manor, a continuous care retirement community in Emporia, KS. Data were analyzed through the use of Pearson product-moment correlation and a t-test. All data were analyzed at the $p>.05$ level of significance.

CHAPTER IV
ANALYSIS OF DATA

The purpose of this study was to determine the relationship between scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986) among two groups of elderly, those with a history of falls and those with no history of falls. The subjects resided in a continuous care retirement community.

This chapter presents an analysis of the data collected from the subjects at Emporia Presbyterian Manor. Pearson product-moment correlations were used to analyze the scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986). The scores were analyzed as one group (N=29) and in subgroups: subjects with a history of falls (N=7) and subjects with no history of falls (N=22) (Hypothesis 1). The scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and subjects' medical status were analyzed through the use of a t-test (Hypothesis 2). Further,the scores on the Tinetti Gait Scale (Tinetti, et al., 1986) and subjects' medical status were analyzed through the use of a t-test (Hypothesis 3). All data were analyzed at the $p>.05$ level of significance.

Sample Analysis

Twenty-nine subjects participated in the study, four males and twenty-five females. Table 2 summarizes the demographic characteristics of the subjects.

Table 2:

Demographic Characteristics of Subjects

	MEAN AGE (years)	AGE RANGE
GROUP	88.5	76-98
MALES	89.0	84-98
FEMALES	88.4	76-97
HISTORY OF FALLS	89.4	82-95
NO HISTORY OF FALLS	88.2	76-98

	HISTORY OF FALLS	NO HISTORY OF FALLS	TOTAL
GROUP	N=7	N=22	N=29
MALES	N=1	N=3	N=4
FEMALES	N=6	N=19	N=25

	# RESIDING IN JONES HEALTH CENTER	# RESIDING IN APARTMENT OR DUPLEX
GROUP	11	18
HISTORY OF FALLS	4	3
NO HISTORY OF FALLS	7	15

	MENTAL STATUS:		
	INTACT	MILD IMPAIRMENT	MODERATE IMPAIRMENT
GROUP	13	7	9
HISTORY OF FALLS	2	2	3
NO HISTORY OF FALLS	11	5	6

	EDUCATION:		
	GRADE SCHOOL	HIGH SCHOOL	COLLEGE
GROUP	4	7	18
HISTORY OF FALLS	1	1	5
NO HISTORY OF FALLS	3	6	13

Statistical Analysis

Descriptive statistics (means and standard deviations) were computed for scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986) (Tables 3 and 4).

Hypothesis one stated there is no relationship between the scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986). This hypothesis was rejected at the correlational value of - 0.8290 (Table 5).

In addition, the research examined the relationship of the two subgroups of subjects (fallers/nonfallers) with the scores on the two tests. A high inverse relationship was also found in this examination, meaning a high score on one test correlated with a low score on the other. This indication is logical, since one test shows a low score as good, while the other test shows a high score as good.

Hypothesis two stated there was no difference between fallers'/nonfallers' scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and the subjects' medical status. This hypothesis was not rejected at the $p>.05$ level of significance (Table 6).

Hypothesis three stated there was no difference between fallers'/nonfallers' scores on the Tinetti Gait Scale (Tinetti, et al., 1986). This hypothesis was not rejected at the $p>.05$ level of significance (Table 7).

Table 3:

Descriptive Statistics for the Up and Go Test (Scores)

	HISTORY OF FALLS	NO HISTORY OF FALLS
MEAN	26.9929	22.35586
STD. DEV	12.754	12.228
STD. ERROR	2.109	1.095

Table 4:

Descriptive Statistics for the Tinetti Gait Scale (Scores)

	HISTORY OF FALLS	NO HISTORY OF FALLS
MEAN	17.1429	20.5000
STD. DEV	5.581	5.134
STD. ERROR	4.820	2.607

Table 5:

Pearson Product-Moment Correlation of Scores on the Up and Go Test and the Tinetti Gait Scale

SUBJECTS WITH:	CORRELATION
NO HISTORY OF FALLS	- 0.8164
HISTORY OF FALLS	- 0.8577
TOTAL SUBJECTS	- 0.8290

Table 6:

T-Test to Determine Difference Between Fallers'/Nonfallers' Scores on the Up and Go Test

	t VALUE	DF	p VALUE (1-TAIL)
POOLED VARIANCE ESTIMATE	0.86	27	0.198
F VALUE	1.09		

*p>.05

Table 7:

T-Test to Determine Difference Between Fallers'/Nonfallers' Scores on the Tinettti Gait Scale

	t VALUE	DF	p VALUE (1-TAIL)
POOLED VARIANCE ESTIMATE	- 1.48	27	0.076
F VALUE 1.18			

*p>.05

Summary

Hypothesis 1 examined the relationship between scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986) in two groups of elderly with or without a recent history of falls. Results indicated a very high negative correlation between the scores. A low score on one test and high score on other indicate the same conclusion about a subject. The subproblems of analyzing within the history/no history of falls subgroups showed the same correlational findings, with the history of falls subgroup having the strongest relationship of the three.

Hypothesis 2 and 3 focused on the differences in scores between subjects with a history/no history of falls. The results indicated there was no significant difference in the scores on the Up and Go Test (Podsiadlo & Richardson, 1991), while there is a slight, but not significant, difference in scores on the Tinetti Gait Scale (Tinetti, et al., 1986).

CHAPTER V
DISCUSSION AND FUTURE RECOMMENDATIONS

The purpose of this study was to determine if a relationship exists between scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986) in elderly subjects. From the results of the study, there appears to be a high correlation between the two tests. No significant difference was found between subjects with a history of falls and those individuals with no history of falls and their scores on the Up and Go Test (Podsiadlo & Richardson, 1991). A slight, but not significant, difference was indicated between subjects with a history and no history of falls and their scores on the Tinetti Gait Scale (Tinetti, et al., 1986). The following section discusses the results of testing, as well as suggesting future recommendations for future research.

Discussion

While there was found to be a high correlation between the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1991), which was one of the teseted hypotheses, no significant indication was discovered as to the ability of either test to predict falls based on falls history. As will be mentioned later under future research needs, if more study was done on either test's predictability, this research would offer "second

opinion" options for medical officers. If one test was administered and any doubt arose, the other test could be administered easily to verify conclusions.

Both tests still have positive value, though the researcher could not conclude it was in the area of predicting falls. Both tests are quick and easy to administer, and do not require any special equipment. Because the tests replicate common activities of daily living, both instruments could be used by medical officers to determine if an elderly person has the capacity to perform specific necessary daily movements. Further, both instruments could also be used in an exercise program format to work on and improve certain ADLs. The test scores could then be utilized to monitor progress in the program.

Additionally, subjects residing in the Jones Health Center were monitored by Emporia Presbyterian Manor staff in much the same way hospitals monitor patients. This data is extremely relevant in that subjects who in all probability do have difficulty moving about reported no prior history of falls due, in part, to the fact that the residents are assisted in much that they do. The researcher feels, in essence, that these residents do not have a history of falls simply because they are assisted in so much that they do daily. For example, several subjects arrived at the testing site via staff-driven wheelchairs, completed the tests of their own power, then were taken back to their

rooms in the wheelchair.

Hypothesis 2 indicated no significant difference, and hypothesis 3 indicated a slight, but not significant, difference in scores on the Up and Go Test (Podsiadlo & Richardson, 1991) and the Tinetti Gait Scale (Tinetti, et al., 1986), respectively, between fallers and nonfallers. This is not surprising for several reasons. First, the number of subjects with a history of falls (N=7) was considerably lower than the number of subjects with no such history (N=22). Also, four out of the seven subjects who had fallen described falls which, in this researcher's opinion, were not a result of problems with mobility (working in a garden on the side of a hill and misstepping, for example).

The researcher believes further research should include a delineation between spontaneous falls and purposeful falls. Spontaneous falls would be defined as falls occurring for no apparent reason, or, in terms of the elderly, a fall which a younger person could have abrupted or avoided. A purposeful fall would be defined as a fall that could be attributed to some known factor other than declining physical mobility (tripping over an unseen object, for example).

In administering the tests, unexpected obstacles were encountered. With both instruments, a measured distance was marked with a straight, tape line from point to point. A

majority of the subjects attempted to walk "on the line" in at least one portion of the testing, rather than just using the line as a guide.

The researcher also found the "pull test" task on the Tinetti Gait Scale (Tinetti, et al., 1986) uncomfortable to administer. In this test, the tester stood behind the subjects and pulled on their wrist to check for posterior imbalance. Some subjects would raise their arms on the pull and some subjects would turn their body with the pull. It is suggested that the pull from one shoulder would be a better indicator of balance to the rear.

Several subjects also commented on the armless chair used in the Tinetti Gait Scale (Tinetti, et al., 1986). Emporia Presbyterian Manor could not find an armless chair in the building. The researcher had to bring a chair to the testing site. Armless chairs are probably not normal furniture used by the elderly. Hence, the researcher believes the Tinetti Scale (Tinetti, et al., 1986) would prove to be a more reliable instruments if an armed chair was utilized. Also, the use of a 5-lb weight in Tasks 10 and 11 of the balance portion could easily be altered to use a detergent box, for example, to accommodate the look, as well as the feel, of an ADL, while still testing for strength and balance.

Recommendations for Future Research

The following are recommendations for future research.

1. This study was limited in the number of subjects with a history of falls. Further research should be done using more subjects with a history of falls.

2. Further use of this protocol could be done with a group of subjects who are independently living within the community, i.e., in their own home or apartment.

3. Research found for the Review of Literature indicated that certain medications commonly prescribed to the elderly can affect gait. The protocol used in this study could be utilized examining two subgroups of elderly, one subgroup using the certain medications, the other subgroup being a control group.

4. Prior research also indicated that cardiovascular ailments affect and hinder gait. Further testing could involve subgroups of elderly with/without cardiovascular ailments.

5. Correlational testing could be done comparing scores of independently living elderly and those residing within a retirement community.

6. This study could be done longitudinally, over a period of one to five years. Along with readministering the two gait tests, subjects could be asked about any falls, as well as changes in medication. This information would be beneficial since the tests could be reevaluated for

validity, changes in the subjects health, medication status and history of falls.

REFERENCES

Alexander, J. (1992). Fall-related injuries in older adults. American Journal of Public Health, 82, 1020.

Boucher, J. L., Denis, S., & Landriault, J. (1985). Effects of ageing on visuo-motor coordination. Journal of Human Movement Studies, 11(6), 325-337.

Branch, L. G., Guralnik, J. M., Foley, D. J., Kohout, F. J., Wetle, T. T., Ostfeld, A., & Katz, S. (1991). Active life expectancy for 10,000 Caucasian men and women in three communities. Journals of Gerontology, 46(4), M145-M151.

Brown, S., & Cundiff, D. (1988). Exercise, aging and longevity. Health Education, 19(2), 4-7.

Campbell, A. J., Borrie, M. J., Spears, G. F., Jackson, S. L., Brown, J. S., & Fitzgerald, J. L. (1990). Circumstances and consequences of falls experienced by a community population 70 years and over during a prospective study. Age and Ageing, 19(2), 136-141.

Cress, M. E., Thomas, D. P., & Johnson, J. (1991). Effect of training on VO2 max, thigh strength and muscle morphology in septuagenarian women. Medicine and Science in Sports and Exercise, 23(6), 752-758.

Cumming, R. G., Miller, J. P., Kelsey, J. L., Davis, P., Arfken, C. L., Birge, S. J., & Peck, W. A. (1991). Medications and multiple falls in elderly people: the St. Louis OASIS study. Age and Ageing, 20(6), 455-461.

Duncan, P. W., Weiner, D. K., Chandler, J., & Studenski, S. (1990). Functional reach: A new clinical measure of balance. Journals of Gerontology, 45(6), M192-M197.

Dunn, J. E., Rudberg, M. A., Furner, S. E., & Cassel, C. K. (1992). Mortality, disability, and falls in older persons: The role of underlying disease and disability. The American Journal of Public Health, 82(3), 395-400.

Gehlsen, G., & Whaley, M. (1990). Falls in the elderly: Part I, gait; part II, balance, strength, and flexibility. Archives of Physical Medicine and Rehabilitation, 71, 735-741.

Heitmann, H. M. (1982). Older adult physical education: Research implications for instruction. Quest, 34(1), 34-42.

Israel, R., & Caranasos, G. J. (1991). Problems with gait in older persons. Journal of Florida Medical Association, 78(7), 439-441.

Lipsitz, L. A., Jonsson, P. V., Kelley, M. M., & Koestner, J. S. (1991). Causes and correlates of recurrent falls in ambulatory frail elderly. Journal of Gerontology, 46(4), M114-M122.

Maki, B. E., Holliday, P. J., & Topper, A. K. (1991). Fear of falling and postural performance in the elderly. Journal of Gerontology, 46(4), M123-M131.

Mathias, S., Nayak, U. S. L., & Isaacs, B. (1986). Balance in elderly patients: The "get up and go" test. Archives of Physical Medicine and Rehabilitation, 67, 387-389.

Myers, A. H. (1991). Risk factors associated with falls and injuries among elderly institutionalized persons. American Journal of Epidemiology, 133, 1179-1190.

Podsiadlo, D., & Richardson, S. (1991). Basic functional mobility in frail elderly persons. Journal of the American Geriatrics Society, 39, 142.

Rowe, J. W., & Kahn, R. L. (1987). Human aging: Unusual and successful. Science, 237(4811), 143-149.

Smith, E. L., & Gilligan, C. (1983). Physical activity prescription for the older adult. The Physician and Sportsmedicine, 11(8), 92.

Stelmach, G., & Goggin, N. (1988). Psychomotor decline with age. Proceedings of the 61st Annual Meeting of the American Academy of Physical Education, 22, 6-18.

Tinetti, M. E. (1986). Performance-oriented assessment of mobility problems in elderly patients. Journal of the American Geriatrics Society, 34, 119-126.

Tinetti, M. E., & Ginter, S. F. (1988). Identifying mobility dysfunctions in elderly patients: Standard neuromuscular examination or direct assessment? The Journal of the American Medical Association, 259(8), 1190-1193.

Tinetti, M. E., Williams, T. F., & Mayewski, R. (1986). Fall risk index for elderly patients based on number of chronic disabilities. The American Journal of Medicine, 80, 429-434.

Urton, M. M. (1991). A community home inspection approach to preventing falls among the elderly. Public Health Reports, 106(2), 192-195.

Whipple, B. (1987). The relationship of knee and ankle weakness to falls in nursing home residents: An isokinetic study. Journal of the American Geriatrics Society, 35, 13-20.

Woollacott, M., Shumway, A., & Nashner, L. (1986). Aging and posture control: Changes in sensory organization and muscular coordination. International Journal on Aging and Human Development, 23(2), 97-114.

Zylke, J. W. (1990a). As nation grows older, falls become greater source of fear, injury, death. The Journal of the American Medical Association, 263(15), 2021.

Zylke, J. W. (1990b). Research focuses not only where, why, how of falls, but also on preventing them. The Journal of the American Medical Association, 263(15), 2022-2023.

APPENDIX A

APPENDIX A

APPLICATION FOR APPROVAL TO USE HUMAN SUBJECTS

This application should be submitted, along with the Informed Consent Document, to the Institutional Review Board for Treatment of Human Subjects, Research and Grants Center, Campus Box 4048.

1. **Name of Principal Investigator(s) or Responsible Individuals:** Nancy E. House

2. **Departmental Affiliation:** HPER

3. **Person to whom notification should be sent:** Nancy E. House
   Address: Campus Box 4013

4. **Title of Project:** The Relationship Between the Scores on the Up and Go Test and the Tinetti Gait Scale in Elderly Subjects Based on History of Falls.

5. **Funding Agency (if applicable):** N/A

6. **Project Purpose(s):** Based on subjects' past history of falls or no falls, the study is designed to: 1)check validity of the Up and Go Test and the Tinetti Gait Scale in identifying fallers vs nonfallers, and 2)to determine if one test is more accurate than the other.

7. **Describe the proposed subjects: (age, sex, race, or other special characteristics, such as students in a specific class, etc.)** Residents of Emporia Presbyterian Manor, above the age of 75. Must be mobile with or without the use of a cane or walker. Subjects must also have scored above the "severe intellectual impairment" level on the SPMSQ.

8. **Describe how the subjects are to be selected:** volunteers from Emporia Presbyterian Manor

9. **Describe the proposed procedures in the project. Any proposed experimental activities that are included in evaluation, research, development, demonstration, instruction, study, treatments, debriefing, questionnaires, and similar projects must be described here. Copies of questionnaires, survey instruments, or tests should be attached. (Use additional page if necessary.)** See attached testing instruments.

10. **Will questionnaires, tests, or related research instruments not explained in question #9 be used?**
_____Yes _____No (If yes, attach a copy to this application.)

11. **Will electrical of mechanical devices be used? ___Yes ___No (If yes, attach a detailed description of the device(s).)**

12. **Do the benefits of the research outweigh the risks to human subjects? _____Yes _____No This information should be outlined here.** The availability of simple, life-skill mobility tests to predict possible fallers or nonfallers will be tremendously valuable to those working with/for the aged.

13. **Are there any possible emergencies which might arise in utilization of human subjects in this project? _____Yes _____No Details of these emergencies should be provided here.** Subjects may, indeed, lose their balance while being tested. A restorative nurse from Emporia Presbyterian Manor and myself will be present to prevent an actual fall from occurring. Use of a gait belt by all subjects will aid in prevention of falls as well.

14. **What provisions will you take for keeping research data private?** Number identification assigned each subject after master subject list is compiled. Also, testing will be done individually.

15. **Attach a copy of the informed consent document, as it will be used for your subjects.**

STATEMENT OF AGREEMENT: I have acquainted myself with the Federal Regulations and University policy regarding the use of human subjects in research and related activities and will conduct this project in accordance with those requirements. Any changes in procedures will be cleared through the Institutional Review Board for Treatment of Human Subjects.

_____ _____
Signature of Principal Investigator **Date**

_____ _____
Signature of responsible individual (faculty advisor) **Date**

APPENDIX B

EMPORIA STATE UNIVERSITY
1200 COMMERCIAL EMPORIA, KANSAS 66801-5087 316/341-5351 RESEARCH AND GRANTS CENTER - BOX 48

February 23, 1994

Nancy E. House
Division of HPER
Box 13
CAMPUS

Dear Ms. House:

The Institutional Review Board for Treatment of Human Subjects has evaluated your application for approval of human subject research entitled, "The Relationship Between Scores on the Up and Go Test and the Tinetti Gait Scale in Elderly Subjects." The review board approved your application which will allow you to begin your research with subjects as outlined in your application materials.

Best of luck in your proposed research project. If the review board can help you in any other way, don't hesitate to contact us.

Sincerely,

Faye N. Vowell

Faye N. Vowell, Dean
Office of Graduate Studies
and Research

FV:pf

cc: Kathy Ermler

APPENDIX C

INFORMED CONSENT DOCUMENT

AUTHORIZATION FOR CLINICAL INVESTIGATION

I, the undersigned, here authorize **Nancy E. House** to conduct the research study presently identified as:

THESIS PROPOSAL: The Relationship Between the Scores on the Up and Go Test and the Tinetti Gait Scale in Elderly Subjects Based on History of Falls.

I have been informed that this study is investigational. I fully understand the above authorization, the reasons why the study is being conducted, its advantages and possible risks or complications, and I voluntarily consent to the study. I have been given sufficient opportunity to ask any questions I had concerning the procedures and possible risks involved.

I further understand that I am free to withdraw consent and discontinue participating at any time during the testing. I have also been informed that the information derived from this test is confidential, and information from this test not identifiable to me will be used for research purposes.

I release the attending student and Emporia Presbyterian Manor from liability for any results that may occur.

SIGNED:_____
(Resident, or person authorized to consent for resident)

DATE:_____

WITNESS:_____

APPENDIX D

EMPORIA PRESBYTERIAN MANOR

JONES HEALTH CENTER

SHORT PORTABLE MENTAL STATUS QUESTIONNAIRE (SPMSQ)

ASK ALL QUESTIONS AND RECORD ANSWERS. ASK QUESTION #4 ONLY IF THE RESIDENT HAS A TELEPHONE. CHECK CORRECT (+) OR INCORRECT (-) FOR EACH AND RECORD TOTAL NUMBER OF ERRORS BASED ON TEN QUESTIONS.

	+ -	+ -	+ -
1. WHAT IS THE DATE TODAY? (MONTH, DAY, AND YEAR)	___ ___	___ ___	___ ___
2. WHAT DAY OF THE WEEK IS IT?	___	___	___
3. WHAT IS THE NAME OF THIS PLACE?	___	___	___
4. WHAT IS YOUR TELEPHONE #? WHAT IS YOUR STREET ADDRESS?	___ ___	___ ___	___ ___
5. HOW OLD ARE YOU?	___	___	___
6. WHEN WERE YOU BORN? (MONTH, DAY, YEAR)	___	___	___
7. WHO IS THE PRESIDENT OF THE US?	___	___	___
8. WHO WAS THE PRESIDENT BEFORE HIM?	___	___	___
9. WHAT WAS YOUR MOTHERS MAIDEN NAME?	___	___	___

10. SUBTRACT 3 FROM 20 AND KEEP SUBTRACTING 3 FROM EACH NEW NUMBER YOU GET, ALL THE WAY DOWN. (CORRECT ANSWER IS 17, 14, 11, 8, 5, 2)

	INITIAL	FOLLOW-UP	FOLLOW-UP
NUMBER OF ERRORS	_____	_____	_____

INSTRUCTIONS FOR COMPLETING SPMSQ

0-2 ERRORS= INTACT
3-4 ERRORS = MILD INTELLECTUAL IMPAIRMENT
5-7 ERRORS = MODERATE INTELLECTUAL IMPAIRMENT
8-10 ERRORS = SEVERE INTELLECTUAL IMPAIRMENT

ALLOW ONE OR MORE ERROR IF THE SUBJECT HAS ONLY A GRADE SCHOOL EDUCATION. ALLOW ONE FEWER ERROR IF THE SUBJECT HAS HAD EDUCATION BEYOND HIGH SCHOOL.

Revised 10/92 EPM

APPENDIX E

Tinetti Scale

PERFORMANCE-ORIENTED ASSESSMENT OF MOBILITY I

BALANCE

Instructions: Subject is seated in hard armless chair. The following maneuvers are tested.

1. Sitting Balance

   0 = leans or slides in chair
   1 = leans in chair slightly or slight increased distance from buttocks to back of chair
   2 = steady, safe, upright

2. Arising

   0 = unable without help or loses balance
   1 = able but uses arm to help or requires more than two attempts or excessive forward flexion
   2 = able without use of arms in one attempt

3. Immediate standing balance (first five seconds)

   0 = unsteady marked staggering, moves feet, marked trunk sway or grabs object for support
   1 = steady but uses walker or cane or mild staggering but catches self without grabbing object
   2 = steady without walker or cane or other support

4. Side-by-side standing balance

   0 = unsteady
   1 = unsteady, but wide stance (medial heels more than 4" apart) or uses cane, walker or other support
   2 = narrow stance without support

5. Nudge (subject at maximum position with feet as close together as possible, examiner pushes lightly on subject's sternum with palm of hand three times)

   0 = begins to fall
   1 = staggers, grabs, but catches self
   2 = steady

6. Pull test (subject at maximum position as above, examiner stands behind and exerts mild pull back at wrist)

   0 = begins to fall
   1 = staggers, grabs, but catches self
   2 = steady

7. Turn 360°

0 = unsteady (grabs, staggers)
1 = steady but steps discontinuous
2 = steady and steps continuous

8. Able to stand on one leg for five seconds (pick one leg)

0 = unable or holds onto any object
1 = some staggering, swaying or moves foot slightly
2 = able

9. Tandem stand

0 = unable to stand with one foot in front of other or begins to fall
1 = some staggering, swaying, moves arms, or moves foot slightly
2 = able to tandem stand X five seconds

10. Reaching up - Examiner holds 5 lb weight at height of subject's fully extended reach

0 = unable or holds onto any object
1 = some staggering, swaying or moves foot slightly
2 = able

11. Bending over (place 5 lb weight on floor and ask subject to pick it up)

0 = unable or is unsteady
1 = able and is steady

11a. Time required _____seconds

12. Sit down

0 = unsafe (misjudged distance; falls into chair)
1 = uses arms or not a smooth motion
2 = safe, smooth motion

12a. Timed rising

Time required to rise from chair three time _____seconds

GAIT

Instructions: Subject stands with examiner. Walks down 15 foot walkway (measured). Ask subject to walk down walkway, turn and walk back. Subject should use customary walking aid.

1. Initiation of gait (immediately after told to "go")

   0 = any hesitancy or multiple attempts to start
   1 = no hesitancy

2. Path (estimated in relation to line on floor or rug). Observe excursion of one foot over middle 10 feet of course.

   0 = marked deviation
   1 = mild/moderate deviation or uses walking aid
   2 = straight without walking aid

3. Missed step (trip or loss of balance)

   0 = yes and inappropriate attempt to recover balance
   1 = yes, but appropriate attempt to recover
   2 = no

4. Turning (while walking)

   0 = staggers, unsteady
   1 = discontinuous, but no staggering, or uses walker or cane
   2 = steady, continuous without walking aid

5. Timed walk performed after 1-7 complete (measure out 15 foot walkway)

   a) Ask subject to walk at normal pace _____seconds
   b) Ask subject to walk as "fast as feels safe" _____seconds

6. Step over obstacle (to be assessed in a separate walk with a block placed on course)

   0 = begins to fall or unable
   1 = able but uses walking aid or some staggering but catches self
   2 = able and steady

APPENDIX F

UP AND GO TEST

Subject is seated in a standard highback office chair with arms. The task to complete is to get up from the chair, walk forward to a line 3m away, turn around, walk back and return to a seated position.

APPENDIX G

Raw Data from Testing

SUBJECTS	UP AND GO TEST	TINETTI GAIT SCALE
1	26.55 seconds	14 pts
2	23.16 seconds	16 pts
3	40.90 seconds	9 pts
4	26.92 seconds	19 pts
5	16.05 seconds	23 pts
6	45.67 seconds	23 pts
7	9.70 seconds	25 pts
8	33.54 seconds	17 pts
9	10.06 seconds	27 pts
10	42.87 seconds	13 pts
11	11.36 seconds	21 pts
12	11.56 seconds	27 pts
13	31.30 seconds	16 pts
14	8.28 seconds	26 pts
15	18.97 seconds	27 pts
16	23.92 seconds	15 pts
17	36.38 seconds	15 pts
18	8.65 seconds	22 pts
19	16.65 seconds	26 pts
20	24.67 seconds	19 pts

Raw Data from Testing

SUBJECTS	UP AND GO TEST	TINETTI GAIT SCALE
21	53.17 seconds	13 pts
22	14.59 seconds	26 pts
23	29.60 seconds	16 pts
24	18.90 seconds	22 pts
25	19.08 seconds	15 pts
26	21.83 seconds	18 pts
27	34.42 seconds	18 pts
28	9.55 seconds	26 pts
29	12.54 seconds	26 pts

NOTE: First 7 subjects were history of falls group.

APPENDIX H

February 21, 1994

Dear :

My name is Nancy House and I am presently working on my Masters degree in Health, Physical Education and Recreation at Emporia State University. I am writing a thesis on being able to predict falls in the elderly. To complete the thesis, I am doing an experimental study on residents at Emporia Presbyterian Manor.

Each subject will take a Short Portable Mental Status Questionnaire, as well as two testing instruments: 1)the Up and Go Test, and 2)the Tinetti Gait Scale. The Up and Go Test involves starting from a seated position, rising and walking about ten feet, turning and walking back, returning to a seated position. The Tinetti Gait Scale is a little more involved. Subjects will be asked to complete several small tasks while I observe their body mechanics in motion. Examples of tasks include sitting down, arising from a chair, reaching for an object above their head, turning around.

For safety precautions, subjects will wear a gait belt at all times during the study. A gait belt is a securely fitting belt that goes around the waist and has loops or grips for "spotters" to grab onto in the case of imbalance.

Additionally, there will be a restorative nurse or the Nursing Director of Emporia Presbyterian Manor assisting me at all times during the study.

_____ has been informed about the testing procedures, and the attached consent form must be returned before he/she can be a subject. If you have any questions or concerns about my study, please don't hesitate to contact me. I will be glad to speak with you regarding this matter.

Thank you in advance for your help.

Sincerely,

Nancy E. House
Graduate Assistant
Emporia State Univ.
342-0492 h
341-5354 w

APPENDIX I

I, **NANCY ELISABETH GRAY**, hereby submit this thesis/report to Emporia State University as partial fulfillment of the requirements for an advanced degree. I agree that the Library of the University may make it available for use in accordance with its regulations governing materials of this type. I further agree that quoting, photocopying, or other reproduction of this document is allowed for private study, scholarship (including teaching) and research purposes of a nonprofit nature. No copying which involves potential financial gain will be allowed without written permission of the author.

Nancy E. Gray
Signature of Author

12-8-94
Date

THE RELATIONSHIP BETWEEN THE SCORES ON THE UP AND GO TEST AND THE TINETTI GAIT SCALE IN TWO GROUPS OF ELDERLY

Title of Thesis

Mary Cooper
Signature of Graduate Office Staff Member

12-8-1994
Date Received