INTRODUCTION AND REVIEW OF LITERATURE

Aging

The population of America is "graying," posing an interesting situation in the field of public health. In contrast to the beginning of the 20th century, when only 4% of the American population was over the age of 65, senior citizens currently comprise over 12% of the population (approximately 35 million people). The proportion of the population aged 65+ is projected to increase from 12.4% in 2000 (35 million) to 19.6% in 2030 (71 million). Additionally, the number of individuals aged 80 years and above will increase from 9.3 million in 2000 to as much as 19.5 million in 2030 (U.S.Census Bureau, 2003). The United States is not alone in this regard; the worldwide population of those aged 65+ increased an estimated 9.5 million from 410.5 million in 1999 to 420 million in 2000. Furthermore, from 2000 to 2030, the worldwide population of those aged 65+ years is projected to increase by approximately 550 million to reach 973 million, an increase from 6.9% to 12.0% (CDC, 2003b).

According to the National Center for Health Statistics, life expectancy has increased dramatically for both sexes. In fact, male life expectancy has increased 25 years since 1900 to 72.5 years. Women have experienced an even greater increase to a life expectancy of 78.9 years, 30 years longer than the life expectancy of 1900 (CDC, 2003a).

Functional Impairment and Disability

The implications of these changing demographics have triggered healthcare challenges. While an increased life expectancy reflects the success of public health

interventions, there are resulting challenges that must be dealt with. More people are suffering from chronic diseases, which lead to the possibility of long-term disability and loss of independence (Guralnik, Fried, & Salive, 1996). In the United States, approximately 80% of all persons aged 65 years or older have at least one chronic condition, such as arthritis, hypertension, hearing loss, heart problems, or diabetes, and 50% of these individuals have at least two chronic conditions (King, 1991). Estimates also suggest that approximately 42% of the elderly suffer some functional limitations (Katz, 1983). Based on one of the largest national prevalence surveys of disability, 16% of those aged 65 years and older have difficulty with mobility-related activities, and 12% have difficulty with basic activities of daily living (ADLs) (Guralnik et al., 1996). Unfortunately, the prevalence of functional limitations and disability is expected to continue growing. Estimates from the National Health Interview Survey show that the percentage of older adults with ADL and IADL disabilities will rise to more than 30% over the next two decades, with the greatest increase among those aged 85 years and older (Ostir et al., 1999).

A distinction must be made between functional limitations and disabilities. Functional limitations are restrictions in performing fundamental physical activities. These include activities such as difficulty ambulating or climbing stairs. Disabilities, on the other hand, are functional limitations placed in a social context. Disability has also been defined as the gap between an older individual's ability to perform a task and the demands imposed by that task (Verbrugge, 1990). A widened gap typically results in an increased difficulty in performing day-to-day tasks, in the inability to maintain self-sufficiency, and, ultimately, in a loss of independence (Ostir et al., 1999). Basic ADLs

like sitting down in or getting up from a chair and instrumental activities of daily living (IADLs) such as shopping or performing housework are all examples of disabilities (Miller, Rejeski, Reboussin, Ten Have, & Ettinger, 2000).

The functional status of older adults is primarily linked to their underlying chronic disease status and to physiological changes associated with aging (Fried & Guralnik, 1997; Dunlop, Manheim, Sohn, Liu, & Chang, 2002). In the Established Populations for Epidemiologic Studies of the Elderly (EPESE), intact mobility was defined as the ability to walk a half-mile and climb stairs without assistance. The EPESE showed that, of those individuals aged 65 and older with intact mobility, 36% lost their mobility over the following four years. It was also estimated that the likelihood that these individuals would lose mobility altogether increased two-fold with each 10-year increase in age after 65 (Guralnik et al., 1993).

The functional limitations and chronic conditions associated with aging pose the potential for increased healthcare costs. Disability is a major cause of nursing home institutionalization and hospitalization of elderly adults. Americans aged 65 and older currently account for 30% of healthcare expenditures in this country, with their medical costs exceeding 50 billion dollars annually (King, 1991). The healthcare cost per capita for persons over the age of 65 is three to five times greater than the cost for persons under the age of 65. Because of the continual growth of the number of older individuals and because of medical technology advances, healthcare expenses will rise as the population ages (CDC, 2003b). Furthermore, the healthcare system must increase longevity without decreasing quality of life (i.e., by preventing an increase in the number of years spent in a disabled or dependent state).

The normal process of aging will inevitably result in a decline in physical abilities. In addition to the physiological changes that occur, a progressive decline in one's level of physical activity generally accompanies aging. Some activities are curtailed voluntarily, whereas others may become too difficult due to functional limitations. Reducing normal activities alone could lead to disability resulting from disuse, muscle atrophy, loss of flexibility, and diminished endurance (Vorhies & Riley, 1993). This disuse disability becomes perpetual, setting up further reductions in activity and leading to a vicious cycle of disuse and declining function (Carlson et al., 1999). Researchers have documented the association between one's lifestyle behaviors and the risk of functional limitations and disability (Simonsick et al., 1993; van den Hombergh, Schouten, van Staveren, van Amelsvoort, & Kok, 1995; Mor et al., 1989). Mor and colleagues (1989) examined healthy older adults between 70 and 74 years of age and found that those who were inactive or walked less than a mile once a week were 1.5 times more likely to decline in function over the next 2 years as compared to those who reported regular exercise. This suggests that an active lifestyle has the potential to delay the onset of functional consequences of chronic disease and aging, producing a gain in one's "active life expectancy" (Katz et al., 1983).

Functional Declines with Age: Cardiovascular, Flexibility, Balance, and Strength

As previously mentioned, physical disability is also related to age-associated changes that may be indicators of frailty. This includes evidence that decreases in aerobic capacity, flexibility, balance, and strength are risk factors for disability. The following sections of this review will focus on these various areas of aging decline.

Aging and Cardiovascular Function

Cardiovascular endurance, determined by the maximal oxygen uptake (VO_2max) attained during exercise, is an index of an individual's capacity for movement. VO_2max declines at a rate of 0.8% - 1.0% each year from 25 to 65 years of age, which is equivalent to about 5 ml/kg/min per decade. Thereafter, an accelerated decline may occur (Buskirk & Hodgson, 1987; Lacour, Kostka, & Bonnefoy, 2002). VO_2max has been found to be 40-41% lower in older sedentary subjects compared to younger sedentary subjects, while trained older adults can reduce this gap to 25% (Ogawa et al., 1992).

In examining the decline in VO_2max experienced by aging adults, it is difficult to ascertain how much of this loss is inevitable and how much of the decline is the result of a progressive decrease of habitual physical activity. The loss of cardiovascular function results in some functional consequences. Depending on the nature of the task and the working environment, sustained exercise is fatiguing if it demands more than 33-50% of the person's maximal oxygen uptake. Thus, the aging of the oxygen transport system progressively restricts the ability of the aged to undertake normal ADLs, such as walking up stairs or performing household chores. Full independence requires a peak oxygen transport of approximately 12-14 ml/kg/min, and many seniors drop below this threshold around 80 years of age (Shepard, 1991).

One reason for the decrease of VO_2max with age is the reduction of enzymatic activity associated with aerobic energy production (Kirkendall & Garrett, Jr., 1998). Other cardiovascular changes that accompany the normal aging process include prolongation of excitation-contraction and relaxation, increased afterload, increased

vascular and myocardial stiffness, and decreased catecholamine sensitivity (Lakatta & Yin, 1982; Lakatta, Mitchell, Pomerance, & Rowe, 1987).

Some structural and functional changes can occur in older hearts as a response to exercise. A relatively constant level of regular vigorous exercise can potentially reduce the rate of age-related decrease in VO_2max by approximately one-half to ~5% per decade (Rogers, Hagberg, Martin, III, Ehsani, & Holloszy, 1990). Therefore, training can reduce the rate in age-related VO_2max decline, increase capillarization, and boost aerobic enzyme activity (Kirkendall et al., 1998). However, some aspects of normal aging are unaltered by exercise training. According to a study by Douglas and O'Toole (1992), systolic blood pressure, posterior wall thickness, and relative wall thickness increased in older adults, regardless of activity level, and this is attributed to the aforementioned cardiovascular changes .

Aging and Flexibility

By 70 years of age, the flexibility of a sedentary individual declines, on average, 20 – 30%. The elasticity of tendons, ligaments, and joint capsules decreases as cross-linkages develop between adjacent fibrils of collagen. Over the working life, adults lose approximately 8-10 cm of lower back and hip flexibility, as measured by the "sit-and-reach" test. This could, in time, threaten one's independence, impairing activities such as dressing, combing hair, stooping, bending, or climbing stairs (Shepard, 1990). Although flexibility as a specific intervention has rarely been studied, several supervised exercise programs for the elderly have incorporated flexibility training (Morey et al., 1991; Judge, Lindsey, Underwood, & Winsemius, 1993).

Aging and Balance and the Risk of Falls

Balance has been defined as the ability to control upright posture in a variety of conditions (Berg & Norman, 1996). Normal balance is necessary for performing many ADLs, and impaired balance that occurs with age often leads to falls. Approximately 30% of people over the age of 65 fall at least once each year, and half of these individuals fall on multiple occasions each year (Sattin, 1992). Falls have the potential to lead to more serious functional decline and are the leading cause of unintentional-injury deaths for individuals over the age of 79 years (Larsson & Ramamurthy, 2000). Falls and fall-related injuries in old age involve impairments in the neuromuscular, peripheral, and central nervous systems. Somatosensory function has a strong connection with posture, and decrements in somatosensation, vision, and vestibular function can negatively impact postural balance (Nevitt, Cummings, & Hudes, 1991).

Reductions in physical activity pose a problem with bone mass, muscle strength, muscle power, and postural stability. The combination of loss of muscle strength and bone mass decline has been associated with increased falls and the incidence of hip fracture (Nevitt et al., 1991). Several components of strength are associated with the occurrence of falls. According to a study by Wolfson and colleagues (1995), lower extremity strength is a fundamental component of mobility, and when strength declines below a critical threshold required for mobility-related activities, the risk of falls becomes very prominent. In this study, subjects classified as "fallers" had lower strength levels in various lower extremities and also lacked the muscle synergies needed to effectively deliver counter-forces to neutralize backward displacement and prevent a fall.

Physical activity has a positive effect upon balance. In a study on older women, Lord and colleagues (1993) discovered that those women who exercised performed significantly better on tests of strength, reaction time, and sway compared to non-exercisers. In particular, improved lower body strength (ankle dorsiflexion, hip abduction, knee extension, and plantar dorsiflexion) provides some reduction in fall risk (Shaw & Snow, 1998). More recently, in comparison to mere resistance, endurance, or balance training, Tai Chi has become known as an effective therapy for fall prevention in the elderly. By combining elements of strengthening, balance, postural alignment, and concentration, Tai Chi addresses the main components of fall prevention (Wu, 2002).

Sarcopenia

Sarcopenia, a Greek term coined by Rosenberg (1989) to literally mean "poverty of flesh," describes the decline in muscle mass and strength that occurs with healthy aging. Beginning as early as 25 years of age, a progressive reduction in muscle volume occurs with increasing age, resulting in a loss of approximately 10% of muscle area by age 50. Thereafter, the reduction accelerates, and 30 years later, nearly half of the muscle area is essentially wasted (Lexell, Taylor, & Sjostrom, 1988). In terms of strength decreases, it appears that healthy men and women in their 60's and 70's exhibit, on average, 20-40% less strength. These losses can extend to 50% or more in the very old. This equals a decline in strength of approximately 1.0-1.5% per year (Vandervoort, 2002; Doherty, 2003).

Sarcopenia has been defined as a muscle mass greater than 2 standard deviations below the mean of a healthy young reference group (Baumgartner et al., 1998). The New

Mexico Elder Health Survey documented a linear decline in skeletal muscle mass in men and women, and the prevalence of sarcopenia by the above definition increased from 13 – 24% in persons aged 65 to 70 years to over 50% in persons over 80 years of age (Baumgartner et al., 1998). Similarly, Iannuzzi-Sucich and colleagues (2002) performed a recent study and found an overall prevalence of sarcopenia of 22.6% in women and 26.8% in men, with values climbing to 31 and 45%, respectively, for women and men over 80 years of age.

Declining muscle mass has been documented, but the quality of lean body mass, defined by Kehayias and colleagues (1997) as the ratio of cell mass to lean mass, also declines with age. Thus, both quantitative and qualitative changes in lean body mass occur with age. Multiple, interrelated factors contribute to the development and progression of sarcopenia. Each contributes in varying degrees to the age-related losses of muscle mass, strength, muscle quality, and the degree of functional impairment and reserve present in older adults. The causes and consequences of the age-related loss in muscle mass are only partly understood (Roubenoff & Hughes, 2000; Doherty, 2003).

Studies have shown that the overall cross-sectional area of muscle declines with age, indicating some age-related changes in muscle fiber distribution. Cross-sectional area measurements taken from whole muscle show average reductions of 40% for subjects between 20 and 80 years of age (Lexell et al., 1988), with preferential decreases in muscle mass in the lower body (Janssen, Heymsfield, Wang, & Ross, 2000). Aging atrophy seems to be due to both a loss of and a reduction in the size of muscle fibers. In particular, the average type II fiber size diminishes with age, whereas the size of type I fibers is much less affected. Reductions in type II area range from 20 to 50%, while type

I fiber area losses range from 1 to 25% (Lexell et al., 1988; Doherty, Vandervoort, Taylor, & Brown, 1993). As a result, the muscle mass of the elderly is smaller, has a higher proportion of type I fibers, and is weaker because of the loss of type II fibers. This leads to a loss of total force production due to muscle mass decline (Kirkendall et al., 1998).

It has been suggested that α-motor neuron loss in the central nervous system may be largely responsible for the age-related loss of muscle mass (Doherty et al., 1993). The motor unit is the final pathway for movement generation; with aging, motor units undergo a process of reduction and adaptation, which in turn affects the capacity to produce forces on the joints (Vandervoort, 2002). Studies show that motor neurons and motor units are well maintained until the seventh decade and then begin to decline precipitously thereafter (Brown, Strong, & Snow, 1988). There are data that suggest that, by age 60, the loss of motor units is on the order of nearly 50%, with the greatest loss among the largest and fastest motor units (type II). This loss is a likely cause of reductions in contractile force demonstrated in older individuals (Doherty et al., 1993).

Anabolic hormones, such as growth hormone, testosterone, and estrogen, are reduced with age, and the withdrawal of their trophic effects may lead to muscle atrophy and sarcopenia. Growth hormone begins to decline in the fourth decade; however, it is not clear that this deficiency is an important cause of sarcopenia. Mean serum testosterone levels decline by about 30% between the ages of 25 and 75 years, and free testosterone levels decline by up to 50% (Roubenoff et al., 2000). A decline in lean body mass and a gain in fat mass occur in women experiencing menopause, which raises the question of whether menopause (and a loss of estrogen) accelerates the loss of muscle mass (Poehlman, Toth, & Gardner, 1995). It has been suggested that the loss of these

hormones with age could have both direct and indirect catabolic effects on muscle (Roubenoff et al., 2000).

Finally, physical inactivity is a significant contributing factor to age-related sarcopenia. Older men and women who are less physically active have less skeletal muscle mass and an increased prevalence of disability (Roubenoff et al., 2000; Vandervoort, 2002; Janssen, Heymsfield, & Ross, 2002). The benefits of physical activity upon muscle mass and strength will be discussed in greater detail in subsequent sections of this review.

Impact of Sarcopenia

Loss of muscle mass below a critical threshold may lead to functional impairment and physical disability. The well-recognized consequences of sarcopenia are those related to its effects on function, including gait and balance problems, increased fall risk, and loss of functional independence. There is also an increased risk of chronic diseases such as diabetes and osteoporosis. Advanced muscle loss may affect quality of life, the need for supportive services, and, ultimately, the need for long-term care in older individuals (Baumgartner et al., 1998; Janssen et al., 2002). Healthcare expenses are also affected by sarcopenia. An estimated $18.5 billion was estimated in 2000 to be the direct healthcare cost attributable to sarcopenia in the United States, representing about 1.5% of total healthcare expenditures for that year (Janssen, Shepard, Katzmarzyk, & Roubenoff, 2004).

The relationship between declining strength and function has been established for individuals of all ages with muscle weakness. It is well documented that the reductions

in strength occurring with age, particularly of the lower extremities, have negative consequences on walking speed, rising from a chair, climbing stairs, and other aspects of physical performance. This is particularly true if the age-related decline in strength is exaggerated by inactivity or a debilitating disease (Bassey, Bendall, & Pearson, 1988; Mor et al., 1989; Al-Abdulwahab, 1999). As people become weaker, either because of disease or age-related muscle loss, the amount of effort required for daily tasks increases. Weakness, in turn, leads to further disuse, as people avoid activities that are uncomfortable (Roubenoff, 2000).

The New Mexico Elder Health Survey provides researchers with an idea of the relationship between sarcopenia and functional status. Compared to study participants with normal muscle mass, men and women with sarcopenia were found to have 4.1 and 3.6 times higher rates of disability, respectively. In addition to disability, there was a significantly greater risk of the use of a cane or walker and a history of falling (Baumgartner et al., 1998). Consistent with these findings, Melton and colleagues reported that sarcopenia was associated with difficulty walking in older men and an increase in fractures in older women (Melton, III et al., 2000).

Although studies have demonstrated an association between lower extremity strength and physical performance capacity, a dose-response relationship between strength and function has not been well established. It makes intuitive sense that muscle strength and functional abilities are related; however, one must be cautious about assuming a direct and causative relationship. More interventions are necessary to better establish this relationship (Doherty, 2003).

Effect of Training on Sarcopenia and Function

Much of the weakness caused by sarcopenia can be reversed with strength training; so far, no other intervention has proven to be as efficacious in doing so. Physical activity is one of the few factors within the control of nearly everyone, and pharmacological treatment is not required in order for it to be successful (Roubenoff et al., 2000). Unfortunately, current data indicate that less than 10% of the older population participates in regular strength training (Seguin & Nelson, 2003). Muscular strength has been shown to increase between 60 and 100% of the one repetition maximum in response to training (Kamel, 2003). Positive results were observed in the first high-intensity strength training study in older adults conducted by Frontera and colleagues (1988). Striking improvements were reported in leg muscle strength and muscle fiber sizes from this 12-week training program in older men. The increases in strength averaged approximately 5% per session, similar to strength gains observed in younger men. The strength increases averaged 107% in the knee extensors and 227% in the knee flexors, and total muscle area, estimated by computerized tomography, increased by 11.4%.

Fiatarone and colleagues (1990) showed that it is never too late for strength training, implementing a progressive resistance training program with frail elderly nursing home patients in their 90s. After 8 weeks, the absolute amount of weight lifted improved nearly 175%, and the cross-sectional area of the thigh muscle increased by an average of 10%. In addition, mean tandem gait speed improved 48% after training. This combined increase in muscle strength, mass, and walking speed has multiple implications for reducing physiologic and functional impairment as well as decreasing the risk for falls and fractures.

A reduced rate of contractile protein synthesis appears to be one cause of muscle protein wasting in the elderly. Evidence shows that strength training results in increased protein synthesis as well as hypertrophy of the muscles and muscle fibers. Typically, however, the strength increments resulting from high-intensity resistance training have been much larger than the muscle hypertrophy response. This leads one to believe that much of the adaptations to strength training are due to neural responses (Porter, 2001). Previous research has led to the belief that, especially in the early phases of resistance training, strength gains are due to improved neuromuscular recruitment, while later gains are associated with muscle hypertrophy (Moritani & deVries, 1979; Frontera et al., 2003). Moritani and deVries (1980) reported that, based on electromyogram (EMG) analysis, the contribution of neural factors to increased muscle strength was about 90%. Expressing strength per unit of the trained muscle mass, known as muscle quality, provides an estimate of the contribution of muscle hypertrophy and neuromuscular factors to changes in strength (Moritani et al., 1979). Researchers have found an increase in muscle quality due to a short-term strength-training program in older men and women (Tracy et al., 1999).

Numerous resistance-training studies have successfully shown gains in muscle mass and strength, yet understanding the relationship between such gains and functional outcomes is an even more important factor. A systematic review of progressive resistance training in older adults revealed that resistance training does in fact increase strength and has a positive effect on several important functional limitations in older individuals (Latham, Bennett, Stretton, & Anderson, 2004). Fiatarone et al. (1994) studied the effect of progressive resistance exercise and /or nutritional supplementation

on muscular strength and function in 100 frail nursing home residents over a 10-week period. Muscular strength increased by 113%, gait velocity by 12%, and stair-climbing power by 28% in the group that received exercise training. Examining the relationship between strength and risk of falls, the study by Campbell and colleagues (1999) in New Zealand demonstrated that strength training at home in near frail women (aged $\geq$ 80 years) resulted in 31% fewer falls.

The effect of resistance training on functional abilities is dependent on the health status of subjects and their functional limitations at baseline. This is demonstrated by Skelton and colleagues (1995), who implemented a 12-week strength training program in healthy women aged $\geq$ 75 years. There were significant improvements in knee extensor muscle strength (27%), yet the program did not affect functional tests. On the other hand, a recent investigation by Nelson et al. (2003) demonstrated significant improvements in physical function following 6 months of home-based strength and balance training in elderly subjects reporting functional impairment prior to the study. The exercise group experienced a 26% improvement in physical function.

Favorable changes can be seen in the performance of basic activities of daily living, such as mobility and balance, as a result of resistance training. Stair climb time was decreased by 11% and balance time was increased by 26% as a result of 14 weeks of strength training by Nichols and colleagues (1995). Subjects with the lowest baseline scores made marked improvements in function reinforcing the notion that greater improvements are seen in sedentary individuals and those who are frail than healthy, fit individuals.

Empowerment

While the training studies mentioned have shown physiological and functional improvement with strength training, these programs lack certain components that would create a truly powerful effect on the lives of older individuals (Rejeski & Focht, 2002a). For older adults, even in the absence of a quality lifestyle, attitude often determines life satisfaction. Unfortunately, attitudes and stereotypes toward older persons are often negative, and these negative societal perceptions become internalized. These attitudes, combined with frequent losses (i.e., job, spouse, home), contribute to lowered self-esteem among older individuals as well as to an increasingly external locus of control and lack of self-efficacy. Efficacy expectations are important to one's actions (Bandura, 1997); therefore, older persons may need help in finding a sense of control over their lives and in realizing the strengths and competencies that they possess. This is an underlying assumption of the process of empowerment (Myers, 1991).

The power needs of individuals are met when they perceive that they can effectively cope with events, situations, and/or the people they confront. Conversely, the power needs of individuals are frustrated when individuals feel powerless or when they feel unable to cope with the physical and social demands of the environment. In this context, power may refer to an intrinsic need for self-determination or a belief in personal self-efficacy (Conger & Kanungo, 1988).

The term empowerment has appeared with increasing frequency in the literature over the past decade, yet ambiguity surrounds its definition. Dictionaries commonly cite two definitions of empowerment. In contrast to the earlier definition of empowerment as giving, investing, or granting power or authority to others, the second refers to

empowerment as enabling others. Enabling implies the creation of conditions for heightened task accomplishment motivation through the development of a strong sense of personal efficacy. Individuals are enabled to strengthen their skills and resources to gain power over their lives (Swift & Levin, 1987; Conger et al., 1988). People are empowered when they discover and develop their inherent capacity to be responsible for their lives, and this occurs when one has the knowledge, skills, attitudes, and self-awareness necessary to influence one's own behavior and that of others to improve the quality of one's life (Funnell et al., 1991).

In a broad sense, empowerment is a process by which people gain mastery over their lives (Rappaport, 1987). However, it has been suggested that empowerment takes on different forms in different people and contexts and is, therefore, hard to define and measure. It is a multilevel construct that exists at the level of the individual, organization, and community (Rappaport, 1987; Israel, Checkoway, Schulz, & Zimmerman, 1994; Zimmerman, 2000). An overly individualistic conception of empowerment may limit our understanding of the construct because, although psychological empowerment is primarily an individual level of analysis, it is embedded in participation in one's sociopolitical context (Rappaport, 1987; Zimmerman & Rappaport, 1988; Mcwhirter, 1991; Wallerstein, 1992; Zimmerman, 1990; Zimmerman, 2000). According to Zimmerman and Rappaport (1988), psychological empowerment may be generally described as "the connection between a sense of personal competence, a desire for, and a willingness to take action, in the public domain." Israel and colleagues (1994) argue that it is possible to develop a program aimed at individual empowerment. However, if this program fails to consider the context in which the individual is embedded (such as the

organization or community), then there is less likelihood that actual increases in control or improvement in health and quality of life will occur.

Empowerment at the individual level of analysis may be referred to as psychological empowerment (Zimmerman et al., 1988; Zimmerman, 1990). Dimensions of psychological empowerment include intrapersonal, interactional, and behavioral components. The intrapersonal component refers to one's perceptions and includes domain-specific perceived control and self-efficacy, motivation to control, and mastery. This component includes personality, cognitive, and motivational aspects of perceived control. The interactional component provides the bridge between perceived control and taking action to exert control, encompassing how people think about and relate to their social environment. The behavioral component then refers to actions taken to directly influence outcomes in one's environment (Zimmerman, 1995). A greater emphasis will be placed on the individual level of psychological empowerment, particularly in terms of the intrapersonal component, because it is the foundation for empowerment at other levels of analysis.

The development of qualities such as positive self-esteem, perceived competence, self-efficacy, an internal locus of control, personal satisfaction, a sense of connectedness, and an improved quality of life facilitate empowerment at the personal level (Conger et al., 1988; Gibson, 1991). When an individual becomes empowered, he or she becomes proactive and takes personal responsibility in improving his/her life situation and well-being (Wallerstein & Bernstein, 1988; Gutierrez, 1990).

Desire

In Zimmerman and Rappaport's (1988) definition of empowerment, one's desire for personal competence is an item of interest. Little research has been conducted on this construct, but it refers to the value that one places upon a particular item or behavior. Both Rotter (1954) and Bandura (1986) have found that values and incentives can be important determinants of one's behavior. When the value that one associates with a particular behavior is high, there is more motivation to perform the behavior. However, if there is little incentive value for a behavior, an individual is more apt to give up on the behavior. Further research on the concept of desire is warranted.

Self-Efficacy

Empowerment and self-efficacy are closely related constructs. Self-efficacy is the belief that one can effectively perform a given behavior (Bandura, 1986). Empowerment approaches achieve their effects by equipping people with the required knowledge, skills, and resilient self-beliefs of efficacy to alter aspects of their lives over which they can exercise some control (Ozer & Bandura, 1990). Methods of empowerment operate through the self-efficacy mechanism because a sense of competency and efficacy is the anticipated outcome of the empowerment educational process (Pellino et al., 1998).

According to Bandura's Self-Efficacy Theory (1977; 1986), an individual's motivation to increase his or her effort in a given task is dependent on two types of expectations: (a) that his/her effort will result in a desired level of performance (self-efficacy expectation) and (b) that his/her performance will produce desired outcomes (outcome expectation). When individuals are empowered, personal efficacy expectations

are strengthened, while outcome expectations may not necessarily be affected. These empowered individuals develop a sense of personal mastery or a "can do" attitude (Conger et al., 1988). However, the relationship between self-efficacy judgments and behavior may be stronger for those who hold the general belief that there is a relationship between their behavior and their health. Behavior depends on both outcome and efficacy expectations (Kaplan, Atkins, & Reinsch, 1984).

Expectations of personal efficacy are influenced by four major sources: performance accomplishments, vicarious experience, social or verbal persuasion, and physiological arousal (Bandura, 1977; 1986). Of these, performance accomplishments, or mastery experiences, have been found to have the most potent influence on efficacy expectations. Successful experiences make one feel more capable while failures undermine a sense of personal efficacy (Conger et al., 1988).

A second source of efficacy development is by way of vicarious experience, or social modeling, which involves an individual observing someone similar to him- or her-self performing certain activities. In addition, while empowering individuals, words of encouragement and other forms of social persuasion are often used. According to Bandura (1986),

> People who are persuaded verbally that they possess the capabilities to master given tasks are likely to mobilize greater sustained effort than if they harbor self-doubts and dwell on personal deficiencies when difficulties arise.

Empowering means "to enable," so even under conditions of failure to gain desired outcomes, individuals may feel empowered if their efficacy belief is reinforced by their leader's recognition of their performance (Conger et al., 1988).

Finally, individuals' feelings of competence are influenced by their perceptions of their emotional and physiological arousal state. Individuals feel more competent when they are not experiencing strong aversive arousal. Therefore, empowerment techniques providing emotional support and a supportive and trusting group atmosphere and an understanding that certain physiologic changes or effects are normal may be valuable in strengthening self-efficacy beliefs (Conger et al., 1988).

Perceptions of personal efficacy influence the types of activities people choose to engage in, the level of effort they expend, their perseverance in the face of difficulties, and the thought patterns and emotional reactions they experience. Subjects with weaker efficacy beliefs tend to limit their range of activities and put forth less effort with less perseverance (Bandura, 1986). This pattern of avoidance and lack of perseverance will lead to less experience with successful performances. Consequently, this could contribute to a greater likelihood of perceiving oneself as being unable to perform such behaviors, and ultimately result in self-reported declines in functional abilities (Mendes de Leon, Seeman, Baker, Richardson, & Tinetti, 1996; Seeman, Unger, McAvay, & Mendes de Leon, 1999).

Self-Efficacy Enhancement

It has been well documented that physical activity influences self-efficacy (Ewart, Taylor, Reese, & DeBusk, 1983; Atkins, Kaplan, Timms, Reinsch, & Lofback, 1984;

McAuley, Courneya, & Lettunich, 1991; Stewart, Kelemen, & Ewart, 1994). Self-efficacy can act as both a determinant and a consequence of physical activity participation (McAuley & Blissmer, 2000; McAuley, Pena, & Jerome, 2001). Self-efficacy may operate as a motivator during exercise, with greater efficacy beliefs leading to an enhanced effort, regardless of whether exercise performance exceeds or fails to meet set goals (Bandura & Cervone, 1983). Both acute bouts and long-term participation in exercise can result in significant increases in self-efficacy (McAuley et al., 1991; McAuley, Bane, & Mihalko, 1995). In most cases, the exercise stimulus serves as a mastery experience, therefore enhancing perceptions of physical self-efficacy (McAuley et al., 2001).

Most studies that have examined the effect of exercise on psychological well-being have employed aerobic activities, with relatively few focusing on resistance training. However, according to Tucker and Maxwell (1992), "weight training may be superior to aerobic activity for improving psychological health because of the noticeable physical changes which tend to result from regular training." The training environment contains many opportunities for positive feedback as observable physique improvements and strength gains reward participants psychologically as well as physically. Unfortunately, despite the potential benefits of strength training on various health variables for the elderly, it has often been underestimated or ignored in community-setting exercise programming for older adults.

Stewart and colleagues (1988) performed a three-year intervention study on the psychological effects of strength training in male cardiac patients. All subjects performed aerobic exercise, but one group engaged in strength training as well. Results

showed that only subjects who performed strength training reported significant increases in physical self-efficacy for arm and leg activities. Ewart (1989) also reported that a 10-week combined strength training and aerobic exercise program significantly increased arm and leg self-efficacy. Other strength training studies have resulted in significant improvements in self-efficacy, mood states, and overall perceptions of physical and emotional well-being for older individuals (Beniamini, Rubenstein, Zaichkowsky, & Crim, 1997; Tsutsumi, Don, Zaichkowsky, & Delizonna, 1997). Perhaps as participants become cognizant of the increasing weight they can lift, they experience greater physical efficacy.

Self-Efficacy Theory indicates that human actions and adoption of new or difficult behavior patterns are guided by highly specific estimates of personal capabilities, rather than by more global perceptions of competence. A "micro-analytic" measurement strategy is warranted (Bandura, 1977; 1986). Ewart and colleagues (1986) evaluated the specificity hypothesis of self-efficacy by undergoing a study of circuit weight training with cardiac patients. Results supported the theory's assumptions in that the group receiving weight training increased their self-perceived ability to perform tasks demanding significant arm or leg strength yet did not have corresponding gains in self-perceived ability to walk or jog.

Changes in self-efficacy may not depend solely on the physiological improvements obtained through physical activity (McAuley, 1994; Stewart et al., 1994; Oka et al., 2000). The exercise environment, notably the exercise instructor, may play a role in the enhancement of efficacy cognitions. Instructors may provide social modeling and verbal persuasion, which influence an individual's perceptions of efficacy (McAuley

& Jacobson, 1991). Researchers have manipulated exercise environments in order to examine their effects on one's perceptions. Turner, Rejeski, and Brawley (1997) manipulated leadership behavior to create either a socially enriched or bland training environment. As hypothesized, self-efficacy increased to a significantly greater degree in the socially enriched environment. McAuley, Talbot, and Martinez (1999) found similar results. These studies lend support to the theory that variables determining psychosocial benefits from physical activity are not exclusively physiological. Perceived improvements, with or without actual physiological improvements, have succeeded in eliciting beneficial psychological responses from physical activity programs.

Self-efficacy and Affect

Efficacy cognitions not only influence how people behave but are also determinants of affective reactions to tasks that challenge personal skills or capabilities. Exercise is often identified as having positive, uplifting, and energizing effects, and one's perceptions of personal capabilities play a mediating role in the effect that exercise plays on affect (Stewart et al., 1994; McAuley, Shaffer, & Rudolph, 1995; Mihalko, McAuley, & Bane, 1996; McAuley, Talbot, & Martinez, 1999). This supports Bandura's social cognitive perspective that efficacy cognitions influence how individuals respond affectively and these responses, in turn, play a role in shaping subsequent perceptions of capabilities (Bandura, 1986; 1997).

Self-Esteem

While self-efficacy enhancement is of prime importance to the process of empowerment, self-esteem also contributes to the overall effect. In short, self-esteem is a

"personal judgment of worthiness that is expressed in the attitudes the individual holds toward himself" (Coopersmith, 1967). Self-esteem, a quiet confidence and acceptance of one's own worth regardless of shortcomings or deficiencies (Rosenberg, 1979; Sonstroem, 1984), encompasses the affective and evaluative components of self-concept (Sonstroem & Morgan, 1989). Self-acceptance and competence are two dimensions of self-esteem (Sonstroem, Harlow, Gemma, & Osborne, 1991). Along the lines of self-acceptance lie the perceptions of satisfaction or dissatisfaction that an individual has about his or her body. Positive correlations have been found between body cathexis, or satisfaction, and self-esteem (Mahoney & Finch, 1976; Rosenberg, 1979).

Self-esteem has been identified as the variable with the greatest potential to reflect psychological benefit gained from regular exercise (Hughes, 1984; Sonstroem, 1984). There has been a great deal of interest in the underlying mechanisms of the exercise-esteem relationship. Sonstroem and Morgan (1989) postulated a hierarchical model suggesting that global self-esteem can be influenced by a generalization of competence, originating with physical self-efficacies specific to particular tasks within a training program. Several researchers have documented this relationship (Sonstroem et al., 1991; McAuley, Mihalko, & Bane, 1997), and this relationship does not appear to be limited to aerobic activity (McAuley, Blissmer, Katula, Duncan, & Mihalko, 2000). Therefore, self-efficacy not only mediates the impact that exercise has on affect and mood but its influence on self-esteem as well. This combination of psychological enhancement occurring with physical activity will hopefully contribute to the empowerment experience.

Group-Mediated Interventions

While many of the studies reviewed have shown benefits on functional capabilities and psychological factors, physical activity alone may be insufficient in improving the perceptions of older adults on their level of function and how it relates to their daily activities. Older adults often need motivation, instruction, and practice in developing self-regulatory skills in order to enhance their ability to live active, independent lives. Physical activity programs for older adults should go beyond the traditional standards for exercise prescription in order to allow these individuals to make the important connection between their improved function and their daily lives, and this may be accomplished through group and individual counseling strategies (Rejeski & Focht, 2002a).

Rejeski and colleagues (2002b) demonstrated the aforementioned concept by comparing the effects of standard cardiac rehabilitation (CRP) versus a group-mediated cognitive-behavioral intervention (GMCB) on physical function in older adults. This intervention resulted in greater improvement in self-reported physical function for older adults with lower initial function compared to those in the traditional setting. A similar study by Rejeski et al. (2003) comparing these same activity settings also brought greater increases in self-efficacy beliefs for the GMCB subjects.

Group interaction improves the empowerment experience in that it provides a strong sense of group identity (Wallerstein et al., 1988; Pensgaard & Sorensen, 2002). Collective efficacy is the belief in the group and its capabilities to execute certain courses of action, and the functioning of a group is the product of the interactive dynamics of its members (Bandura, 1986; 1997). Perceived collective efficacy is likely to influence how

much effort individuals will spend on work in the group (Pensgaard et al., 2002). Group settings often provide older adults with: (a) increased feelings of community and belonging, (b) strengthened social support and interaction, (c) decreased isolation and loneliness, (d) acquired coping skills, (e) rediscovered uniqueness, (f) resolved issues, and (g) restored sense of control, self-worth and integrity (Thomas, 1991). Therefore, peer groups and group counseling can play an important empowering role for individuals.

There appears to be great benefit in the integration of psychological interventions with traditional exercise programs. In doing so, individuals may become more empowered to adopt an active lifestyle and to allow the positive effects of physical activity and training to carry over into one's activities of daily living.

Study Hypotheses

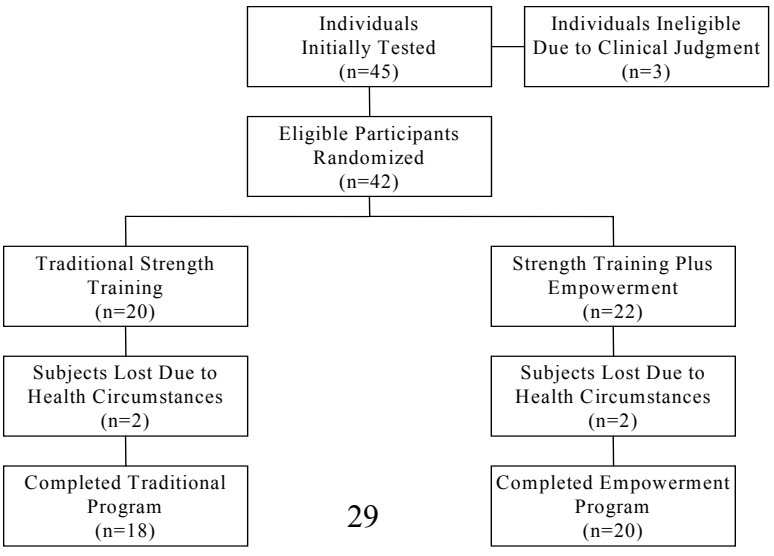
Along with standard resistance training, the current study implemented an empowerment intervention designed to reinforce the competencies and desires of older individuals for physical strength. The study was developed in light of the following hypotheses:

1) Participants involved in the empowerment intervention will experience greater change in their level of desire for physical strength compared to those involved in a traditional strength-training program.
2) Participants involved in the empowerment intervention will experience greater change in their level of self-efficacy for physical strength compared to those involved in a traditional strength-training program.
3) Participants involved in the empowerment intervention will perform better on a task of functional ability as compared to those in a traditional strength-training program.

METHODS

Participants

Participants for this study were recruited from Forsyth County and surrounding areas by way of personal advertisement at local malls and in local newspapers. To be considered eligible, participants had to be over the age of 60 and sedentary at the commencement of the program, with self-reported difficulty in one or more activities of daily living that require ambulation. They had to have stability of residence for the duration of the study as well as the willingness to participate in all aspects of the trial. Participants were excluded for psychiatric illness, severe symptomatic heart disease, systemic disease, active cancer, hearing or sight impairment, cognitive impairment, alcoholism, and the inability to walk unassisted. In addition, the participants could not be participating in any other trials simultaneously. Of the 45 individuals initially tested, 3 were unable to participate based upon clinical judgment, while 4 individuals dropped during the training program due to various health reasons. The reasons for these individuals dropping were due to pre-existing health conditions (i.e., back pain) but were unrelated to the training. The final group of participants in the study consisted of 12 males and 26 females, ranging in age from 60 to 81 years (M = 70.50, SD = 5.32).



Overview of the Study

Empowerment is gained through the development of personal efficacy. According to Bandura (1997), empowerment is achieved by equipping people with firm beliefs that they, whether individually or collectively, can produce valued effects and by providing them with the means to do so. This was the basis of this study. The goal was to not only improve each participant's efficacy, but their efficacy as a group as well.

The study was designed in order to test the effects of a traditional strength-training program supplemented by an empowerment intervention on one's self-efficacy for physical strength, on one's desire for physical strength, and on one's performance on a timed task. All participants engaged in the same 6-week weight training routine; however, in addition to the traditional routine, one group was exposed to an intervention of self-enhancement, encouragement, and positive feedback. Each group was to meet for two days each week for center-based training, while they completed one day of home-based training each week. During baseline testing, participants completed questions concerning their self-efficacy for physical strength and their desire for physical strength and engaged in a timed performance task that tested their ambulation and lifting/carrying abilities. Following testing, all eligible participants were randomized into one of two training groups. Upon completion of the 6-week training program, post-test evaluations were completed for each of the measures.

Measures

The measures utilized for the current study were created specifically for this study and were designed in a manner that is consistent with principles of measurement from social cognitive theory.

Strength Efficacy. Participants were assessed on how much certainty they had in their ability to successfully lift various amounts of weight. In administering this questionnaire, the participant stood with 5 different weights in front of him or her on a table. The participant performed one repetition with the lightest weight then completed questions related to that weight. Specifically, the questionnaire asked for his or her confidence in lifting it 2-, 4-, 6-, 8-, and 10- times without stopping. The questionnaire was answered in terms of percentages ranging from 0%, "Not at all Certain" to 100%, "Completely Certain." After the five questions were answered in response to the lightest weight, the next highest weight was lifted and so on. This was done for both upper body and lower body strength, for a total of 25 questions related to each. The bicep curl was used for assessing upper body strength efficacy while the leg extension using ankle weights measured lower body strength efficacy. Measurement of efficacy was achieved by lifting one repetition with the dominant arm or leg. Different weight increments were used for males and females. The five weight increments for males in the upper body efficacy measurement were 5-, 8-, 12-, 15-, and 20- pounds and for lower body, 5-, 7.5-, 12.5-, 20-, and 25- pounds. The five weight increments for females in the upper body efficacy measurement were 3-, 5-, 8-, 12-, and 15- pounds and for lower body, 2.5-, 7.5-, 10-, 15-, and 20- pounds. The total strength efficacy score was calculated by taking the average from all 25 questions, for both upper and lower body strength. Therefore, scores

could range anywhere from 0 to 100%. For the current study, the alpha reliability coefficients were 0.9689 for upper body strength self-efficacy and 0.9650 for lower body strength self-efficacy (see Appendix A).

Desire for Physical Strength. Following the measure of strength efficacy, participants were asked to report their level of desire or motivation to be able to lift each weight 6 times. Again, the interest was not in whether participants could lift the weight six times or not, but rather, in their motivational level to be able to lift the weight. Answers to the questions scaled from "No Desire Whatsoever" to "Very Strong Desire" and measured the desire for both upper and lower body strength for a total of 10 questions. The total score for both upper and lower body was calculated by taking the average of the scores, and this ranged from 0 to 4. Alpha reliability coefficients for the current study were 0.9057 for desire for upper body strength and 0.8787 for desire for lower body strength (see Appendix B).

Lift and Carry Performance Task. Participants were given a timed performance task in which they were asked to pick up a weight from a chair with both hands, turn, and carry the weight a distance of 10 feet around a cone, then come back 10 feet and place the weight on top of a shelf overhead. The selected weight for each individual was determined by the measurement of strength efficacy. The self-efficacy scale ranged from 0 to 100%; therefore, the first weight at which one's confidence level dropped to 50% on that scale became the weight used for the performance task. This task was intended to measure ambulation and lifting/carrying ability.

Procedures

Prior to the commencement of the study, participants reported for baseline assessments. Informed consent forms were read and signed by all participants (see Appendix C) and they completed the Physical Activity Readiness Questionnaire (PAR-Q; see Appendix D). If there were no medical conditions that appeared to make exercise unsafe, the subjects completed a short demographic questionnaire assessing age, gender, ethnic background, education, occupation, and any diseases or medical conditions (see Appendix E). Participants then began baseline testing, starting with height, weight, and blood pressure. They completed questionnaires that assessed self-efficacy for upper and lower body strength, desire for upper and lower body strength, as well as a timed performance task as previously described. Following completion of baseline testing, participants were randomized into one of two groups: (1) traditional strength training group or (2) traditional strength training plus empowerment training group.

The empowerment and traditional strength training groups were completely separated during training, attending training sessions on opposite days of the week to avoid contamination of the intervention. In addition, each treatment group was divided into two sections in order to allow for closer supervision by the exercise leaders. As the 6-week strength-training program began, the first week of the program was very similar between the groups, getting individuals accustomed with the techniques and principles of strength training. On the first day of the program, participants were instructed on proper form, breathing techniques, and safety issues in addition to an overview of the program as a whole. Each day would begin with a warm-up consisting of several laps of walking around the track followed by a brief stretching routine. In determining the appropriate

amount of weight for each individual, participants were placed into small groups with an exercise leader where correct form was demonstrated for each exercise. Then each participant attempted the exercise, beginning with a weight that seemed appropriate to fatigue him or her by the eighth or tenth repetition. If the subject was unable to do more than 6 repetitions, then a lighter weight was chosen; if the subject could do 12 or more repetitions with ease, then a higher weight was chosen. The goal in the training program was to perform 8-12 repetitions of each exercise and always feel very fatigued due to muscle failure by the last repetition, to the point that another repetition could not be achieved. Following the first introductory session, participants were ready to begin training.

On the first day of training, individuals from both the traditional and intervention groups worked independently on each exercise with the close supervision of the leaders. At the close of this session, dumbbell sets and therabands were distributed to each participant along with a home program packet in order for them to perform a training session independently one day each week. This equipment was theirs to keep.

Following the first week, group differences became more noticeable in the interactions between exercise leaders and participants. The traditional group continued strength training individually while in the empowerment group, participants were paired up in order to monitor each other on technique and to offer encouragement to one another. These peer groups helped with developing good social bonds; they also helped to create a high level of encouragement between subjects. Group meetings also began in the second week of training for the empowerment group. Leader-participant interactions and the empowerment group meetings will be described later in more detail. At the conclusion of

the 6-week training program, all physiological and psychological measures were once again repeated.

Traditional Strength Training Program

The six-week strength-training regimen consisted of two center-based training sessions per week coupled with one home-based training session per week. Participants were provided with dumbbells and therabands, as well as an exercise pamphlet and log, in order to continue the prescribed strength-training regimen at home. During the supervised training days, exercises were developed to target eight muscle groups (chest, back, shoulders, biceps, triceps, quadriceps, hamstrings, and calves). Exercises were developed for both free weight and machine use. Training consisted of the following 12 exercises:

- Free weight incline chest press (2 sets)
- Seated row
- Free weight bent-over row
- Free weight overhead press
- Free weight lateral side raise
- Free weight bicep curls
- Free weight triceps extension
- Leg extension
- Leg curl
- Leg press
- Calf raises

The exercises prescribed for the home-based program was essentially the same as the center-based program, with dumbbells and therabands used to simulate the various exercises. By developing exercises that were similar to those performed during supervised sessions, there were fewer problems with compliance to the home program. Having the participants perform these exercises at home helped these individuals to take personal responsibility for building their strength, and allowing them to keep this equipment was intended to help them continue the strength-training program even once the study was complete.

Interactions between the exercise leaders and participants during the traditional treatment arm focused primarily on instruction and supervision of proper methods of training. Specifically, features of the traditional training condition included:

- Giving vague feedback (i.e., "That is correct" or "That was fine");
- Avoiding direct attention to any one individual, but rather, being general in most comments ("You are all doing better");
- Focusing on corrective feedback and instruction ("Don't put your elbows down" or "Try to not do it so fast");
- Failing to follow up with praise or comment after a correction or exercise.

Traditional Strength Training plus Empowerment Intervention

The empowerment intervention was designed to create its effect in two ways: through altered interactions during training as well as through a group-counseling module. The training program was the same as described above, consisting of six weeks of two center-based training sessions and one home-based training session per week. These

participants were also given dumbbells, therabands, and the equipment necessary to continue the prescribed training regimen at home. The difference between the two groups lies beyond the actual strength training.

Altered Interactions During Training

Individuals in the empowerment group, while training, received a great deal of specific, positive feedback on their form, effort, and ability. Great effort was made to hone in on each participant's self-efficacy and motivation, guiding them to feel good about their accomplishments and to be able to apply this activity to their daily lives. Specific components of the empowerment training condition included:

- Giving frequent individual attention
- Providing specific reinforcement for positive behaviors to each participant
- Enhancing efficacy by giving encouragement before and after each session as well as after mistakes
- Focusing on positive comments during instruction
- Giving specific feedback on the participant's ability and technique
- Pairing participants into peer groups and promoting peer performance feedback and encouragement
- Rewarding effort immediately
- Giving performance feedback and charting each participant's progress

Group Counseling Module

The counseling component of the empowerment intervention, which was implemented through post-exercise group sessions, began at week 2 of the training program and continued through the completion of the study. The first introduction to this intervention merely touched upon the importance of strength with aging. The program these individuals were beginning was going to make them unique; they were becoming "pioneers of fitness" for the aged and a positive model for others. This set the stage for the empowerment process to begin.

Group Session #1. The first group meeting began with introductions, because one goal of the study was to produce a strong social bond between each of the participants. Before going any further, rules for being a good group member were reviewed so the session would not be monopolized by one group member's views and the most benefit could come out of each group session. For instance, to be an effective group member, one should be non-judgmental to others, allow time for everyone to speak, and really listen and feel what each individual is trying to say. This was intended to be a time to learn from one another. The topic of physical disability was touched upon in this first meeting. Factors contributing to disability include disease, inactivity, "ageism," and sarcopenia. Participants were told that older adults over age 65 lose 1 to 1.5% of their strength each year (Vandervoort, 2002; Doherty, 2003). However, the good news is that older adults are just as responsive to weight training as younger individuals. This brought an opportunity to build efficacy in the participants, instilling in them the knowledge that they were capable of much improvement, and that they had already begun showing improvement even in the first week. To close the first session, participants were

given a homework assignment that would encourage them to analyze their lives and any difficulties they may encounter. The questions were as follows:

- How is strength important to the things you do on a daily basis? Are there things that you would like to do but can't because of a lack of strength?
- Have you noticed any positive or negative effects from the program thus far? What are they?
- What do you hope to get out of the program?

Group Session #2. The next group meeting began with a discussion of the questions listed above, specifically on how the participants felt limited in certain activities. This led to a discussion of the basic activities of daily living (ADLs), which inevitably become more difficult with age. If nothing is done to overcome the decline in strength with age, eventually some of the basic ADLs will become impossible. Without maintaining or increasing one's strength, one encounters a higher risk of getting on the "slippery slope" toward physical disability.

Group Session #3. The importance of self-monitoring was the next topic of discussion. It was important that each individual monitor his or her progress. Participants were instructed to record his or her training activities at home and make all efforts to stay on track. With the close of this session, participants were asked to develop three specific, measurable goals. By making these goals specific and measurable, self-monitoring and progress evaluation could be accomplished more easily. These goals could also be used to help tailor their training program to more effectively meet their needs.

Group Session #4. The following week, the post-exercise session was utilized by placing emphasis upon each participant's improvement over the first half of the training program. Graphs showing their increase in strength in four of the twelve exercises were created for participants. Strength levels were measured by taking the product of the weight lifted and the number of repetitions performed (See Appendix F). This created good visualization of their improvement. By providing verbal praise and documenting one's increased strength as individuals and as a group, this was a great opportunity for building individual self-efficacy as well as a sense of collective efficacy. It created excitement for them and helped them feel good about themselves and their accomplishments.

Group Session #5. In teaching the concept of self-awareness, participants were instructed to focus on the muscles targeted by each exercise as they were lifting. By directing their attention to those muscles, they could feel the contraction and the change in tension; knowing that the muscles are growing and changing contributed to self-awareness and self-efficacy. This concept led to a discussion of confidence. Gaining confidence in one's abilities and trying new things is, in part, a state of mind, and individuals have the ability to create their own self-esteem and shape how others see them.

Group Session #6. A goal of this study was to have the participants take their confidence to a new level. Confidence stems from motivation. Building and maintaining motivation is an active process, not an inborn trait. One must proactively seek out sources of confidence while not focusing on activities that decrease one's confidence. This could be done through the examination of simple daily activities and whether there

have been any noticeable changes over the past few weeks. Are they easier or more difficult? Also, have there been any changes in physiological parameters, such as changes in the weights being used? Additionally, setting realistic yet challenging goals can be used as a source of confidence. Focusing on all of these sources of confidence will help to cultivate motivation and continue the cycle.

Group Session #7. Approaching the final week of training brought another opportunity to emphasize each participant's improvement as well as the group's improvement by way of graphic feedback. Graphs were created and distributed once again, visually presenting their strength increases throughout the six-week training program in several of the exercises. Total weight increases as a group and averages per individual were also given. Again, by individualizing their improvements, this gave the opportunity to build the participants' efficacy in their strength.

Group Session #8. The final group meeting focused on each participant's fears of the program coming to an end and what their plan of action would be from that time forward. Some of their fears included:

- loss of motivation without the encouragement of the trainers;
- loss of the social bonds that were formed;
- loss of the physical gains that were achieved;
- lack of a facility to continue weight training activity.

This led to a discussion of how to maintain an exercise program. Maintenance involves numerous components. First of all, by targeting the behavior, they would need to set specific and measurable, yet challenging goals. A plan of action could then be formed, whether it is joining the YMCA, keeping contact with their fellow group members and

keeping one another accountable, or calling the exercise leaders for guidance and assistance. Motivation must be continually cultivated; it is an active process. The participants could maintain their motivation by thinking about the gains and benefits they received by participating in this program. Also, placing cues in their normal environment would be a constant reminder to exercise. Maintaining this level of activity is a hard feat to achieve by oneself, so it is also important to enlist social support in this undertaking, whether from family members or friends. Most of all, one must expect relapses in his or her motivation and activity levels; however, how one manages that relapse and moves on is the key.

Statistical Analyses

Descriptive statistics are reported as means and standard deviations or as frequencies, partitioned by treatment group. In order to examine the changes in self-efficacy for strength, desire for strength, and performance task ability as a result of training, a General Linear Model procedure was utilized. After creating difference scores for each of the measures (found by subtracting the pre-test score from the post-test score), analyses of covariance (ANCOVAs) were performed, covarying for pretest values of the dependent variables and gender. In addition, effect sizes were also calculated for each measure by dividing between group differences by the pooled standard deviation of each measure.

RESULTS

Participant Demographics

Demographic and disease characteristics of the participants during the initial screening are shown in Table 1, partitioned by treatment group. The overall sample population had a mean (±SD) age of 70.5 (±5.32) years. Participants were overweight with a mean (±SD) body mass index of 26.67 (±5.40) kg/m^2. The group was predominantly Caucasian and education levels were varied, with 11% obtaining a high school diploma and 55% earning a college degree or greater. Overall, participants had a variety of chronic diseases and conditions. For example, 47% of the sample suffered from various forms of arthritis, while 42% had hypertension. Randomization was effective in that there were no statistical differences between treatment groups on demographic or disease characteristics.

Table 1: Descriptive Characteristics of Participants at Baseline

Variable	**Overall** M (SD)	**Traditional** M (SD)	**Empowerment** M (SD)
Age (yrs)	70.5 (5.32)	71.3 (6.37)	69.8 (4.20)
Body mass index (kg/m^2)	26.67 (5.40)	27.13 (4.82)	26.26 (5.97)
Blood pressure (mmHg)			
Systolic BP	136 (18.26)	135 (15.14)	136 (21.07)
Diastolic BP	74 (12.04)	74 (11.34)	74 (12.92)

Table 1 continued

Variable	Overall N (%)	Traditional N (%)	Empowerment N (%)
Gender			
Female	26 (68)	10 (56)	16 (80)
Male	12 (32)	8 (44)	4 (20)
Race			
White	36 (95)	18 (100)	18 (90)
African American	2 (5)	0 (0)	2 (10)
Highest level of education			
< High school graduate	2 (5)	1 (6)	1 (5)
High school graduate	4 (11)	0 (0)	4 (20)
> High school graduate	11 (29)	7 (39)	4 (20)
College graduate	7 (18)	2 (11)	5 (25)
> College graduate	14 (37)	8 (44)	6 (30)
Diseases / medical conditions			
Arthritis			
No	20 (53)	8 (44)	12 (60)
Yes	18 (47)	10 (56)	8 (40)
Hypertension			
No	22 (58)	10 (56)	12 (60)
Yes	16 (42)	8 (44)	8 (40)
Heart disease			
No	35 (92)	15 (83)	20 (100)
Yes	3 (8)	3 (17)	0 (0)
Cancer			
No	34 (90)	15 (83)	19 (95)
Yes	4 (10)	3 (17)	1 (5)

Table 1 continued

Variable	Overall N (%)	Traditional N (%)	Empowerment N (%)
Diabetes			
No	34 (90)	17 (94)	17 (85)
Yes	4 (10)	1 (6)	3 (15)
Other			
No	34 (90)	18 (100)	16 (80)
Yes	4 (10)	0 (0)	4 (20)

Manipulation Checks

Consistent with the proposed schedule of contact, participants assigned to the traditional strength training condition met only for two center-based training sessions per week for six weeks with no additional contact. Empowerment subjects, on the other hand, were exposed to 8 additional group sessions, lasting for 30 minutes following exercise. Average (±SD) attendance to the behavioral group sessions, per participant, was 7.5 (±0.83) out of 8 total sessions. This is equivalent to a 93.75% attendance rate for these sessions. In terms of the attendance to the training sessions, the average attendance per session for the empowerment group was 95%, while the average attendance for the traditional group was 86%. Finally, examination of the strength gains experienced from the beginning to the end of training revealed that the empowerment group increased the amount of weight lifted by an average (±SD) of 185.53 (±65.92) pounds per person while the traditional strength-training group increased the amount of weight lifted by an average (±SD) of 161.42 (±89.49) pounds per person.

In addition, during the first three weeks of training, a trained observer examined the interactions between the exercise leaders and the participants. The purpose was to ensure that the components of training, as outlined previously in the methods section, were properly executed. This analysis demonstrated that the percentage agreement between planned interactions and actual interactions was 91%.

Study Outcomes

The goal of the current study was to examine the effect of a strength-training regimen accompanied by an empowerment intervention upon social cognitive variables, compared to a traditional strength-training program alone. It was hypothesized that the participants comprising the empowerment group would experience greater increases in their level of desire for physical strength as well as their level of self-efficacy for physical strength. This included both upper and lower body parameters of desire and self-efficacy. As a secondary hypothesis, empowerment participants were also expected to experience greater improvements on a performance task measuring their ambulation and lifting/carrying ability. Therefore, the primary measures employed in this intervention were intended to assess one's desire for upper and lower body strength, one's self-efficacy for upper and lower body strength, and one's objective functional capability.

Desire and Strength Efficacy. Tables 2 and 3 present descriptive statistics for the various psychological parameters (i.e., desire for strength and self-efficacy for strength) given to each participant. Means and standard errors for pre-training scores, post-training scores, and the change that occurred from the pre- to post-test are given for each of the

measures. The desire for physical strength scores ranged from 0 to 4; therefore, the average scores of each of the groups were in the mid-level of this range. No statistical differences were apparent between the two groups in the pre-test measures. After inspection of Table 2, it appears that the empowerment group experienced a greater amount of change in the desire for upper body strength (mean adjusted change (Δ) = 0.71, SE = 0.12) compared to the traditional strength-training group (mean adjusted Δ = 0.27, SE = 0.13). Change in the desire for lower body strength did not reveal an effect by the empowerment intervention compared to the traditional group (mean adjusted Δ = 0.33 and 0.28, respectively). Consistent with the aforementioned hypothesis, general linear model analyses on difference scores, covarying for pre-test values for the dependent variable and gender, revealed a statistically significant gain in the desire for upper body strength, $F(1,33) = 5.699$, $p = 0.023$, ES = 0.79). The level of desire for lower body strength fell short of significance ($F(1,34) = 0.029$, $p = 0.866$, ES = 0.06). This analysis revealed that the empowerment intervention was successful in improving the desire for physical strength in the upper body as compared to the traditional strength-training group.

Table 2: Desire for Physical Strength

Variable	**Traditional** M (SE)			**Empowerment** M (SE)		
	Pre	Post	Adj. Δ	Pre	Post	Adj. Δ
Upper Body Desire For Strength	2.95 (0.24)	3.31 (0.15)	0.27 (0.13)	3.13 (0.21)	3.76 (0.11)	.71 (0.12)
Lower Body Desire For Strength	3.16 (0.19)	3.47 (0.17)	0.28 (0.18)	3.22 (0.22)	3.52 (0.22)	0.33 (0.17)

Note: Adjusted difference scores (Adj. Δ) are calculated as the amount of change from pre- to post-test, controlling for pre-test values and gender.

Inspection of the self-efficacy data (range 0-100) reveals trends that parallel the changes in desire. Evaluation of Table 3 indicates larger upper body strength efficacy gains for the empowerment group, with a mean adjusted change (±SE) of 25.70 (±3.02) compared to 17.18 (±3.19) in the traditional group. Gains in lower body strength efficacy were also larger for the empowerment group, with a mean adjusted change (±SE) of 12.09 (±3.70) compared to 4.26 (±3.90). General linear model analyses did not reveal statistical significance for the change in upper body strength efficacy ($F(1,34) = 3.637$, $p = 0.065$, ES = 0.63) nor in lower body strength efficacy ($F(1,34) = 2.047$, $p = 0.162$, ES = 0.47). Nonetheless, a moderate effect size (ES = 0.63) was observed for upper body strength efficacy as a result of the intervention. While the changes in strength efficacy were not of statistical significance, these analyses reveal trends in the expected direction, in favor of the empowerment intervention's ability to increase one's self-efficacy for physical strength.

Table 3: Self-Efficacy for Physical Strength

Variable	**Traditional** M (SE)			**Empowerment** M (SE)		
	Pre	Post	Adj. Δ	Pre	Post	Adj. Δ
Upper Body Strength Efficacy	68.38 (5.13)	84.49 (3.96)	17.18 (3.19)	64.64 (5.61)	91.30 (2.72)	25.70 (3.02)
Lower Body Strength Efficacy	79.98 (4.93)	83.96 (4.91)	4.26 (3.90)	78.32 (5.03)	90.66 (2.79)	12.09 (3.70)

Note: Adjusted difference scores (Adj. Δ) are calculated as the amount of change from pre- to post-test, controlling for pre-test values and gender.

Performance Task. A secondary analysis measuring the functional capabilities of the participants was employed, based upon the lift and carry task. Table 4 presents the mean (SE) times that it took each group to perform the task during the pre- and post-test. The differences between the two tests, adjusting for the baseline value and gender, are given as well. There were no statistical differences between the two groups in the pre-test measure. Inspection of the table reveals that both groups experienced improvement in performance as a result of strength training, yet the empowerment group's improvement was slightly larger compared to the traditional strength-training group (mean adjusted change = 1.64 and 1.29, respectively). This difference, however, did not reach the conventional level of statistical significance, $F(1,34) = 1.335$, $p = 0.256$, ES = 0.39.

Table 4: Performance Task Time

Variable	Traditional M (SE)			Empowerment M (SE)		
	Pre	Post	Adj. Δ	Pre	Post	Adj. Δ
Performance Task Time (Sec)	8.88 (0.67)	7.35 (0.48)	-1.29 (0.22)	7.91 (0.37)	6.47 (0.29)	-1.64 (0.21)

Note: Adjusted difference scores (Adj. Δ) are calculated as the amount of change from pre- to post-test, controlling for pre-test values and gender.

DISCUSSION

The purpose of this study was to evaluate the benefits of adding a psychological empowerment intervention to traditional strength training on social cognitive variables in community-dwelling older adults. One of the underlying assumptions of the psychological empowerment intervention was that older individuals often need encouragement in finding a sense of control over their lives and in realizing the strengths and competencies that they possess (Bandura, 1997; Myers, 1991). According to its definition, empowerment is intended to enable individuals to strengthen their skills and resources to gain power and mastery over their lives (Swift et al., 1987; Rappaport, 1987; Conger et al., 1988). In the current study, the process of empowerment was operationalized consistent with constructs in social learning theory (Bandura, 1977; 1986), attempting to strengthen self-efficacy expectations and the desire for physical strength. This was done through interactions during training as well as through group-mediated behavioral sessions. Emphasis was placed upon enhancing the confidence of the participants in their strength, as well as the value they place upon their strength and its effect upon their daily lives.

While empowerment has been found to be a multi-level construct (Rappaport, 1987; Zimmerman, 2000), the focus of the present study was primarily upon the individual. Development of personal control and an internal belief that one is able to manage life begins with the individual. This investigation dealt primarily with proximal components of the empowerment process, such as the individual and the group. It was the hope of the researchers that, over time, these participants would be able to apply what they learned and transfer their skills to their everyday lives.

The results of this investigation partially support the hypothesis that a strength-training program supplemented by an empowerment intervention has the potential to enhance one's desire for strength and one's self-efficacy compared to a strength-training program alone. As a result of the empowerment intervention, there were significant increases in the desire for physical strength of the upper body while the desire for lower body strength remained unaffected for the most part. Similarly, increases in self-efficacy for upper and lower body strength were in the expected direction in favor of the empowerment intervention, yet failed to reach conventional levels of statistical significance. Improvements also occurred in the time it took to complete the lift and carry performance task. Improvements were demonstrated in both groups for this task, yet the empowerment group showed a slightly greater amount of improvement. However, this difference also was not statistically significant.

Desire

Little research has been conducted on the effects of physical activity interventions on one's level of desire for physical competence or strength. Both Rotter (1954) and Bandura (1986) have found that incentives can play an important role in determining one's behavior. When the value or incentive that one associates with a particular behavior is high, this leads to greater intention of performing the behavior. If an individual holds little incentive value for a behavior, he/she is more apt to give up more quickly on that behavior. The current study found significant increases in the level of desire for physical strength, particularly in the upper body. It appears that the empowerment intervention helped these individuals realize the value of their upper body

strength in dealing with basic, yet important, everyday activities (i.e., carrying bags of groceries, vacuuming, pushing a lawnmower, etc.). While there was no difference in the amount of emphasis placed upon upper and lower body by the leaders, the participants could more easily see the changes that were occurring in the muscles of their upper body, particularly their biceps. Many older adults often wear long pants during training; therefore, they could not see how the muscles of their lower body were responding to training to the extent that they could with their upper body.

Self-Efficacy

Previous data has shown that physical activity has positive effects on self-efficacy (Atkins et al., 1984; McAuley et al., 1991; McAuley et al., 1995; Mihalko et al., 1996; McAuley et al., 2000). The exercise stimulus is oftentimes a mastery experience, enhancing an individual's perceptions of self-efficacy (McAuley et al., 2001). Much of the previous research on self-efficacy enhancement has been performed with aerobic exercise. However, several studies have made use of resistance training to examine the effect upon self-efficacy (Stewart, Mason, & Kelemen, 1988; Ewart, 1989; Beniamini et al., 1997; Tsutsumi et al., 1997). As Tucker and Maxwell commented in 1992, a weight-training environment contains many opportunities for positive feedback due to observable physique and strength improvements. Participants are rewarded both physically and psychologically. Consistent with the previous research, the current study found that self-efficacy for strength did increase for both treatment groups as a result of strength training. However, this study also demonstrated that a weight-training environment containing

additional positive feedback mechanisms showed a trend for even larger gains in self-efficacy, as seen by the results of the empowerment group.

Verbal persuasion is one of the four major sources that influence efficacy expectations (Bandura, 1977; 1986). As demonstrated in previous studies (Turner, Rejeski, & Brawley, 1997; McAuley et al., 1999), exercise environments may be manipulated through the behaviors of the exercise instructors to make the exercise experience more socially enriched. Just as self-efficacy increased to a greater degree in the socially enriched environments in these previous studies, the current study also suggests a trend for self-efficacy improvement due to the manipulation of the exercise environment. These studies indicate that the interactions of the exercise leaders might have a large effect upon the psychological response of participants. As demonstrated by the current research, individuals may feel empowered if their efficacy belief is reinforced by their leader's recognition of their performance, regardless of whether their efforts result in success (Conger et al., 1988). In contrast to the previous aerobically based studies, the current study demonstrated manipulations in a strength-training environment, an area that has been lacking in research of this nature.

According to Rejeski and Focht (2002a), in addition to standard exercise protocols, older adults often need extra guidance and motivation in developing self-regulatory skills. This is necessary in order to help these individuals effectively make an association between their improved function and their daily activities. The current study employed a group-mediated behavioral intervention in order to achieve this, and the results were comparable to the study by Rejeski and colleagues (2003). In that study, a group-mediated cognitive-behavioral intervention (GMCB) was compared to a standard

cardiac rehabilitation program, and the GMCB intervention produced greater increases in self-efficacy beliefs among participants. Group behavioral sessions appear to not only help with the development of efficacy beliefs; they help to develop collective efficacy and group cohesiveness as well (Bandura, 1986; 1997).

Functional Ability

Physical function is a reflection of an older adult's ability to perform daily tasks. Previous research has shown improvements in functional abilities as a result of resistance training (Fiatarone et al., 1994; Nichols, Hitzelberger, Sherman, & Patterson, 1995; Latham et al., 2004). Increased strength may allow one to obtain an enhanced physiological reserve to help avoid, or at least limit, functional impairment. The previous resistance training studies resulted in decreased stair climb time and increased gait velocity, among other factors. Similarly, the current study revealed decreases in performance task time of nearly 21% in the empowerment group and 15% in the traditional group over the 6-week period. Comparisons of the two groups revealed no statistically significant difference in performance task time even though the empowerment group showed a slightly greater decrease in task time. It could be implied that the empowerment intervention, through its attempt to relate strength training to the daily activities of these older individuals, allowed for their increased desire and efficacy for strength to carry over to this particular functional task.

Research Limitations and Future Directions

The present study partially supports the hypothesis that a psychological empowerment intervention enhances various social cognitive variables in older adults. However, due to the fact that it was a small pilot study, there are several limitations. First of all, the small sample size reduced statistical power. The empowerment intervention's effect upon several of the outcomes was in the expected direction, yet did not reach conventional levels of statistical significance. Secondly, the length of the program may have restricted the magnitude of the treatment effects. That is to say, the treatment group differences may well have been much larger if the intervention had been longer than 6 weeks. Therefore, a longer strength training/empowerment study with a larger sample size is warranted.

In terms of the health status of the participants, future studies should examine the effect that an empowerment intervention has upon a more frail population compared to a reasonably healthy population. The current study involved a fairly healthy group of individuals, yet with varied functional limitations; however, the sample was too small to divide the participants into subgroups and make that comparison. Based upon previous resistance training investigations, individuals with greater functional impairment at baseline have benefited from the training to a greater extent compared to healthier individuals (Nichols et al., 1995; Nelson, Layne, Bernstein, & et al., 2003). Implementation of a psychological empowerment intervention in addition to standard strength training would most likely result in even larger increases in psychological and functional variables in these frail individuals.

Finally, the current study lacked a sophisticated measure of strength. Estimates were made based upon the changes in the amount of weight lifted and number of repetitions, but actual strength increases could not be reported. However, the primary goal of this study was to examine the changes in social cognitive variables. Perceived improvements in strength have a powerful effect on one's confidence level, regardless of actual improvements in strength. Nevertheless, an assessment of strength level changes would have been useful in examining whether psychological changes coincided with physiological changes.

Conclusion

The results of this study demonstrate the potential value that empowerment interventions may have upon improvement in social cognitive variables among older adults engaging in traditional programs of strength training. Empowerment refers to enabling individuals to recognize their strengths and competencies and to gain mastery over their lives. Many older adults do not realize the competencies they possess and are unable to generalize the effects of training to functional tasks in their daily lives. However, this intervention may contain integral components that many traditional exercise programs are lacking. While some aspects of empowerment were not as strongly demonstrated due to low statistical power, one thing this study certainly succeeded in was helping these individuals realize the value of their strength, as seen by the large improvements in their desire for upper body strength. There is a need to rethink the structure and content of physical activity programs for older adults, and this empowerment study appears to be a step in the positive direction.

APPENDIX A

Strength Efficacy

The strength efficacy questionnaire assesses how much certainty participants have in their ability to successfully lift five different weights 2-, 4-, 6-, 8-, or 10- times without stopping.

To administer this questionnaire, have the participant stand with the various weights in front of them in a private room (only one participant and an assessment person present). The participant will perform ONE repetition with the lightest weight, complete the questions related to that weight (questions 1 thru 5), and then move on to the next heaviest weight (questions 6 thru 10), and so forth. It Is important to administer the questions that apply to a specific weight independently. In other words, after a participant lifts 5 pounds they are only given questions 1 thru 5 to complete. Completion of testing occurs when one of the following conditions is met: (a) the person is able to lift all weights and give a value other than 0 for each weight lifted, or (b) a participant says that he/she has a level of certainty of 0 to be able to lift a specific weight before he/she gets to the heaviest weight.

Scoring:

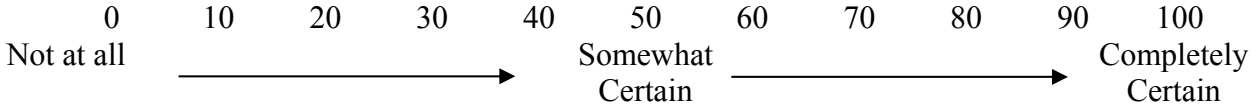
1. For each weight, the lowest possible score is 0 and the highest possible score is 100. This is determined by adding up the scores for each predefined number of repetitions (2, 4, 6, 8, or 10) for each weight and dividing by 5.
2. The scores of the five different weights are then summed and divided by 5 to obtain the final strength efficacy score. If a person stops before he/she reaches the heaviest weight (e.g., gives a certainty rating of 0 for the 3rd weight in the set), then he/she is assigned a value of 0 for all remaining weights and these values are figured into the calculation of the final score.

Instructions for Participant

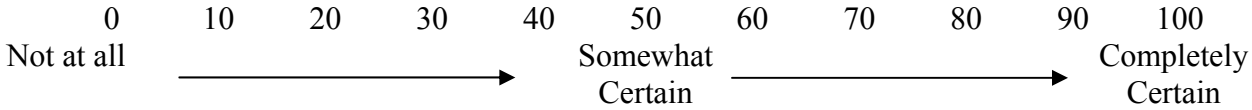
The items listed below are to be completed after you lift each weight one time. Circle the value that applies to you.

I believe that I can successfully lift:

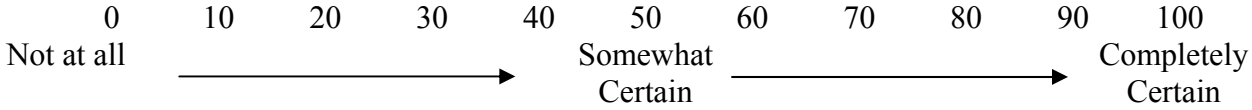
1. Five pounds 2 times without stopping



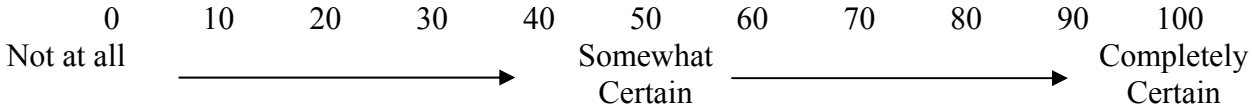
2. Five pounds 4 times without stopping



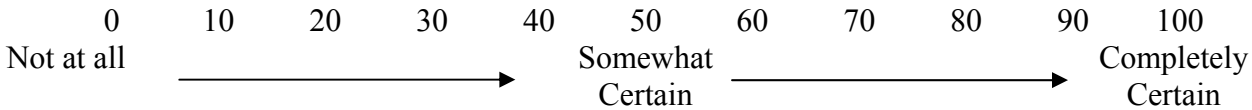
3. Five pounds 6 times without stopping



4. Five pounds 8 times without stopping

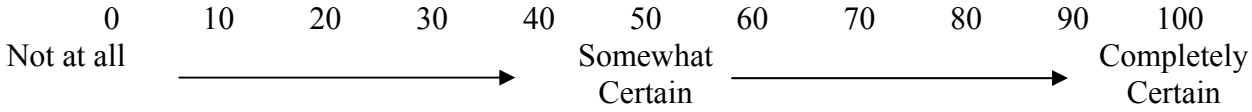


5. Five pounds 10 times without stopping

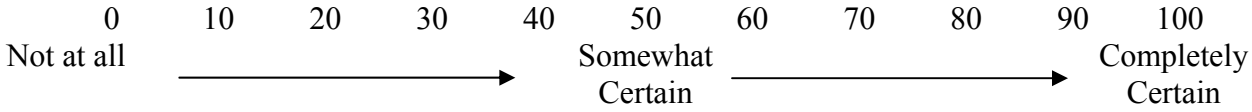


I believe that I can successfully lift:

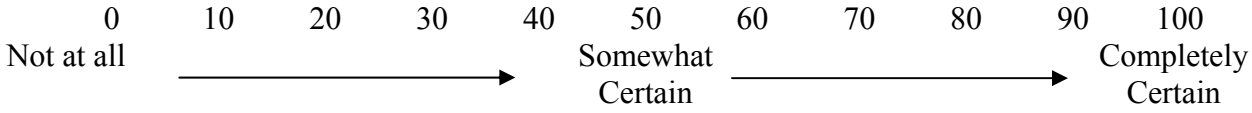
6. Eight pounds 2 times without stopping



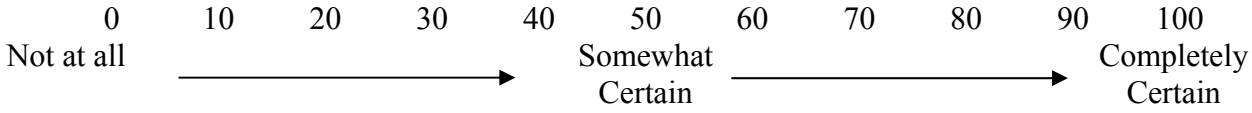
7. Eight pounds 4 times without stopping



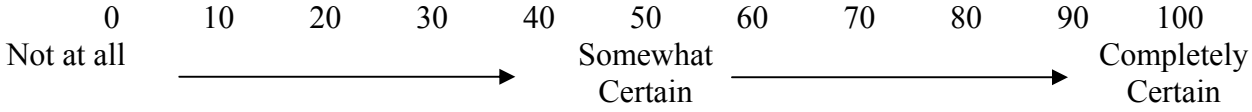
8. Eight pounds 6 times without stopping



9. Eight pounds 8 times without stopping

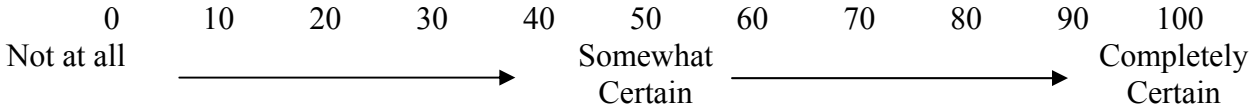


10. Eight pounds 10 times without stopping

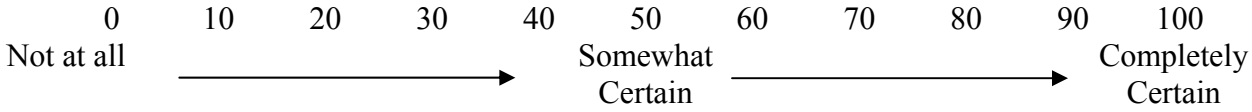


I believe that I can successfully lift:

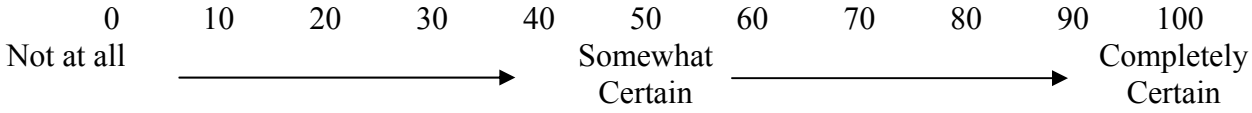
11. Twelve pounds 2 times without stopping



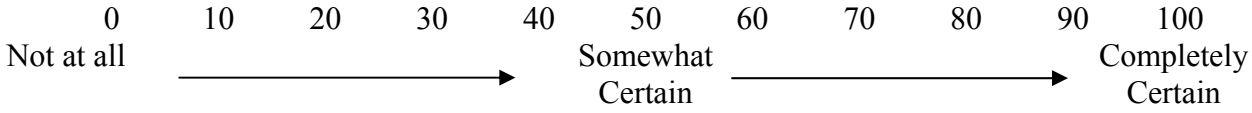
12. Twelve pounds 4 times without stopping



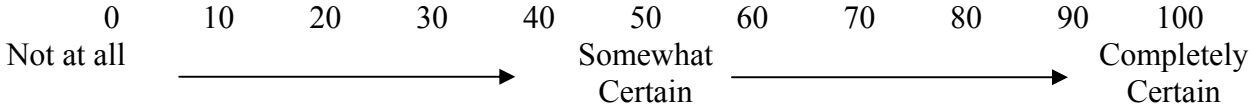
13. Twelve pounds 6 times without stopping



14. Twelve pounds 8 times without stopping

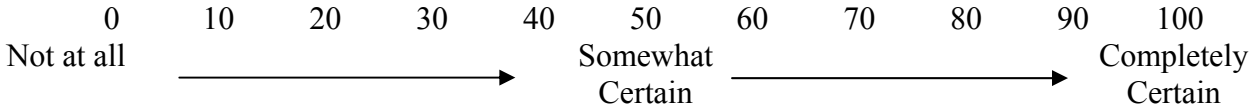


15. Twelve pounds 10 times without stopping

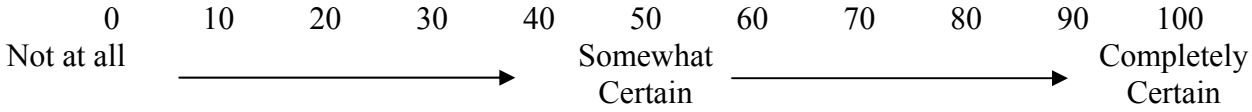


I believe that I can successfully lift:

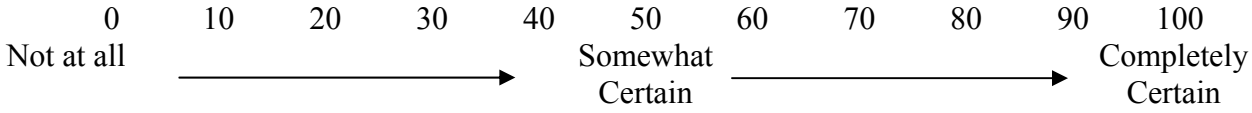
16. Fifteen pounds 2 times without stopping



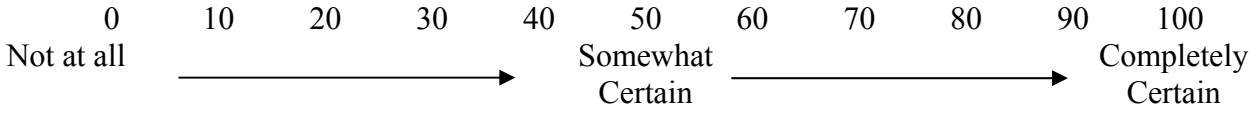
17. Fifteen pounds 4 times without stopping



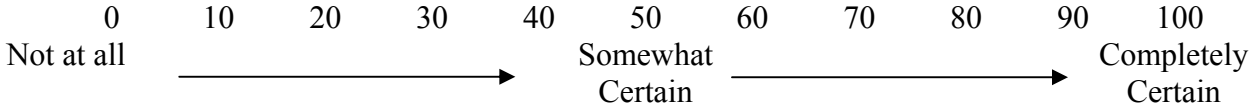
18. Fifteen pounds 6 times without stopping



19. Fifteen pounds 8 times without stopping

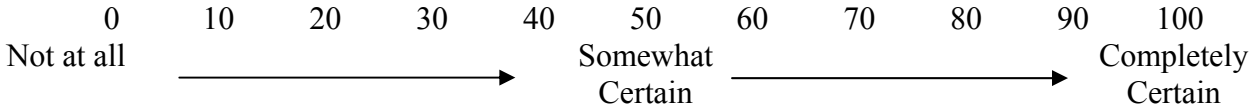


20. Fifteen pounds 10 times without stopping

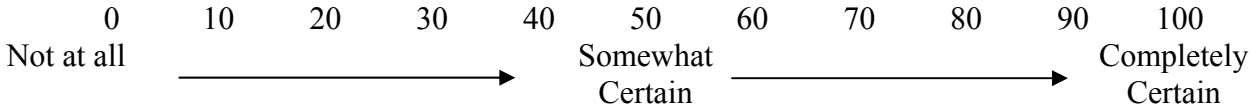


I believe that I can successfully lift:

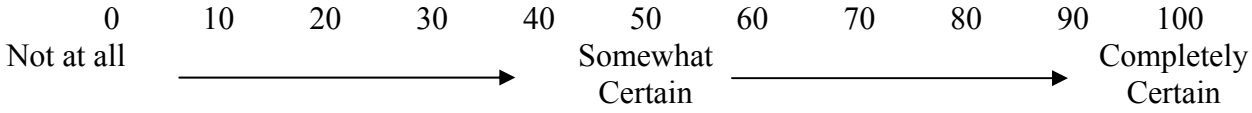
21. Twenty pounds 2 times without stopping



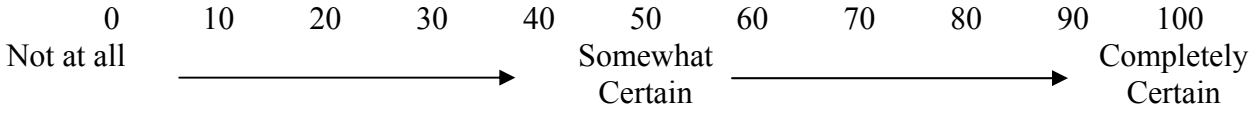
22. Twenty pounds 4 times without stopping



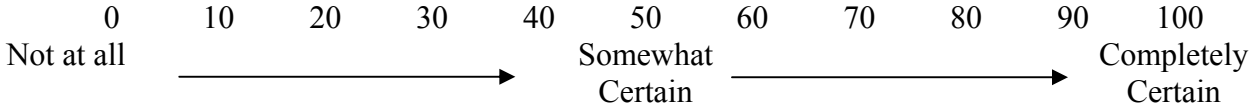
23. Twenty pounds 6 times without stopping



24. Twenty pounds 8 times without stopping



25. Twenty pounds 10 times without stopping



Part II: Leg strength efficacy

The next set of strength efficacy questions assesses the amount of certainty participants have in their ability to successfully lift five different weights with their legs 2-, 4-, 6-, 8-, or 10- times without stopping.

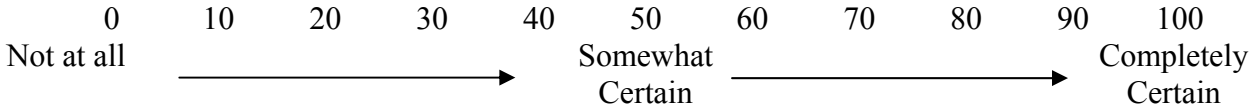
To administer this questionnaire, have the participant sit on the table, assuring that their knee joint lies just beyond the end of the table. The leg should be at a 90° angle. Place the appropriate resistance on the dominant leg of the participant and have the participant perform ONE repetition at that resistance. Then have the participant indicate their level of confidence on the scale from 0 (Not at all confident) to 100 (Completely confident).

Scoring:

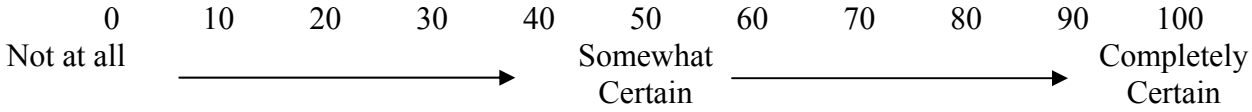
1. For each weight, the lowest possible score is 0 and the highest possible score is 100. This is determined by adding up the scores for each predefined number of repetitions (2, 4, 6, 8, or 10) for each weight and dividing by 5.
2. The scores of the five different weights are then summed and divided by 5 to obtain the final strength efficacy score. If a person stops before he/she reaches the heaviest weight (e.g., gives a certainty rating of 0 for the 3rd weight in the set), then he/she is assigned a value of 0 for all remaining weights and these values are figured into the calculation of the final score.

I believe that I can successfully lift:

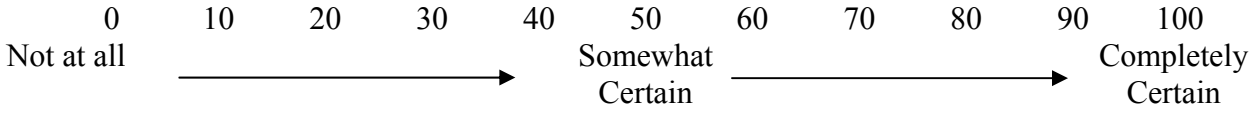
26. Five pounds 2 times without stopping



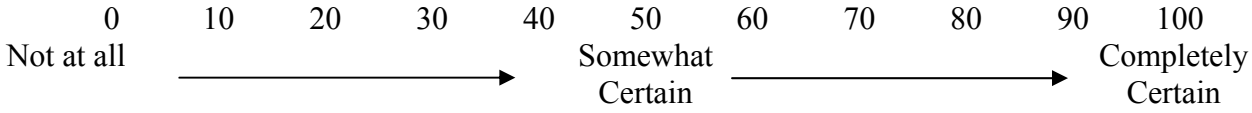
27. Five pounds 4 times without stopping



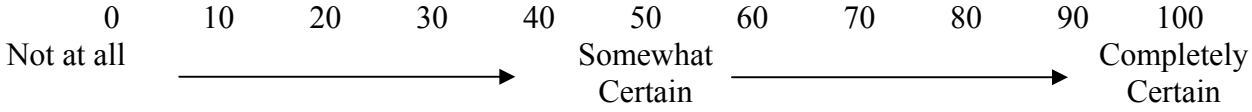
28. Five pounds 6 times without stopping



29. Five pounds 8 times without stopping

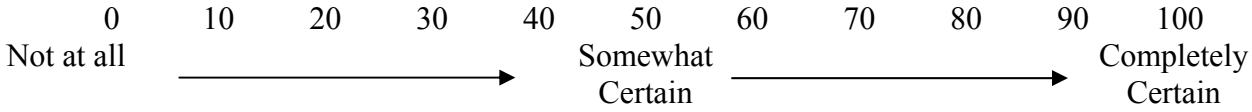


30. Five pounds 10 times without stopping

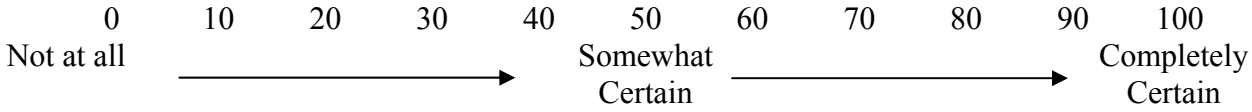


I believe that I can successfully lift:

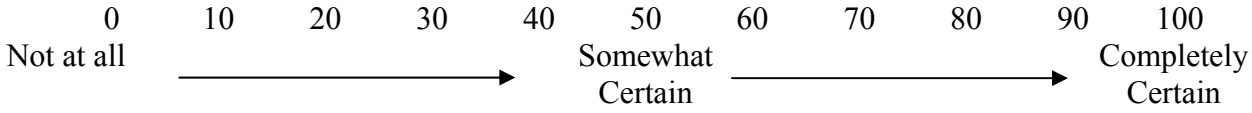
31. Seven and a half pounds 2 times without stopping



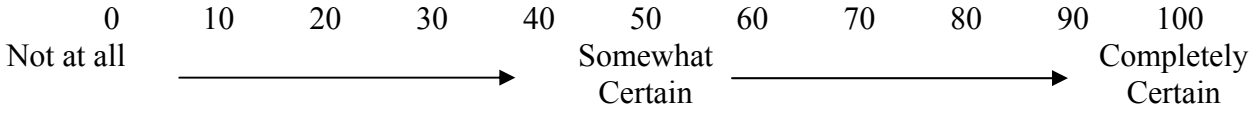
32. Seven and a half pounds 4 times without stopping



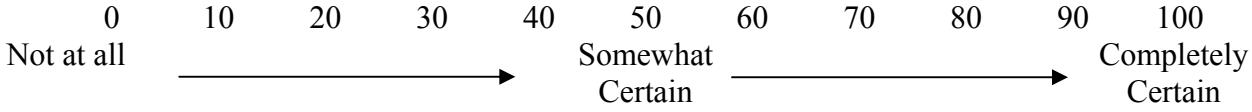
33. Seven and a half pounds 6 times without stopping



34. Seven and a half pounds 8 times without stopping

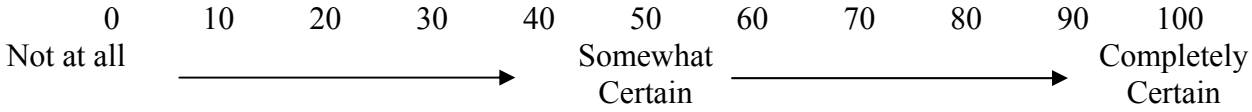


35. Seven and a half pounds 10 times without stopping

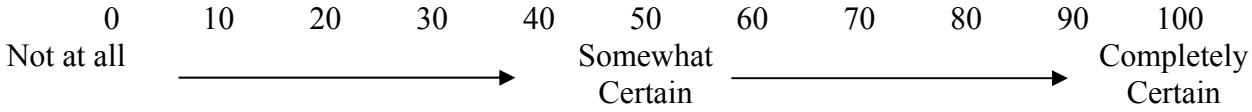


I believe that I can successfully lift:

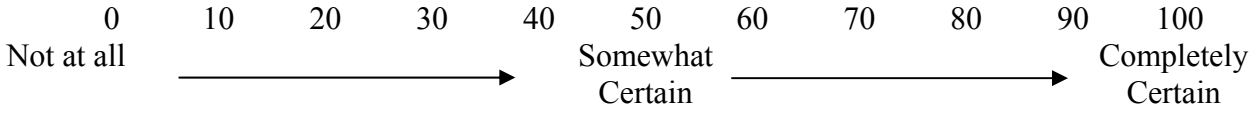
36. Twelve and a half pounds 2 times without stopping



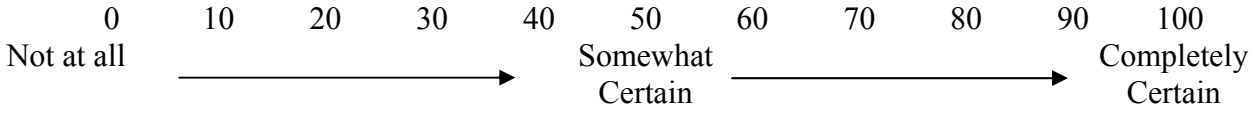
37. Twelve and a half pounds 4 times without stopping



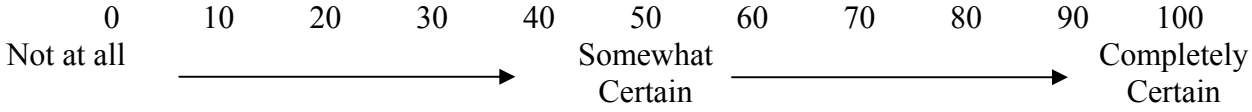
38. Twelve and a half pounds 6 times without stopping



39. Twelve and a half pounds 8 times without stopping

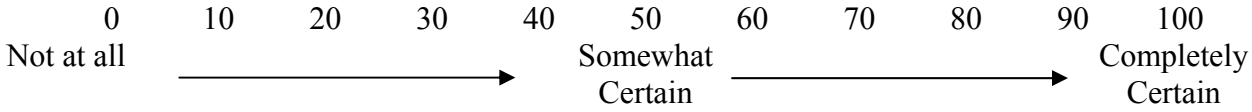


40. Twelve and a half pounds 10 times without stopping

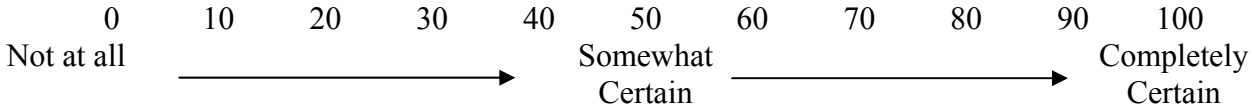


I believe that I can successfully lift:

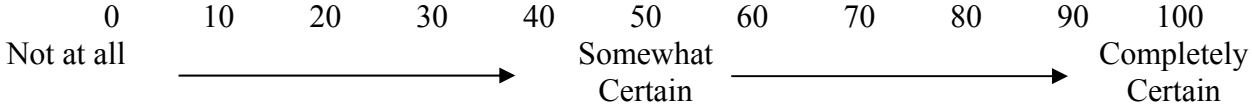
41. Twenty pounds 2 times without stopping



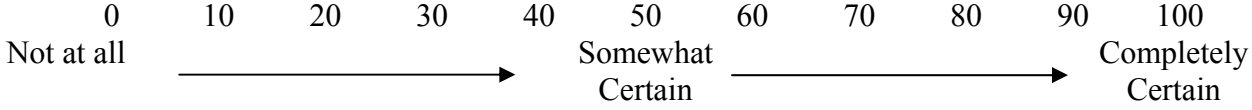
42. Twenty pounds 4 times without stopping



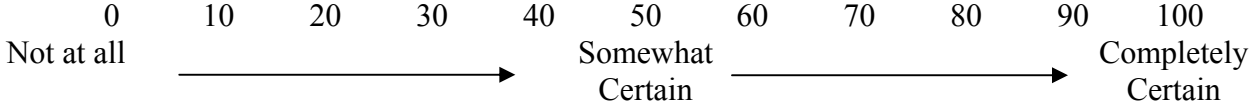
43. Twenty pounds 6 times without stopping



44. Twenty pounds 8 times without stopping

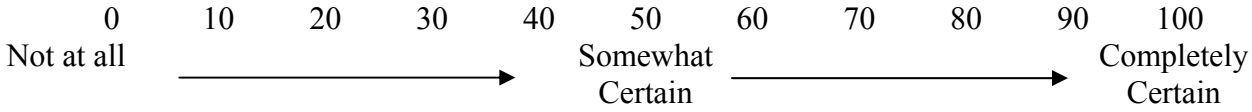


45. Twenty pounds 10 times without stopping

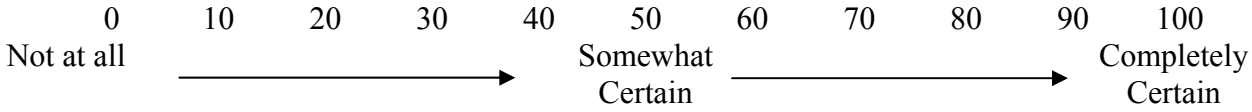


I believe that I can successfully lift:

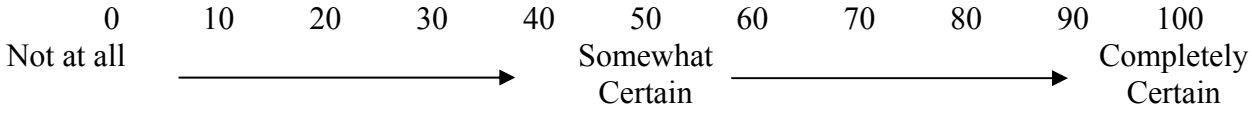
46. Twenty-five pounds 2 times without stopping



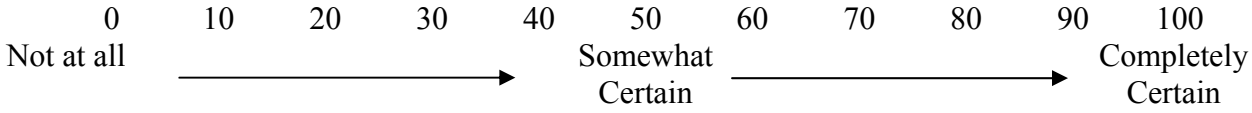
47. Twenty-five pounds 4 times without stopping



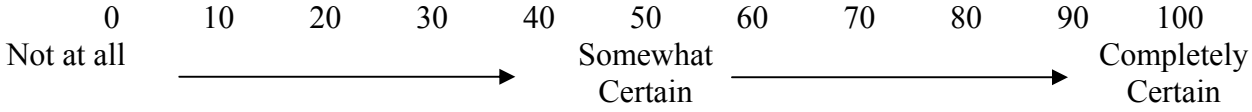
48. Twenty-five pounds 6 times without stopping



49. Twenty-five pounds 8 times without stopping



50. Twenty-five pounds 10 times without stopping



APPENDIX B

Desire for Physical Strength

Think about the activities that you do in your day-to-day life. Would you say that there are things you do which require strength that is similar to the weight you just lifted? For example, picking up a bag of groceries or working in the yard or garden requires a certain amount of strength in order to perform it successfully. Regardless of whether you can lift the weight or not, what is your current level of desire to be able to lift this amount of weight?

Following the measure of strength efficacy, participants will be asked of their level of desire or motivation to be able to lift each weight. For each weight increment, the participant should be asked of their desire in lifting it 5 times. Please indicate their level of desire that corresponds (0 = no desire whatsoever, 4 = very strong desire).

Note: This is to indicate the participant's level of <u>desire</u> to be able to lift each amount of weight. We are not interested in whether they can do the tasks or not, but rather, their motivational level to be able to do each task.

Arm Strength

1. Having the ability to lift five pounds 6 times without stopping

☐	☐	☐	☐	☐
No Desire Whatsoever	Low Desire	Moderate Desire	Strong Desire	Very Strong Desire

2. Having the ability to lift eight pounds 6 times without stopping

☐	☐	☐	☐	☐
No Desire Whatsoever	Low Desire	Moderate Desire	Strong Desire	Very Strong Desire

3. Having the ability to lift twelve pounds 6 times without stopping

☐	☐	☐	☐	☐
No Desire Whatsoever	Low Desire	Moderate Desire	Strong Desire	Very Strong Desire

4. Having the ability to lift fifteen pounds 6 times without stopping

☐	☐	☐	☐	☐
No Desire Whatsoever	Low Desire	Moderate Desire	Strong Desire	Very Strong Desire

5. Having the ability to lift twenty pounds 6 times without stopping

☐	☐	☐	☐	☐
No Desire Whatsoever	Low Desire	Moderate Desire	Strong Desire	Very Strong Desire

Leg Strength

6. Having the ability to lift five pounds 6 times without stopping

☐	☐	☐	☐	☐
No Desire Whatsoever	Low Desire	Moderate Desire	Strong Desire	Very Strong Desire

7. Having the ability to lift seven and a half pounds 6 times without stopping

☐	☐	☐	☐	☐
No Desire Whatsoever	Low Desire	Moderate Desire	Strong Desire	Very Strong Desire

8. Having the ability to lift twelve and a half pounds 6 times without stopping

☐	☐	☐	☐	☐
No Desire Whatsoever	Low Desire	Moderate Desire	Strong Desire	Very Strong Desire

9. Having the ability to lift twenty pounds 6 times without stopping

☐	☐	☐	☐	☐
No Desire Whatsoever	Low Desire	Moderate Desire	Strong Desire	Very Strong Desire

10. Having the ability to lift twenty-five pounds 6 times without stopping

☐	☐	☐	☐	☐
No Desire Whatsoever	Low Desire	Moderate Desire	Strong Desire	Very Strong Desire

APPENDIX C

PARTICIPANT INFORMED CONSENT FORM

AGREEMENT TO PARTICIPATE IN A RESEARCH PROJECT

Principal Investigator:	Marie Sipe
Supporting Investigator:	W. Jack Rejeski, PhD
Institution:	Department of Health and Exercise Science Wake Forest University
Participant Name:	_____
Title of Study:	LIFT: Lifestyle Intervention for Fitness Training Strength Training in Older Adults

1. Description of Study

The purpose of this project is to compare the effects of short-term strength-training on your function. You will be asked to complete questionnaires concerning your opinion of your physical functioning and to participant in a six-week program of strength training activity. The program will meet two times a week, with a third day of home-based training. You will need to attend all 12 sessions and document your six home-based sessions.

2. Potential Risks

The risks of participating in this study are small. A slight risk of injury exists, but precautions will be taken to minimize that risk: you will be instructed on the proper way to perform all exercises, a trainer will supervise your activity, and you may work at your own pace during the program. You may experience fatigue and soreness. Mild soreness is normal and is no cause for concern. Severe soreness may be an indication of injury, and if you experience this, you are encouraged to contact one of the investigators.

3. Confidentiality

The information obtained from this study will be used for research purposes only, with your right to privacy maintained. Your information will be coded with numerical identifications so that your privacy will be protected. All data will be kept in a locked cabinet. Only those individuals directly involved with this project will have access to these files.

4. Voluntary Participation

Participation in this study is voluntary. You are under no obligation to begin or complete this study. You are free to withdraw from participation at any time without penalty to you. You will not be paid for participation. The investigators will not attempt to deceive you at any time.

5. Inquiries/Questions

You are encouraged to ask questions at any time during the study. Any questions regarding the study should be directed to the trainers or you may call Marie Sipe at (336) 758-5398 or Jack Rejeski at (336) 758-5837.

6. Freedom of Consent

I understand that permission to participate is voluntary and that I am free to deny consent if I so desire, both now and at any time during the study. I acknowledge that I have read this document in its entirety and that I fully understand it. All questions have been answered to my satisfaction and I agree to participate in this research project.

_____ _____

Signature of Participant Date

_____ _____

Signature of Investigator Date

APPENDIX D

PAR-Q

(Physical Activity Readiness Questionnaire)

YES	NO	
☐	☐	1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
☐	☐	2. Do you feel pain in your chest when you do physical activity?
☐	☐	3. In the past month, have you had chest pain when you were not doing physical activity?
☐	☐	4. Do you lose your balance because of dizziness or do you ever lose consciousness?
☐	☐	5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?
☐	☐	6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
☐	☐	7. Do you know of any other reason why you should not do physical activity?

I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction.

NAME _____

SIGNATURE _____

DATE _____

WITNESS _____

APPENDIX E

ProDem

THESE QUESTIONS WILL TELL US MORE ABOUT YOU. ALL OF YOUR ANSWERS ARE CONFIDENTIAL.

1. What is your birthdate?

☐☐ ☐☐ ☐☐
Month Day Year

2. What is your age?

☐☐
Years

3. What is your gender?

☐ ☐
Male Female

4a. Do you consider yourself to be of mixed racial background?

☐ YES ☐ NO

If YES, skip question 4b and answer question 4c.
If NO, answer question 4b and skip question 4c.

4b. Check the one box below that best describes your racial/ethnic background.

☐ 1 Asian or Pacific Islander (This area includes, for example, China, India, Japan, the Philippine Islands, Korea, Samoa, etc.)

☐ 2 Hispanic (Persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish Culture or origin, regardless of race)

☐ 3 Black or Negro (Persons having origins in any of the black racial groups of Africa)

☐ 4 White (Persons having origins in any of the original peoples of Europe, North Africa, or the Middle East)

☐ 5 Native American (Persons of Aleutian, Alaska Native, Eskimo or American Indian origin)

4c. If you are of mixed racial/ethnic background, write a "1" in the category you most identify with, a "2" in the next, etc. Leave blank any categories that you do not identify with.

☐ 1 Asian or Pacific Islander (This area includes, for example, China, India, Japan, the Philippine Islands, Korea, Samoa, etc.)

☐ 2 Hispanic (Persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish Culture or origin, regardless of race)

☐ 3 Black or Negro (Persons having origins in any of the black racial groups of Africa)

☐ 4 White (Persons having origins in any of the original peoples of Europe, North Africa, or the Middle East)

☐ 5 Native American (Persons of Aleutian, Alaska Native, Eskimo or American Indian origin)

5. On the scale below, please check the ONE answer that BEST describes the highest level of formal education you have COMPLETED.

☐ No formal education

☐ Grade school (1-4 years)

☐ Grade school (5-8 years)

☐ Some high school (9-11 years)

☐ High school graduate or graduate equivalent

☐ Vocational or training school after high school

☐ Some college

☐ Associate degree (AD or AA)

☐ College graduate (BA or BS)

☐ Some college or professional school after college

☐ Completed master's degree

☐ Completed a doctoral degree (Ph.D., J.D., M.D., D.D.S.)

6. What is your primary occupation? _____
(Please indicate whether retired or not)

7. If you have any known diseases or other medical conditions, please indicate by checking the boxes that apply.

YES	NO	
☐	☐	Arthritis of any joint If yes, where? _____ □ Osteoarthritis □ Rheumatoid arthritis
☐	☐	Hypertension
☐	☐	Coronary artery disease
☐	☐	Cancer If yes, what type? _____
☐	☐	Diabetes
☐	☐	Other _____

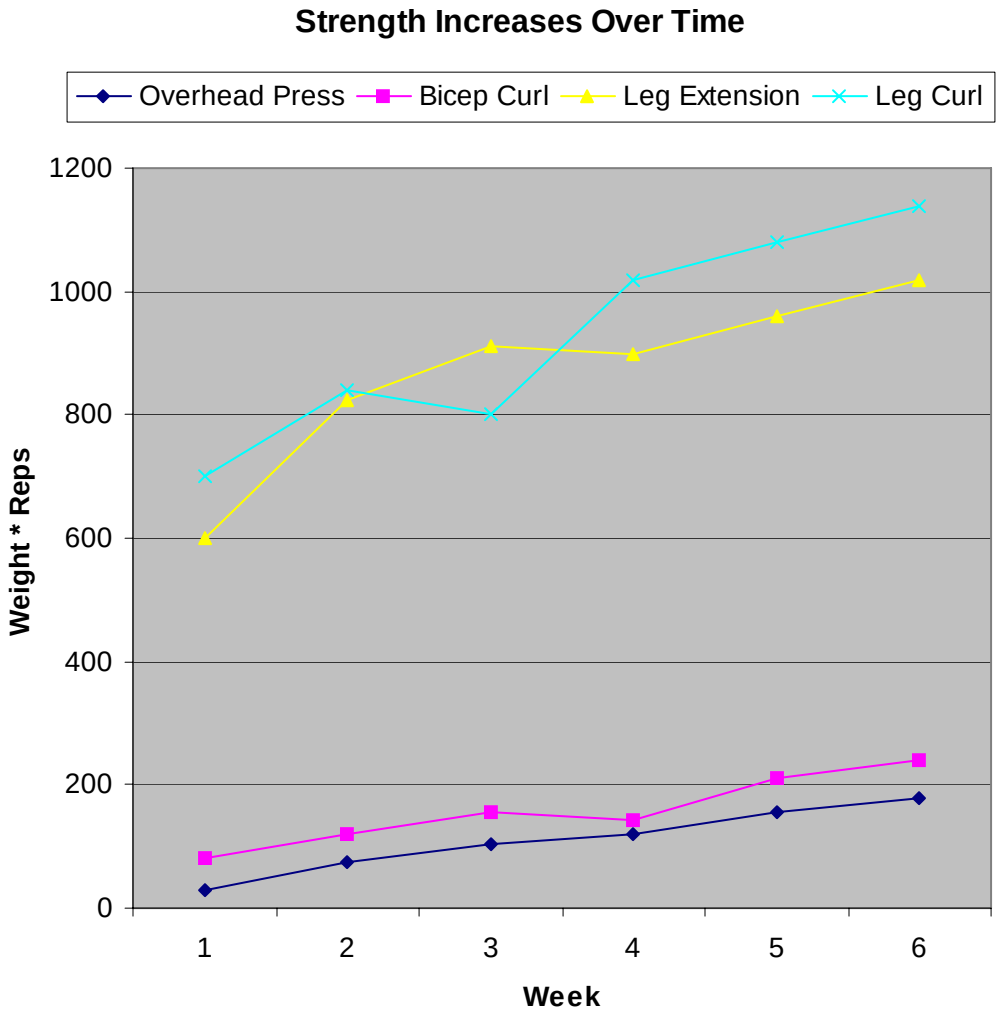
Personal Information:

Home Phone Number _____

Emergency Contact Number _____

APPENDIX F

Example of Graph Showing Strength Increases



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Weight Training in Older Adults: An Intervention for Psychological Empowerment
2004 ACSM Meeting – Indianapolis, IN