THE EFFECTS OF THERA-BAND RESISTANCE TRAINING ON HEALTH-RELATED QUALITY OF LIFE AND MUSCULAR STRENGTH IN ADULTS AGES 60-80

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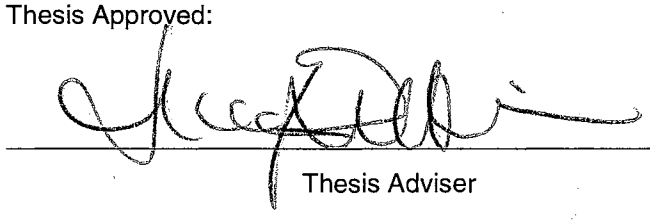

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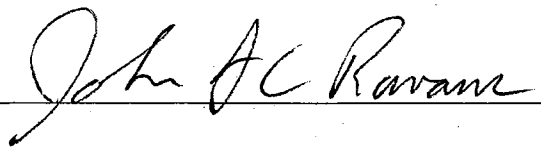

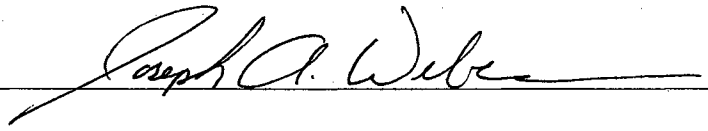

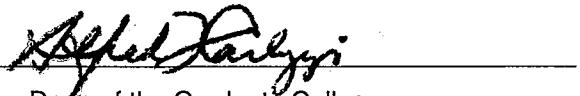

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PREFACE

This study was conducted to provide new knowledge pertinent to improving the quality of life of older African Americans. Quality of life concerns are different for each older individual. Objective or external observations and subjective or internal perceptions help to make up quality of life. It is a term that is used interchangeably with words such as life satisfaction, happiness and well-being. Quality of life is a multidisciplinary perspective that entails the biological, psychological, interpersonal, social, economic and cultural dimensions. It is essential that effective lifestyle interventions become implemented to improve the quality of life for older individuals. Health promotion programs have the potential to greatly impact the functional ability and quality of life of the elderly. The specific objectives of this research were to assess (a) health-related quality of life using the Medical Outcomes Study 36-Items Short Form Health-Related Quality of Life Survey and (b) muscular strength using the Sit and Stand and Arm Curl tests. A repeated measures analysis of variance (ANOVA) was used to analyze the data. Student Newman-Keuls post-hoc test procedure was conducted to determine where the significant differences existed.

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Chapter I

INTRODUCTION

The aging process is a universal occurrence that affects all individuals. It is an inevitable condition that causes significant sensory, motor and cognitive changes in response to old age. All humans do not age at the same rate. Some persons experience more rapid declines in physiological and psychological function during senescence than others (Fries & Crapo, 1981). Prior research indicates that aging is associated with hereditary and environmental factors such as nutrition, stress, smoking and physical activity (Bokovy & Blair, 1994).

The elderly are the fastest growing segment of the population. In 1900, life expectancy was approximately 47 years today it is approaching 80. This trend is expected to continue into the 21st century. The United States Census Bureau (1990) predicts that 39 million persons will be 65 years of age and older in the year 2010. This number will increase to 51 million adults, 65 years of age and older the following ten years. In addition, the oldest-old or persons 85 years of age and older is expected to rise to eight million Americans in the year 2030 (Fowles, 1991).

Exercise and Physical Health

Some common complaints that older adults present for not exercising include pain, weakness and stiffness in the joints. Old age and inactivity causes muscle atrophy, decreased blood volume and impaired immunity (Duong, 1999). Impaired immune function causes older persons to be at risk for reactivation of an earlier infection (Krohn, 1998). Cultural influences, lack of knowledge about fitness and inaccurate myths about exercise are factors that contribute to a static life (Butler & Lewis, 1977). Also, a lack of transportation and accessibility create problems for elderly persons that desire to stay fit. Older persons residing alone are at an increased risk for dependency.

A regular strength training program can reverse the loss of muscle mass and weakness in frail older persons (Schnirring, 1998). A loss of muscle mass is very common in older adults. The excretion of urinary creatinine, which reflects muscle creatinine content and total muscle

mass, decreases 50 percent between 20 and 90 years of age. Computer images show decreases in cross-sectional areas of the thigh, muscle density and increased intramuscular fat stores of individual muscles after 30 years of age. These changes are more pronounced in women (Imamura, Ashida, Ishikawa, & Fuji, 1983). Muscle atrophy results from a gradual and selective loss of muscle mass. The number of muscle fibers significantly declines in the midsection of the vastus laterals of autopsy specimens in older men ages 70-73 compared to young men ages 19-37 (Lexell, Henriksson-Larsen, Wimblod, & Sjostrom, 1983).

A reduction in muscle strength is a primary factor of normal aging. For instance, the Framingham study found that 40 percent of older women 55-64 years of age, 45 percent of women 65-74 years of age, and 65 percent of women 75-84 years of age were unable to lift ten pounds (Jette & Branch, 1981). The majority of these women reported not being able to perform certain tasks of household chores. Research indicates that isometric and dynamic strength of the quadriceps increases up to 30 years of age then begins to decline after 50 years of age (Larsson, Grimby, & Karlsson, 1979). It is estimated that strength declines 30 percent between 50 and 70 years of age. This is due to a selective atrophy of type II muscle fiber, which is most dramatic after 70 years of age. These myofibrils are fast twitch and low oxidative during performance. They are found in places such as the knee joint. Type I fibers are slow twitch and high oxidative during operation. The Copenhagen City Heart study (Danneskoild-Samsoe, Kofod, Munter, Grimby, & Schnohr, 1984) reported that knee extensor strength in a group of healthy adults 80 years of age was 30 percent lower than a previous study of adults 70 years of age (Aniansson, Grimby, Hedberg, & Krotkiewski, 1981). Thus, cross-sectional and longitudinal data indicates that muscle strength decreases approximately 15 percent per decade from 60 to 80 years of age then 30 percent the following decades (Murray, Duthie, Gambert, Sepic, & Mollinger, 1985). Prior studies show the majority of strength loss results from age-related decreases in muscle mass.

Exercise and Subjective Health

Self-rated health or one's own health perception is an important health outcome. Prior literature indicates that self-rated health is a strong indicator of mortality that is independent of

objective health (Idler & Benyamini, 1997). In addition, self-rated health is a predictor of well-being, quality of life and use of health care services (Ware & Sherbourne, 1992). It is a frequently utilized measure to calculate the life expectancy (van de Water, Boshuizen, & Perenboom, 1996). The primary determinant of subjective self-rated health is objective physical health or chronic conditions and disabilities for older adults. The relationship between chronic conditions, disabilities and self-rated health in older adults is well documented (Mourn, 1992). Self-rated health decreases as chronic conditions and disabilities increase.

Wallace et al (1998) conducted a multi-component disability prevention program on 100 older adults recruited at a senior center for a six-month randomized clinical trial. The experimental group received an exercise intervention, nutritional counseling and a home safety assessment. An outcome variable was the Medical Outcomes Study 36-Items Short Form Health-Related Quality of Life survey. Experimental subjects had significantly better scores on seven of eight Short Form 36 domains and fewer depressive symptoms than controls after the six-month intervention. Fontaine et al (1999) examined the effects of treatment induced weight loss on health-related quality of life in 38 moderately overweight adults. Older adults were assigned to either a program of lifestyle physical activity or traditional endurance activities. The Short Form 36 was administered a second time after the 13th week. Weight loss was associated with significantly higher scores relative to baseline, on physical functioning, role-physical, general health, vitality and mental health scales of the Short Form 36.

Resistance Training and Health

Resistance training can be a safe and inexpensive intervention that provides several health-related benefits for the elderly (Kirchner, 1999). Research shows that it allows older individuals to perform activities of daily living with greater ease and it counteracts muscle weakness and frailty. In addition, resistance training improves the ability of the muscle to develop tension. Several studies report that older persons have similar or greater percentage strength gains compared to young persons as a result of resistance training. For example, muscle strength

increased two to threefold over a three to four month period in muscle fibers recruited during training in this population (Frontera, Meredith, O'Reilly, & Evans, 1990).

The term "Resistance Training" as defined by (Tabers Cyclopedic Medical Dictionary, Edition 18, p. 1660, 1997) states:

> "Exercise in which an outside force is applied to a muscle, requiring it to develop greater tension. This is done to increase strength. If the resistance is applied by using weights, it is called mechanical resistance; if applied by a therapist it is called manual resistance."

Older persons can compete on a consistent basis like young adults in sports such as track and field, swimming and golf (deVries, 1981). They are attracted to activities that require a high level of stamina. For example, the New York City marathon had 200 participants 60 years of age and older, 20 participants 70 years of age and older and one participant 85 years of age take part in the run during the last decade (Ward, 1984).

It is recommended that older adults exercise two to three hours each week to reduce bone mineral loss in old age (Howley, 1997). Recent literature shows that high intensity resistance training can significantly increase bone formation in frail older adults (Andersen & Wadden, 1997). This reduces the risk for lower back pain, falls, tension and stress (Trotto, 1999). In addition, resistance training improves central nervous system recruitment of muscle, hypertrophy and force output (Kirkendall & Garrett, 1998).

Fitness Standards for the Elderly

Fitness performance standards are measures that allow older individuals to assess their physical condition. These values indicate whether or not the person is physically fit for their age. For instance, there is 20 percent less muscle tissue for a person 70 years of age than a person 20 years of age. It is estimated that 70 percent of women 70 years of age and older and 35 percent of men 70 years of age and older are unable to lift ten pounds. Sixty percent of women 70 years of age and older are unable to perform household chores such as sweeping and vacuuming (Rikli & Jones, 1999).

Some tests used to measure the physical status of older adults include the number of repetitions in 30 seconds the person can complete by rising from a chair with no arm support,

which indicates lower body strength. The number of times a five to eight pound weight is lifted in 30 seconds using the biceps muscles, which measures upper body strength (Rikli & Jones, 1999). The number of meters walked in six to eight minutes can be used to measure aerobic fitness (Rikli & Jones, 1999). Older persons should be allowed extended periods of time to progress and adapt to resistance training exercises.

Resistance Training for the Elderly

There are three guidelines the American College of Sports Medicine (1995) recommends for the intensity, frequency and duration of resistance training for older adults. First, individuals should perform one set of eight to ten exercises that train all the major muscle groups. For instance, some muscle groups include gluteus, quadriceps, hamstrings, pectorals, latissimus dorsi, deltoids and abdominal. Each set should involve 8-12 repetitions that elicit a perceived exertion rating of 12 to 13 (somewhat hard) on the Borg scale. Second, resistance training should be conducted at least twice a week with a minimum of 48 hours of rest between sessions. Third, sessions should not last longer than 60 minutes because of the negative effect on exercise adherence. Adherence should enable exercisers to complete total body resistance training sessions within 20 to 30 minutes.

Many strength resistance exercise programs are designed for all age groups. The activities help to prevent early loss of muscle tissue, increase muscle strength, muscle size and muscle endurance. Cress et al. (1999) reported that strength and endurance exercises increase skeletal muscle strength and aerobic capacity in older adults. This should be an integral component of an exercise regimen. Training should be progressive, tailored to the needs of the individual and stimulate all the major muscle groups (Duong, 1999). Evidence indicates a high rate of adherence for programs that are designed to meet the specific needs of the elderly (Ecclestone, Myers, & Patterson, 1998). Also, resistance training increases reaction time, work capacity, decreases muscle atrophy and prevents spinal injuries. For example, calisthenics are strength exercises that use muscle energy against resistance, which enables the body to grow and develop muscle tone (Powell, 1974).

There are several advantages that strength resistance training provides for the elderly. Page et al. (1993) assessed the influence of elastic bands on shoulder strength in a group of athletes. A 19.6 percent increase in eccentric external rotation torque was observed during the six-week intervention done three days per week. The exercises significantly increased shoulder strength and serve performance for the tennis players. Muscle strength improved five percent each day in a group of older men that trained at 80 percent of one repetition maximum for 12 weeks (Fontera, Meredith, & O'Reilly, 1988). There was significant increases of cross-sectional areas of types I thigh fibers and type II thigh fibers. Type II muscle fibers are fast twitch and low oxidative during performance. They are found in places such as the knee joint. Type I fibers are slow twitch and high oxidative during operation. Fiatarone (1990) performed a progressive resistance program for institutionalized adults 100 years of age and older. The absolute amount of weight lifted increased 175 percent and cross sectional area of the thigh muscle improved more than 15 percent after an eight-week intervention. Muscle strength increased more than 113 percent over a ten-week period for 100 frail nursing home residents 80 and 90 years of age and older (Fiatarone, O'Neill, & Ryan, 1994).

Resistance training is directly related to the health status of young and older adults. It improves health, creativity, self-confidence or self-esteem, general well-being and reduces pain (McAuley & Rudolph, 1995). Also, resistance training increases the quality of life or satisfaction, extends independence and provides a sense of accomplishment for older persons (World Health Organization, 1997). It is a comprehensive intervention for the preservation and enhancement of physical function for the final decades of life. Thus, Thera-Band resistance training was implemented as the method of exercise for older persons in this research.

Significance of the Study

The primary determinant of subjective self-rated health is objective physical health or chronic conditions and disabilities for older adults. The relationship between chronic conditions, disabilities and self-rated health in older adults is well documented (Mourn, 1992; Johnson). Self-rated health decreases as chronic conditions and disabilities increase. The majority of American

health care expenditures are for persons with chronic or long-term conditions (Rice, Hodgson, & Kopstein, 1985).

It is estimated that 250,000 adult deaths occur each year as a result of physical inactivity (Powell & Blair, 1994). Physical inactivity is a leading cause of death and disability for adults in the United States (Buchner, 1997). Past studies have reported the physiologic benefits of physical activity for older adults (Blair et al., 1996). For instance, a regular strength training program can reverse the loss of muscle mass and weakness, which is very common in frail older persons (Schnirring, 1998).

Past studies shows that older adults have similar or greater strength gains compared to young persons as a result of resistance training. Muscle strength increased two to threefold over a three to four month period in muscle fibers recruited during training in this population (Frontera, Meredith, O'Reilly, & Evans, 1990).

Thus, the purpose of this research is to determine the effects of Thera-Band resistance training on: (a) health-related quality of life in adults ages 60-80; (b) objective measures of muscular strength will include the sit and stand test, which indicates lower body strength and the number of times a five to eight pound weight is lifted using the biceps muscles to determine upper body strength. Cardiologists, exercise physiologists and rehabilitation nurses are professionals that could utilize these findings. Also, the results may help to increase knowledge about the benefits of Thera-Band training and willingness of older persons to participate in this exercise.

The Problem

The purpose of this study was to determine the effects of a ten-week Thera-Band resistance-training program on subjective health-related quality of life and muscular strength in African American adults 60-80 years of age.

Delimitations

The delimitations for this study include:

1. This research will be delimited to persons of African American descent.
2. This research will be delimited to 40 volunteers 60-80 years of age that reside in the community of Enid, Oklahoma.
3. This research will be delimited to two 25-30-minute exercise sessions a week for ten-weeks between September and November 2000.
4. The subjects will be assessed for health-related quality of life, sit and stand function and arm curl strength using the biceps muscles twice during the intervention.
5. This research will be delimited to five levels of progressive Thera-Band resistance training.

Limitations

The limitations for this study include:

1. Daily activities of the subjects other than the elastic band training exercises will not be controlled.
2. Subjects will be of African American descent.
3. Subjects will be volunteers from the Enid community and willing to participate in an elastic band training program.
4. Participation and adherence will be uncontrolled factors that could influence the results of the study.
5. No attempt will be made to control the daily life stresses the subjects will experience during the study.
6. No attempt will be made to monitor the daily food intake of the subjects during the research.
7. No attempt will be made to control social interactions of the subjects with family members, friends and others during the study.

Logical Assumptions

The following assumptions were made for this study:

1. The records experimental subjects maintain on the exercise activity chart will accurately reflect their adherence with the exercise program.
2. The experimental subjects will correctly perform the exercises using the proper techniques and safety the researcher demonstrates.
3. The experimental subjects will exert maximum effort on the sit and stand test and the number of times a five to eight pound weight is lifted using the biceps muscles.

Hypotheses

The hypotheses for this study include:

1. There will be no significant difference between the control group and experimental group on average scores of the physical component summary scale before and after the treatment.
2. There will be no significant difference between the control group and experimental group on average scores of the mental component summary scale before and after the treatment.
3. There will be no significant difference between the control group and experimental group on the sit and stand test before and after the treatment.
4. There will be no significant difference between the control group and experimental group on the number of times a five to eight pound weight is lifted using the biceps muscles before and after the treatment.

Definition of Terms

The following definitions and terms are included in this study:

1. Activities of Daily Living refers to one's ability to perform daily tasks such as bathing, dressing, eating and toileting (Tabers Cyclopedic Medical Dictionary, Edition 18, 1997).
2. Adherence refers to a state of continuing. Often used to describe people who continue to participate in a physical activity program (Juneau, Rogers, & De Santos, 1987).
3. Biceps is the large muscles at the front of the upper arm, which is responsible for pulling the arm upwards when flexed (ACSM, 1995).
4. Bodily Pain refers to the intensity of bodily pain and the extent it interfere with work (McHorney et al., 1992).
5. Cool down is a period of light activity following moderate to heavy exercise (ACSM, 1995).
6. Deltoid Muscle is the triangular shaped muscle that surrounds the lateral, anterior, and posterior sides of the shoulder joint. It is responsible for lifting the arms outwards and rotating the upper trunk towards the front and rear (ACSM, 1995).
7. Dynamic Training refers to shortening of the muscle with the joint moving through a full range of motion (ACSM, 1995).
8. Flexibility Training refers to static or "held" stretches performed three times a week, held for 5 to 40 seconds per stretch, one to five repetitions per stretch and increased until mild muscular tension develops without pain (ACSM, 1995).
9. Gastrocnemius and Soleus Muscles are located on the posterior side of the lower leg. The muscles work together to flex the foot (ACSM, 1995).
10. General Health Perceptions is one's overall perception of their health (McHorney et al., 1992).
11. Health-Related Quality of Life refers to one's level of satisfaction or confidence with their physical, psychological, emotional and social functions of everyday activities (McHorney et al., 1992).

12. Home-Based Exercise is physical activity outside a formal group structure, which an individual completes alone (King, Taylor, Haskell, & Debusk, 1990).
13. Instrumental Activities of Daily Living refers to one's ability to perform daily tasks such as answering the telephone, housekeeping, laundry, light meal preparation, running errands and shopping (Tabers Cyclopedic Medical Dictionary, Edition 18, 1997).
14. Isokinetic contraction is a muscle contraction with controlled speed, allowing maximal force to be applied throughout the range of motion (Gale Encyclopedia of Medicine, Edition 1, 1999).
15. Isometric contraction is a muscle contraction in which the muscle length is unchanged (Gale Encyclopedia of Medicine, Edition 1, 1999).
16. Mental Health is an individual's subjective feeling in regards to their state of mind. It includes emotions of nervousness, happiness and calmness (McHorney et al., 1992).
17. One Repetition Maximum (1RM) is the maximal force that can be exerted in a single contraction by a muscle group (ACSM, 1995).
18. Physical Function refers to one's ability to engage in various activities like running, vacuuming, carrying groceries, climbing stairs, bending, walking and bathing (McHorney et al., 1992).
19. Progressive Strength Exercises is an activity program designed to enhance one's muscular skeletal development through a slow and gradual progression of increased weight loads over time.
20. Quadriceps and Biceps Muscles are located on the front and rear of the thigh, respectively. The muscles are antagonistic muscles that regulate extension and flexion of the knee joint (ACSM, 1995).
21. Role Emotional refers to one's ability to do work or other activities in a usual safe and careful manner (McHorney et al., 1992).
22. Role Physical is an individual's limitation, set back, lack of progress and difficulty with work or other activities (McHorney et al., 1992).

23. Senescence is the process or condition of growing old (Tabers Cyclopedic Medical Dictionary, Edition 18, 1997).
24. Social Function refers to the frequency and extent health problems interferes with normal social activities (McHorney et al, 1992).
25. Sprain is a stretching or tearing of the ligament tissues surrounding a joint, resulting in discoloration, swelling and pain (Tabers Cyclopedic Medical Dictionary, Edition, 18, 1997).
26. Strain is the over stretching or tearing of a muscle or tendon (Tabers Cyclopedic Medical Dictionary, Edition, 18, 1997).
27. Thera-Bands are color-coded elastic bands that progress in thickness to provide increased resistance (The Hygenic Corporation, 1998).
28. Thera-Band Exercise Training refers to the use of looped resistive elastic bands that provide resistive force for the development of muscular strength (Lazowski, Ecclestone, Myers, & Patterson, 1999).
29. Triceps is the muscles at the back of the arm, which is responsible for pulling the arm downwards when extended (ACSM, 1995).
30. Vitality refers to one's physical or mental vigor with life (McHorney et al, 1992).
31. Warm-up is physical activity of light to moderate intensity prior to a workout (ACSM, 1995).

Chapter II

REVIEW OF THE LITERATURE

It is estimated that 250,000 adult deaths occur each year as a result of physical inactivity (Powell & Blair, 1994). Physical inactivity is a leading cause of death and disability for adults in the United States (Buchner, 1997). Exercise is the most common intervention for the prevention or management of disability (Jette et al., 1996). The United States Preventive Services Task Force (1996) highly recommends professional referral and counseling for physical activity among older adults. Past studies shows that physical activity is greatly reduced in older adults compared to young adults (National Heart Foundation of Australia, 1990).

A primary goal of exercise is to rebuild the psychological, physical and social functions that are loss for older adults (Schroeder, 1987). Regular physical activity can help to minimize and reverse these negative conditions experienced during old age (World Health Organization, 1997).

Strength Training among the Elderly

Research indicates that resistance-training interventions can produce strength gains in older adults (Macera, 2000; Damush & Damush, 1999; Fiatarone et al., 1994; Morganti et al., 1995; Simonsick, 1993; McCartney, Hicks, Martin, & Webber, 1996). Morganti et al. (1995) conducted a progressive resistance training study of 39 apparently healthy older women (mean age 59.5 years). Subjects were assigned to a control group or progressive resistance-training group that trained twice a week for 12 months. Testing was performed at baseline, six months and 12 months for the control group and monthly for the experimental group. The experimental group trained at 80 percent of one repetition maximum or more on the lateral pull down, knee extensor and double leg press apparatus. A result was significant if its probability value was less than or equal to .05 ($P \leq .05$). Repeated measures analysis of variance showed that one repetition maximal significantly increased for all muscle groups trained in the experimental group compared to the control group ($P < .0001$). Increases of $73.7 \pm 12\%$, $35.1 \pm 3\%$ and $77.0 \pm 5\%$,

respectively, for knee extension, double leg press and latissimus pull-down in the progressive resistance training group and 12.7% ± 8%, 3.7% ± 3%, and 18.4% ± 4%, respectively for the control group, were observed. It is estimated that 50 percent of the gains occurred during the first three months for the knee extensor and lateral pull down exercises and 40 percent for the double leg press. The data revealed that high-intensity strength training results in significant strength gains in postmenopausal women. Simonsick et al. (1993) found that strength training improves muscle strength, which helps older adults maintain their functioning and mobility during late-life. The investigators examined the relationship between recreational physical activity among apparently healthy older adults and functional status, incidence of selected chronic conditions and mortality over three and six years. Data was collected from the Established Populations for Epidemiological Studies of the Elderly. Moderate to high physical activity reduced the risk of physical impairments over three years. The results suggest that strength training may positively affect multiple domains of health-related quality of life (e.g., bodily pain, physical and social functioning, and psychological distress). However, many older adults do not have access to traditional resistance training equipment (e.g., weight machines) to reap potential health benefits.

Most resistance training interventions have utilized weight machines at a facility or clinical laboratory (McCartney, Hicks, Martin, & Webber, 1996). For example, McCartney, Hicks, Martin, & Webber (1996) conducted a two year randomized control trial of 142 apparently healthy subjects 60 to 80 years of age. Pretest and posttest measures were given for dynamic strength. Dynamic strength was defined as the heaviest weight that could be lifted once throughout a complete range of motion. Movements tested were unilateral arm curl, military press, leg press and bilateral bench press. Data was analyzed using a four-way mixed analysis of variance. Statistical significance was set at the .05 probability level. There was no change in the one repetition max of the control group over the two-year period but the exercise group demonstrated significance increases of 85%, 90%, 53% and 32% for the arm curl, military press, bench press and leg press, respectively ($p < .0005$). Long-term weight training proved to be a safe and effective intervention for older adults. Muscle strength and size increased each year. The results suggest that after two years of twice a week resistance-training subjects had not yet attained their

maximum strength potential. This pattern indicates that ongoing resistance training for older adults may be an excellent intervention for counteracting normal strength losses associated with old age.

Alternative forms of resistance training may be more accessible and feasible for older adults to maintain long term. Jette et al (1996) conducted a randomized control trial of 102 non-disabled community-dwelling older adults 66 to 87 years of age. Subjects viewed a videotaped, home-based strength-training program using elastic bands to report on its effectiveness in improving muscle strength, psychological well being and health status. Effectiveness was based on change in upper and lower extremity muscle strength. Results showed a trend of overall increase in knee extension torque (3.2 ± 1.2 verse 0.2 ± 1.1; P value .074), knee flexion (5.8 ±1.2 verse 3.3 ± 1.1; P value .117) and maintenance of shoulder flexion torque (-. 03 ± 0.7 verse –1.9 ± 0.6; P value .067) after the intervention for the exercise group compared to the control group. Also analysis revealed adults aged 72 years or less demonstrated a ten percent improvement in knee extensor strength compared to the control group (P = .007). There was not a significant change in knee extensor torque regardless of treatment group for subjects 72 years of age and older.

Damush & Damush (1999) conducted an eight-week resistance training intervention using elastic bands in 62 community-dwelling women with a mean of 68 years. Subjects were randomly assigned to either an exercise group or control group. Pretest and posttest intervention assessments were given for muscular strength. A three-repetition maximum was used to assess maximum strength by measuring the maximum amount of resistance moved in three consecutive repetitions with correct form through the full range of motion for each exercise (Pratley et al., 1994). The subject attained their maximum when they could no longer complete another three repetitions with full range of motion and perceived the effort to be "Somewhat Hard" on the Borg scale. Strength was assessed in both the left and right hands with a Jamar hand dynamometer. Subjects were instructed to grip the device with their maximal effort. Grip strength was assessed three times in each hand with the highest value being retained for analysis. Repeated measures analysis of variance was computed to determine baseline strength differences between the

groups and the effects of resistance training on strength changes. Boneferroni adjustment indicated the effects had to be significant at the .01 probability level to protect against a Type 1 error. There was not a significant difference at baseline for the groups on any strength scores: latissimus dorsi ($p < .67$), pectorals ($p < .47$), quadriceps ($p < .23$), left grip ($p < .92$) and right grip ($p < .45$). Strength significantly increased for the exercise group compared to the waiting list control group on pretest to posttest assessments for the latissimus dorsi ($p < .0001$), pectorals ($p < .01$) and quadriceps ($p < .0001$). In addition, the exercise group on average had a 19.7% increase in latissimus dorsi strength, 27.7% increase in quadriceps strength and a 16.5% increase in pectoral strength after participation in the eight-week strength training intervention. These results show that modest strength gains in healthy older women can be achieved with inexpensive equipment in a short time period.

Strength is maintained with moderate activity during the developing years, which can prevent functional limitations in later life (Macera, 2000). Macera et al. studied 3,658 adults between 30 and 52 years of age. Researchers evaluated muscular strength performance to study the association between strength maintenance and functional limitations in later life. Subjects' responses to a 1990 survey were used to determine their "functional health status" or ability to perform light, modest, and strenuous recreational, household, daily living and personal tasks. Seven percent of men and 12 percent women reported one or more functional limitations after a five-year follow up. Subjects that ranked the highest in physical fitness had significantly less chance of suffering functional limitations five years later.

Strength is gained through resistance training in the latter years. The process is slower in older adults. It is recommended that older adults exercise at a comfortable rate to prevent injuries. For example, strains are muscle pulls and sprains are ligament pulls. They range from mild unto severe. Immovable joints cause minor stiffness in older adults (Duong, 1999). Postural abnormalities include a round shoulder and curved back. The loss of muscle strength and joint flexibility increases the risk of poor posture in older persons. This interferes with balance, breathing and vertebral movements such as raising the arms overhead and standing from a sitting position.

There are several common sense guidelines with regards to resistance training for older adults that should be followed (ACSM, 1995). First, the main purpose of resistance training should be to develop sufficient muscular fitness, which may enhance one's ability to live a physically independent lifestyle. Second, health professionals should closely supervise and monitor the initial resistance training sessions. These individuals should be knowledgeable about the special needs and capabilities of the elderly. Third, minimal resistance should be employed the first eight weeks to allow for adaptations of the connective tissue elements. Proper training demonstrations and breathing techniques should be provided for all the exercises to be performed during the program. For example, older individuals should be instructed to maintain their normal breathing during the exercises. Fourth, the number of repetitions should be increased prior to the resistance to achieve an initial overload as the training effect occurs. Fifth, the resistance should be set to allow the individual to perform at least eight repetitions. Sixth, exercises should be performed in a manner with the speed controlled. For instance, no ballistic movements should be done. All exercises should be performed in a range of motion that is free from pain or the maximum range of motion that does not elicit any pain. Multi-joint exercises should be chosen over single-joint exercises. Seventh, machines should be used as opposed to free weights during resistance training. Machines require less skill, protect the back and stabilize the user's body, which allows the person to begin with a lighter resistance. It is essential that over training does not occur. A minimum number of two training sessions a week is required to produce positive physiological benefits. Additional sessions are neither desirable nor productive depending on the circumstances. Eighth, arthritic individuals should not participate in resistance training during active periods of pain or inflammation.

Compliance for In-Home Resistance Training Programs

It is assumed that class or group based physical fitness programs are the dominant type of exercise instruction in the United States (Dishman, 1988). Prior literature suggests the majority of older Americans desire to participate in physical activity on their own, outside a formal group structure (King, Taylor, Haskell, & Debusk, 1990; Dishman, Sallis, & Orenstein, 1985). In addition,

they are more likely to perform moderate intensity activities compared to high intensity or group exercise protocols (Dishman, Sallis, & Orenstein, 1985). It is believed that lower intensity exercises are safer and more effective for older adults than high intensity activities. For example, most community exercise programs are low to moderate intensity, progressive and done once or twice a week (Myers & Gonda, 1986). Some advantages of home-based exercise training include increased convenience, flexibility and a greater appeal for a large proportion of the American population (King, Taylor, Haskell, & DeBusk, 1990). Home-based resistance training is an attractive alternative for older adults with disabilities because facility accessibility, psychological barriers and transportation are key obstacles to regular exercise (Dishman & Sallis, 1994).

Past studies show that home-based exercise programs that are supervised through the telephone and mail are effective for maintaining high levels of participation and adherence among middle-aged adults (Juneau, Rogers, & De Santos, 1987). Dishman (1988) summarized a review of the adherence literature stated that among adults the drop out rate is 50 percent or greater within the initial 6 to 12 months in a typical supervised exercise setting. Jette et al (1996) conducted an in-home strength training strategy called Strong-for-Life designed specifically for older adults. One hundred and two non-disabled older adults 66 to 87 years of age were randomly assigned to either a progressive resistance training group or control group. Subjects performed an average of 30 sessions or two exercise sessions per week for 15 weeks. Average adherence rates for this program were 58 percent compared to adherence rates of 75 percent or higher for a similar protocol with middle-aged adults 50 to 65 years. Home-based exercise programs for participants older than 70 years of age may require more supervision, training visits and frequent telephone follow-up to maintain adherence and maximize potential benefits. Subjects lose their exercise induced health benefits because they are not maintained by sustained adherence.

Jette et al. (1998) examined the factors associated with exercise participation and adherence in 102 sedentary, functionally limited, community-dwelling adults 60 to 94 years of age. Subjects were randomly assigned to 26-weeks of progressive resistance training using elastic bands. The overall adherence goal was to complete the program three times a week the

entire 26 weeks of the study utilizing an agreed upon level of resistance for most exercises. Simple behavioral incentives (Lachman et al., 1997) were used to promote subject's adherence to the exercise prescription. For instance, subjects received a crisp new dollar bill for returning each exercise calendar, sticker if the exercise goal was achieved for each calendar period and a color magnet for progression to the next level of resistance. Subject monitoring was achieved by periodic telephone calls from the therapist. Telephone contacts were made bimonthly during the first three months and monthly the remaining three months of the study. Additional calls were given if the subjects encountered difficulty. Subjects were instructed to identify obstacles harmful to exercise adherence and strategies for overcoming these barriers. They were informed to notify the monitoring therapist if further assistance was needed.

Calendars are a typical methodology used in exercise studies (Ettinger et al., 1997). Subjects were instructed to record the date, color of elastic band used and the level of perceived exertion for each exercise session. Each calendar covered a two-week period and was returned to the therapist in a self-addressed, stamped envelope. Calendar data provided for two outcomes: First, exercise participation rate was calculated as the total number of exercise sessions performed divided by the total number of exercise sessions possible. For example, three times/week x 26 weeks = 78 sessions. Second, exercise adherence was defined as the number of calendar periods that the subject exercised with the agreed upon level of resistance (elastic band) divided by the total number of calendar periods. Fourteen calendar periods were used to cover participation over the 26-week intervention due to the variation in the day of the week when each subject started the program. The participation rate was 93 percent for 97 subjects that provided calendar data over the 26-week intervention. Fifty-eight percent of subjects achieved participation rates of 100 percent or greater. A participation rate of 90 percent was accomplished by 76 percent of subjects. The adherence rate was high with at least 78 percent of the subjects adhering to the recommended frequency and intensity of the exercise program for 11 of the 14 calendar periods.

This high rate of participation is similar to participation rates reported in other home-based studies with middle-aged adults (Juneau et al., 1987). Also, it is higher than previous exercise studies conducted with older adults (Daltroy et al., 1995).

The high adherence rate for the agreed upon intensity demonstrates the willingness and ability of sedentary disabled older adults to maintain levels of recommended exercise intensity and frequency in home-based strength training programs. In addition, the high adherence and participation rates suggest the cognitive and behavioral techniques were effective reinforcements for the exercise program and motivational tools for the subjects throughout the six-month intervention. An overall participation rate of 58 percent was achieved in an earlier study, which used the same strength-training program but did not employ cognitive behavioral strategies (Jette et al., 1996). For instance, two initial exercise training home visits were done by a physical therapist, frequent telephone contacts were made to monitor and discuss each subject's progress with the program and simple behavioral reinforcement throughout the intervention was designed to enhance participation and adherence rates. Telephone calls with the monitoring therapist averaged seven to eight for thirty minutes over the study period. This is consistent with approaches utilized by others (Juneau et al., 1987).

Results of exercise adherence were associated with several psychological variables including attitudes towards exercise, exercise sense of control, confusion and depressed mood. Adherence was highest among subjects with a positive attitude towards exercise, strong sense of control over exercise, lower levels of confusion and a greater degree of depressed mood. There was a significant inverse association with adherence levels and the number of new medical conditions that occurred during the intervention and the number of bodily systems with disease. Results suggest that knowledge of physical health factors may be important predictors for the frequency of exercise participation. Also, awareness of psychological profiles is important to identify subjects that would adhere or need assistance with adherence to a specific home-based exercise program. The findings are relevant to the design of future home-based exercise interventions.

Bandura (1997) suggests that beliefs related to exercise are important motivational factors involved in maintaining an exercise program. For example, subjects that viewed exercise as desirable, beneficial for their health, and felt they had greater control over their exercise behavior were more likely to attain their exercise goals. Subjects that believe exercise is valuable and a task that can be accomplished will invest more time and effort to achieve their goals.

Interventions targeted at improving the physiologic health and function through exercise should include a focus on psychological variables such as belief about one's control over their exercise behavior (Lachman et al, 1997) in an effort to maximize adherence. The connection of psychological factors to exercise adherence may create profiles of older adults that are unlikely to meet the levels of program adherence needed to produce health benefits. This could lead to the development of strategies and protocols to facilitate long-term adherence of older adults in exercise programs (Public Health Service, 1990). Also, knowledge of psychological factors may assist investigators when estimating attrition rates in prospective studies and enable improved sample size calculations when designing home exercise studies.

A telephone contact is a time efficient and effective strategy for assessing participation in a home-based resistance program. King et al. (2000) conducted an investigation to compare the effects of moderate intensity endurance and strengthening exercises (Fit & Firm) verse stretching and flexibility exercises (Stretch & Flex) in 103 community-dwelling adults 65 years of age and older. Subjects were randomized to 12 months of either of the two interventions. Measurements included functional capacity or endurance, muscular strength, flexibility, subjective physical performance and perceived functioning and well being. Subjects were contacted by a trained health educator each week during the first month of the intervention, every other week the next two months and monthly the remainder of the intervention. The purposes of the calls were to encourage participation in the exercise program, provide problem-solving strategies to overcome exercise adherence and remind subjects to return their exercise logs. The telephone calls lasted an average of 12 to 15 minutes. Average monthly adherence rates were calculated across the 12-month period as a percentage of exercise sessions prescribed for the month. Exercise adherence rates were determined for all subjects randomized. Subjects received a zero for the month in

which adherence data was missing. Exercise adherence was significantly higher for the home-based condition (Fit & Firm-50%; Stretch & Flex-43%) compared to the class based condition (Fit & Firm-27%; Stretch & Flex-29%). The results suggest that telephone contacts may provide a convenient means for supporting regular exercise participation.

Jette et al. (1999) conducted a six-month in-home progressive resistance program of 215 older adults. Subjects were randomly assigned to either an exercise group or control group. Telephone follow-up was provided to support and monitor progress. Subjects were instructed to call with questions or concerns. The cognitive behavioral technique achieved a participation rate of 89 percent compared to 58 percent in a similar study without any cognitive and behavioral strategies. The frequency of telephone contacts can be reduced after the exercise program has been established.

A major challenge of an exercise-training program is sustaining compliance, which is low among older adults (Lindsay, 2000). Lindsay (2000) conducted a study of 424 patients 40 to 64 years of age that were not receiving any vigorous activity. Patients were randomly assigned to one of five intervention levels after a comprehensive examination. Vigorous and moderate activity levels significantly improved in the intervention groups compared to the control group and were highest for subjects that attended an interview and received vouchers. Alternative interventions are needed to help older adults maintain their commitment to exercise.

Pre-exercise screening assessments are used to identify any potential problems or contraindications to exercise (Cardinal & Cardinal, 1995). An exercise program should include a warm-up, exercise and cool down period. The initial period entails light activity such as basic stretches performed with large muscle groups. This will reduce the probability for exercise related physical injury. Range of motion, flexibility and static stretches are exercises that improve activity of daily living skills. The cool down period involves low level activities like walking in place and normal breathing (Duong, 1999).

Also, older adults should receive health education, psychosocial support and risk factor management with the exercise strategy. The exercise specialist should be certified in cardiopulmonary resuscitation, which is the basic cardiac life support, to ensure competency.

There are several techniques used to determine an exercise prescription for older persons. For instance, rating of perceived exertion, anaerobic threshold, lactate and metabolic equivalents help to define reasonable outcomes.

Strength Testing Interventions

Many tests can be used to assess muscular strength. A popular test is a one-repetition maximum. Strength is measured as the heaviest amount of weight that can be lifted through a normal range of motion (Franks & Howley, 1989). The same fitness test can be used with simple adaptations for older adults (Howley & Franks, 1997). The arm curl test can be used to determine the number of times a five to eight pound weight is lifted in thirty seconds using the biceps muscles, which measures upper body strength (Rikli & Jones, 1999). A five to eight pound weight can be used to prevent injury in this older adult sample. The strength test should begin with a warm-up set to avoid injury and familiarize the subjects with the weight (Damush & Damush, 1999).

The ability to stand from a seated position is an important measure of physical function in older adults (Kelly et al., 1976). It is estimated two million Americans 64 years of age and older experience difficulty rising from a chair (Dawson et al., 1987). Chair rise is assumed to be the most biomechanical demanding functional task (Riley et al., 1991). For example, it yields higher peak hip contact pressures, and requires greater moment and range of motion at the knee compared to gait or stair climbing (Berger et al., 1988). In addition, balance is compromised during movement from an intrinsically stable seated position to a dynamically stable standing position (Riley et al., 1991).

Some variables that influence the ability to rise from a chair include balance, choice of chair strategy, chair height, upper body strength and lower body strength (Hughes et al., 1994). It is believed that knee extensor strength is a key factor in the ability to rise from a chair because knee extension moment is the largest of the lower extremity joint moments produced during chair rise (Ikeda et al., 1991). Also, knee extension moment increases when chair height decreases. It is the only lower extremity joint moment that is strongly dependent on chair height (Rodosky et

al., 1989). A chair rise becomes more difficult when chair height decreases (Weiner et al., 1993). Young (1986) found that healthy elderly women might be at, or near the threshold of knee extensor strength required for rising from a chair.

Exercise-Related Quality of Life in Older Adults

It is essential that effective lifestyle interventions become implemented to improve the quality of life for older individuals. Quality of life is a term that is used interchangeably with words such as life satisfaction (Laborde & Powers, 1980), happiness (Shin & Johnson, 1978) and well-being (Carstensen & Cone, 1983). It is a multidisciplinary perspective that entails the biological, psychological, interpersonal, social, economic and cultural dimensions (Flanagan, 1978). Quality of life can be perceived as the level of satisfaction or confidence with one's conditions, relationships and surroundings relative to the available options (Goldsmith, 1996). Two indicators of quality of life include environmental and demographic variables such as age, size of family, type of family, and urbanization status (McKie, 1993; Wallace, 1974). Melon (1980) suggests that quality of life consists of hope for the future, land, adequate food, clothing, shelter, income, employment opportunities, maternal and child health and family and social welfare.

Society assumes that older adults place a higher value on quality compared to quantity of life (Institute of Medicine, 1996). This is not consistent with past studies. Prior literature suggests that improved health and length of life are important for older adults (Kaplan, Bush, & Berry, 1978). For instance, a recent study of hospitalized person's age 80 years and older found few individuals willing to trade quantity of life to improve quality of life in the last days (Tsevat et al., 1998).

Quality of life concerns are different for each older individual. It encompasses the objective or external observations and subjective or internal perceptions (Birren & Dieckmann, 1991). For instance, it comprises the ability to make judgments and solve problems, recall recent and past events, conduct business and financial matters, and pursue hobbies and interests. Also, it consist of starting and maintaining new relationships, recognizing immediate family members and friends, experiencing emotions, knowing oneself, controlling bladder and bowel and having

effective communication (Post & Whitehouse, 1995). A lot of these traits are lost for older persons. Health promotion programs have the potential to greatly impact the functional ability and quality of life of the elderly (Davis, Leveille, Favaro, & Logerfo, 1998).

Autonomy, and respect of treatment refusal, helps to determine the quality of life for nursing home residents (Post & Whitehouse, 1995). The Institute of Medicine (1986) published a major report that stressed the quality of care appropriate for institutionalized residents. In addition, the United States Department of Health and Human Service Advisory Panel on Alzheimer's Disease (1991) stated that priority should be placed on quality of life measures, broadly defined, not mere survival.

It is a decline of mental function in a viable body that raises significant questions for medical ethics and society. Research shows that modern industrial cultures rely on technology and productivity, which creates a bias against the elderly. It is imperative that human dignity remains respected for these individuals. For example, emotional and relational stability can be enhanced despite problems of old age. It is the touch of a hand not technology that demonstrates the greatest respect for older persons.

Jette et al. (1998) conducted a study of 102 sedentary, functionally limited, community-dwelling adults 60 to 94 years of age. Subjects were randomly assigned to 26-weeks of progressive resistance training using elastic bands. The Profile of Mood States Short Form was used to assess six different mood states (McNair, Lorr, & Droppleman, 1981). The Profile of Mood States Short Form consists of 30 items rated on a five-point scale, from "not at all" to "extremely." Mean scores were computed across items, with higher scores indicating greater support of the designated mood. Coefficient alpha internal consistency reliability for the sample on each of the six mood scales was Tension-Anxiety (.83), Depression-Dejection (.84), Vigor (.86), Fatigue (.84), Anger (.86) and Confusion (.62). Results revealed subjects with baseline mental confusion as assessed by Profile of Mood States were less likely to follow the exercise plan. The finding suggests that home-based exercise may not be ideal for older adults with some mental confusion. Also, results showed that a depressed mood was positively associated with adherence to the Strong for Life program. Lynch and colleagues (1992) reported similar results in

an exercise intervention for older adults with elevated cholesterol levels. There are several explanations for this finding: First, subjects unhappy may have been more willing to please the monitoring therapist. Second, depressed subjects may have been more likely to set realistic goals for themselves, thereby leading to greater success in achieving goals (Abramson, Seligman, & Teasdale, 1978). Finally, depressed subjects may have adhered more closely to the intervention because they associated performance of the program with an enhancement of mood. Subjects achieved a mean Short Form 36 physical function score of 64.4 where 0 = maximum disability and 100 = no disability.

King et al. (2000) conducted an investigation to compare the effects of moderate intensity endurance and strengthening exercises (Fit & Firm) verse stretching and flexibility exercises (Stretch & Flex) in 103 community-dwelling adults 65 years of age and older. Subjects were randomized to 12 months of either of the two interventions. Measurements included self-rated physical performance and perceived functioning and well-being. Perceived functioning and well-being or Health-Related Quality of Life was assessed utilizing scales from the Medical Outcomes Study. Measures included self-rated physical functioning, bodily pain, emotional health, energy/fatigue and sleep apnea. Stretch and Flex group reported greater improvements on the self-rated Physical Health index relative to the Fit & Firm group. In addition, the Stretch & Flex group indicated significant improvements in daily pain relative to the Fit & Firm group. Scores remained stable for the Psychological Health Index for groups across the study period. Significant improvements occurred for the Fit & Firm group over time on the Medical Outcomes Study energy/fatigue scale for pretest and posttest assessments (paired-comparisons t test = 2.15, $p < .037$, two-tailed). The results of this study underscores the importance of implementing a specific regimen of flexibility exercises as a routine part of an exercise program aimed at older adults (Hurley & Hagberg, 1998). This is vital for older men because of reduced flexibility relative to female peers.

Jette et al (1996) conducted a videotaped, in-home, strength training program to report on its effectiveness in improving psychological well-being, and health status in 102 non-disabled older adults 66 to 87 years of age. Eight dimensions of health status were assessed: physical

functioning, role limitations as a result of physical or emotional health, social activity limitations due to health, current health perceptions, pain, psychological distress/well-being and energy/fatigue. These dimensions are likely to be affected by exercise. These dimensions were measured using scales from the Medical Outcomes Study Short Form 36. Each standardized scale ranges from 0 to 100, where 0 = worst possible function and 100 = best possible function in that dimension. The reliability and validity of the Short Form 36 has been shown to be sensitive to change in exercise training studies involving non-disabled older adults.

Several dimensions of psychological health improved, especially for men and older participants. Consistent with prior studies (Blumenthal, Emery, Madden et al., 1989), older male subjects reported a significant difference in perceived anger after their participation in the program. For example, a significant decrease in anger occurred in older men aged 72 years or less ($P = .01$) in the experimental group compared to the control group.

Male exercisers of all ages indicated feeling more lively, active and energetic after the intervention. Men in the control group showed a significant decrease in feelings of vigor and pep from the pretest to the posttest. Thus, the intervention served to enhance psychological well-being and minimize declines that might otherwise prevail among older men. Older men in the exercise group reported decreased tension compared to the control group. The exercise program may have reduced feelings of nervousness, uneasiness, and shakiness for older men. These findings are consistent with other studies that have demonstrated psychological benefits in middle-aged and older subjects that exercise (Blumenthal, Emery, Madden et al., 1989).

Women reported no psychological benefits after participation in the program, and older women appeared to report increased confusion following their participation in the program. Future studies should explore why women do not respond to this program as well as men, identify potential negative implications of program termination and strategies for maintaining involvement and commitment to the exercise program.

Significant improvement in social functioning occurred for older subjects after participation in the study, which indicates increased social contact with family, friends, neighbors and groups. A substantial decline in social functioning occurred for older members of the control

group. This finding implies that participation in the exercise program may have permitted more contact with friends and family by enhancing mobility, thereby curtailing a reduction in social function often prevalent among the oldest old. There were no measurable improvements in other dimensions of health status. This may be due, in part, to a ceiling effect for these variables inasmuch as all subjects were non-disabled (Stewart, King, & Haskell, 1993).

Jette, Lachman, Giorgetti, Assmann et al (1999) conducted a six-month investigation to determine whether an in-home resistance training program achieved quality of life benefits in older adults with disabilities. Two hundred and fifteen subjects were randomly assigned to either resistance training or a control group. The Profile of Mood States Short Form was used to assess six different mood states (McNair, Lorr, & Droppleman, 1981). The instrument contains 30 items rated on a five-point scale ranging from "not at all" to "extremely." Measurements included tension/anxiety, depression/dejection, vigor, fatigue, anger and confusion. Mean scores were computed across items with higher scores showing greater support of the designated mood. There was not a significant difference between the resistance-training group and control group on psychological mood states for pretest and posttest scores. Psychological benefits did not occur from the exercise training. Past studies show that psychological change has occurred primarily for subjects that started with moderate or clinical levels of depression.

Damush & Damush (1999) conducted an eight-week resistance training intervention using elastic bands in 62 community-dwelling women with a mean age of 68. Subjects were randomly assigned to an exercise and control group. Pretest and posttest assessments were given for health-related quality of life. Researchers distributed a self-administered battery of Health-Related Quality of Life measures. Health and social functioning scales utilized in the questionnaire were measures identified in the psychological and health literature as Health-Related Quality of Life concepts (Stewart & King, 1991). Two summary Health-Related Quality of Life measures were created: Mental and Physical Health Functioning. The two summary scores comprised ten Health-Related Quality of Life measures from the Medical Outcomes Study (Stewart & Ware, 1992) that included: anxiety, depression, energy/fatigue, sleep problems, general health perceptions, pain, physical functioning, positive affect, role functioning and social

activity limitations. All scores were transformed to a 0 to 100 score range. Higher scores indicate better health.

The Mental Health Functioning index entailed anxiety, depression, energy/fatigue, positive affect and sleep problems. The Physical Health Functioning index consisted of current health perceptions, physical functioning, pain, role functioning and social activity limits. Similar indices using the Medical Outcomes Study measures have been previously created in a sample of exercising older adults (Stewart & et al., 1993).

Analysis of variance revealed no significant differences between groups at baseline for all the Health-Related Quality of Life scales. In addition, results showed no significant difference between the exercise group changes in mental health functioning compared to the control group after eight-weeks of strength training. This is consistent with other studies. Jette et al (1996) reported no significant decreases in nervousness and tension in older adult women after a 12-15 week home-based (low supervision) elastic band intervention. Mihalko and McAuley (1996) found less reported negative affect and greater positive affect after an eight-week strength training intervention, but the differences were not significant from the control group that attended a separate fluid movement class. It is possible that changes in mental health functioning develop over a longer period of resistance training.

In addition, the elastic band strength training intervention did not significantly affect physical health functioning (self-reported). This may be due to a ceiling effect because the subjects were non-disabled community-dwelling older adults. Jette et al (1996) did not find a significant difference on self-reported physical functioning between the intervention and control group except for social functioning. The control group for this study was a waiting list group that did not have any group or social contact with other subjects. The intervention in the present study included a unique aspect in the design, a social waiting list control group. The class and partner structure provided instructions as well as a social supportive environment to exercise. The social atmosphere of the intervention may have affected Health-Related Quality of Life outcomes. Social support was partially controlled for by exposing the control group to the same instructor and class conditions expect for the resistance training. However, the social control group improved on all

the physical health domains and some of the mental health domains. The control group gains on Health-Related Quality of Life despite a lack of strength training and strength changes suggests that attending a scheduled peer group activity outside the home and assisting a partner may positively affect functioning among older adult women. This can be achieved by providing a sense of belonging, meaning and a social network. Also, the walk from home or the parking lot may have positively affected physical functioning among the control group.

Medical Outcomes Study SF-36 Health Survey

The Short Form 36 was constructed to satisfy the minimum psychometric standards required for group comparisons of generic health concepts. These concepts are not specific to any age, disease or treatment group. The eight health concepts were chosen from 40 included in the Medical Outcomes Study (Stewart & Ware, 1992). It is hypothesized these concepts are routinely utilized in frequently used health surveys (Ware & Davies, 1995). In addition, they represent multiple definitions of health such as function and dysfunction, distress/well being and favorable or unfavorable self-evaluations of general health status (Ware et al., 1993). Many items can be found in tools that have been used more than twenty years (Stewart & Ware, 1992). Some instruments include the General Psychological Well Being Inventory (Dupuy, 1984), various physical and role functioning questionnaires (Patrick, Bush, & Chen, 1973), and the Health Perceptions Survey (Ware, 1976).

It is assumed the scales form a distinct higher-ordered cluster due to the shared physical and mental health variance. Factor analytic studies have ascertained the physical and mental factors that account for 85 percent of the reliable variance for the scales in the United States population (Ware et al., 1994). In addition, studies were conducted in Medical Outcomes Study patients (McHorney et al., 1993), Swedish populations (Sullivan et al., 1994), and the United Kingdom (Ware et al., 1994). The Physical Function, Role-Physical and Bodily Pain scales correlate most highly to the scoring of the Physical Component Summary measure. The Mental Health, Role-Emotional and Social Function scales correlate most highly to the scoring of the

Mental Component Summary measure (Ware et al., 1994). The Vitality, General Health and Social Function scales are associated with both scales.

Reliability for MOS SF-36 Health Survey

Internal consistency and test-retest methods have been used to estimate the reliability of the eight scales and two summary measures. Prior studies show the reliability statistics have exceeded the minimum standard of .70 recommended for group comparisons. Most reliability estimates have exceeded .80 (McHorney et al., 1994) and .90 for the physical component and mental component summary scores (Ware et al., 1994). The median reliability for all scales was equal or greater than .80 except for the Social Function scale, which was .76 in a review of 15 published studies (Ware, Snow, & Kosinski, 1993). A reliability of .93 was reported for the Mental Health scale with the alternate forms method, which suggests the internal-consistency method underestimates the reliability of this scale more than three percent (McHorney & Ware, 1995).

McHorney et al. (1992) used data from the Medical Outcomes Study to test the reliability of each scale score. Analysis was performed on 3,445 patients then replicated across 24 subgroups that differed in social and demographic characteristics, diagnosis and disease severity. Three groups were formed that known to differ in medical and psychiatric conditions: group one-minor chronic condition, group two-serious chronic medical condition and group three-current psychiatric condition. Six health scales were measured across four methods: poster charts, global items, Medical Outcomes Study short-form scales and Medical Outcomes Study long-form scales (Ware & Sherbourne, 1992). The six health scales of the short-form were constructed to reproduce the full length Medical Outcomes Study and to achieve psychometric criteria (Ware & Sherbourne, 1992). Questions were asked about the last four weeks of activity. All measures were scored on a scale of 0 to 100. A 100 indicates a favorable health state and 0 the least favorable health state.

Cronbachs alpha coefficients were used to estimate the internal consistency of each scale score. Reliability from .50 (Helmsteader, 1964) to .75 (Nunnally, 1978) or greater are recommended for group comparisons and .95 for individual patient scores. The Medical

Outcomes Study short-form scale met the criteria for group comparisons across all eight scales. This standard was achieved for the Physical Function and Mental Health scales for individual comparisons. In addition, reliability was worst for patients with psychiatric and complicated medical problems for the Role Physical, General Health perception and Social Function scales. The highest reliability was achieved in multiple patient groups for the Physical Function, Vitality and Mental Health scales. Congestive Heart Failure patients attained the highest reliability for the Social Function and Role Emotional scales. High reliability was found in the Role Physical, Bodily Pain and General Health perception scales for patients that completed 9-11 years of education.

Reliability coefficients ranged from a low of .78 for the General Health perception scale to a high of .93 for the Physical Function scale. Internal consistency reliability coefficients for patient subgroups ranged from a low of .82 for the Bodily Pain scale to a high of .93 for the Physical Function scale. Reliability coefficients varied across scales and subgroups from .65 to .94.

Validity for MOS SF-36 Health Survey

Known groups validity was used to test each measure and evaluate relative precision for the discrimination of medical and psychiatric conditions (McHorney, Ware, Rogers, Raczek, & Lu, 1992). Known groups validity compares mean scores across groups known to differ in the underlying health concepts of interest (Kerlinger, 1973). Simple t tests were used on hypothesized differences for group mean estimates. F statistics (t2) associated with a chance probability of less than .01 was significant. All measures or health scales separated groups in the medical and psychiatric tests.

Precision is defined as the ability of a measure to make clinical comparisons under a given study. This depends on two attributes: (1) the degree to which a measure separates groups being compared and (2) within group variance. Relative precision estimates were computed from the ratio of pair-wise F statistics (F for the comparison and F for the standard measure). Relative precision indicates in proportional terms how much more or less a measure is in relation to the standard. Short-form multi-item scales achieved a median relative precision of .93 across concepts and tests compared to long-form scales, which is considered a high level of precision.

Short-form multi-item measures of the General Health perception scale significantly decreased in precision compared to long-form scales. For instance, a 28 percent decline occurred in the medical tests for the five-item scale relative to the 16-item standard.

Item-discriminate tests gauge the extent that items correlate more highly with the concept they are hypothesized to represent than with different concepts. Hypothesized clusters of items are significant when there is a strong correlation between an item and its scale than other scales. Multi-trait scaling techniques were employed to evaluate item-discriminate validity (Hays & Hayashi, 1990). Seven thousand tests of item discriminate validity were conducted across the 24 subgroups and scales. Ninety-nine percent of tests indicated a significant correlation between an item and its hypothesized scale. The association exceeded the correlation with other scales more than two standard errors, which was observed in 92.5 percent of all tests. This indicates a high scaling success rate across patient groups. For instance, scaling success rates ranged from 35 percent to 100 percent with a mean and median of 92.5 percent and 97 percent, respectively. Scaling success rates are lower in smaller patient subgroups because tests are based on the standard error of the correlation coefficient, which is larger in these samples.

Scaling success rates varied by concept and subgroup. Physical Function, Role Emotional and Mental Health scales showed consistently high scaling success rates across patient groups, with a median of 99 percent, 100 percent and 100 percent, respectively. General Health perception scale had the most variability with a range of 35 percent to 100 percent and a median of 85 percent. Scaling success rates for all scales varied the most for patient's 75 years of age and older, less-educated, poor, congestive heart failure and myocardial infarction patients and individuals with psychiatric and complicated medical problems.

Item completion rates were 88 percent to 95 percent for each scale across groups. Item-internal consistency and item-discriminate validity were 97 percent and 92 percent, respectively across patient groups.

Summary

A number of studies have shown that resistance training provides several quality of life benefits for the elderly. Jette et al (1996) conducted a videotaped, in-home, strength training program to report on its effectiveness in improving psychological well-being, and health status in 102 non-disabled older adults 66 to 87 years of age. Eight dimensions of health status were assessed: physical functioning, role limitations as a result of physical or emotional health, social activity limitations due to health, current health perceptions, pain, psychological distress/well being and energy/fatigue. Several dimensions of psychological health improved, especially for men and older subjects. Consistent with prior studies (Blumenthal, Emery, Madden et al., 1989), older male subjects reported a significant decrease in anger after their participation in the program.

Male exercisers of all ages indicated feeling more lively, active, and energetic after the intervention. Men in the control group showed a significant decrease in feelings of vigor and pep from the pretest to the posttest. Thus, the intervention served to enhance psychological well-being and minimize declines that might otherwise prevail among older men. Older men in the exercise group reported decreased tension compared to the control group. The exercise program may have reduced feelings of nervousness, uneasiness and shakiness for older men. These findings are consistent with other studies that have demonstrated psychological benefits in middle-aged and older subjects that exercise (Blumenthal, Emery, Madden et al., 1989).

However, several studies show that resistance training does not produce any benefits for older adults. For example, Damush & Damush (1999) conducted an eight-week resistance training intervention using elastic bands in 62 community-dwelling women with a mean age of 68. Subjects were randomly assigned to an exercise group or control group. Pretest and posttest assessments were given for health-related quality of life. Results showed no significant difference between the exercise group changes in mental health functioning compared to the control group after eight-weeks of strength training. This is consistent with other studies. Jette et al (1996) reported no significant decreases in nervousness and tension in older adult women after a 12-15

week home-based (low supervision) elastic band intervention. It is possible that changes in mental health functioning develop over a longer period of resistance training.

Also, Damush & Damush (1999) intervention did not significantly affect physical health functioning (self-reported). This may be due to a ceiling effect because the subjects were non-disabled community-dwelling older adults. Jette et al (1996) did not find a significant difference on self-reported physical functioning between the experimental group and control group except for social functioning.

It is essential that more studies be conducted on the benefits of elastic band exercise training and health-related quality of life in the elderly. Research suggests that 70 million older adults will be 65 years of age and older in the year 2030. It is both the quality and quantity of life that is important for older persons. For instance, there are six primary factors that affect the quality of life for older persons: physical health, role function, social support, bodily pain, mental or psychological well-being and vitality or energy (McHorney, Ware, & Raczek, 1993). The focus of this research is to investigate whether or not elastic band resistance training could significantly affect the physical and mental function of older individuals. More specific, this study will investigate the effects of Thera-Band resistance training on health-related quality of life and muscular strength in older minorities.

Chapter III

METHODOLOGY

Chapter Overview

The purpose of this chapter is to describe the methods employed to determine the effect of Thera-Band resistance training on health-related quality of life and muscular strength in individuals 60-80 years of age. This research involved the development of a resistance training exercise prescription, assessment of muscular strength and health-related quality of life using the Medical Outcomes Study 36-Items Short Form Health-Related Quality of Life Survey and statistical analysis and interpretation of the data for the health care profession.

Selection of Subjects

This investigation was performed during the fall semester 2000. A convenience sample of older adults was selected for this research from a northwestern city of 45,000 persons. Subjects were recruited through fliers, family recommendations and word of mouth referrals. An introductory training packet for the subjects can be located in Appendix A. All 40 volunteers were of African American descent and ranged in age from 60-80 years. The final sample consisted of 24 women and 14 men. The criteria for participation in the research stated that each subject: (1) fill out an Oklahoma State University approved Informed Consent form prior to the intervention and (2) return the signed Physician's Consent and Release form. Appendix B contains a copy of the Institutional Review Board Form.

Research Design

Subjects were randomly assigned to one of two treatment conditions: control group or experimental group. All subjects were given pretest and posttest assessments for health-related quality of life, sit and stand ability and arm curl strength using the biceps muscles. Females lifted the five-pound and males used the eight-pound weight. Health-Related Quality of Life was measured using the Medical Outcomes Study 36-Items Short Form Health-Related Quality of Life

Survey. Item-discriminate tests gauge the extent that items correlate more highly with the concept they are hypothesized to represent than with different concepts. Hypothesized clusters of items are significant when there is a strong correlation between an item and its scale than other scales. Multi-trait scaling techniques were employed to evaluate item-discriminate validity (Hays & Hayashi, 1990). Seven thousand tests of item discriminate validity were conducted across the 24 subgroups and scales. Ninety-nine percent of tests indicated a significant correlation between an item and its hypothesized scale. The association exceeded the correlation with other scales more than two standard errors, which was observed in 92.5 percent of all tests. This indicates a high scaling success rate across patient groups. For instance, scaling success rates ranged from 35 percent to 100 percent with a mean and median of 92.5 percent and 97 percent, respectively. Scaling success rates are lower in smaller patient subgroups because tests are based on the standard error of the correlation coefficient, which is larger in these samples.

Many tests can be used to assess muscular strength. A popular test is a one-repetition maximum. Strength is measured as the heaviest amount of weight that can be lifted through a normal range of motion (Franks & Howley, 1989). The same fitness test can be used with simple adaptations for older adults (Howley & Franks, 1997). The arm curl test can be used to determine the number of times a five to eight pound weight is lifted in thirty seconds using the biceps muscles, which measures upper body strength (Rikli & Jones, 1999). A five to eight pound weight can be used to prevent injury in this older adult sample. The strength test should begin with a warm-up set to avoid injury and familiarize the subjects with the weight (Damush & Damush, 1999).

An assessment sheet was used to document all measurement data. Appendix C contains a copy of the assessment sheet. Pretests were given a week prior to the experiment and post-tests were done the tenth week of the intervention. An exercise activity chart was developed to guide the subjects' progress and encourage motivation for the different exercises. Appendix D contains a copy of the chart.

Warm-up and Cool down Activities

Warm-up and cool down activities were performed with light movements such as static stretch exercises that utilize large muscle groups. This reduced the risk for exercise related physical injury. Range of motion, flexibility and static stretches are exercises that improve activity of daily living skills for older individuals. The warm-up and cool down activities utilized the pectorals stretch for upper body stretches and the legs squat stretch for lower body stretches. The muscles completed a full range of motion. All subjects performed the stretches prior to and immediately after each exercise session. Appendix E contains a copy of the warm-up and cool down activities.

Pectorals Stretch

The subject was asked to stand upright, knees slightly bent, look straight ahead and relax to begin the pectorals stretch. The researcher asked the subject to hold onto the doorframe with arms at shoulder level, lean forward until a mild stretch was felt. The subject was asked to hold each stretch for ten-fifteen seconds and breathe normally during the stretch. The researcher observed the subject for proper movement, safety and breathing during the stretch. The stretch was terminated and the correct demonstration provided if the subject failed to demonstrate the proper techniques.

Leg Squats Stretch

The researcher asked the subject to sit upright with knees slightly bent, look straight ahead and relax to initiate the leg squats stretch. The subject was asked to raise one thigh off the chair as high as possible then put it back down on the chair and do the same with the other leg. The researcher asked the subject to use their arms to lift the leg up and down if they were unable to lift with one leg. This movement resulted in increased circulation, which help to restore the muscles. The subject was observed for proper movements, safety and breathing during the

stretch. The stretch was voided and the correct demonstration provided if the subject failed to demonstrate the proper techniques.

Thera-Band Resistance Exercises

Thera-Bands were utilized for the treatment of the experimental group. Thera-Bands are color-coded elastic bands that progress in thickness to provide increased resistance. The primary exercises consisted of chest press, biceps curl, triceps extension, leg squats, hip adduction and hip abduction.

Prior studies suggests that frail older adults start with a lighter resistance elastic band then progress to the next appropriate color during a Thera-Band exercise training program (Lazowski, Ecclestone, Myers, & Patterson, 1999). A 24-inch or 60 cm length of Thera-Band is equivalent to a pull of two and a half pounds for yellow, four and a half pounds for red, five pounds for green, seven and a half pounds for blue and nine pounds for black.

All subjects started with the yellow resistance Thera-Band the first two weeks of the intervention. Subjects begin with the minimal resistance to allow for adaptations of the connective tissue elements (ACSM, 1995). The experimental group was given an exercise protocol of one set of 10-15 repetitions for each exercise. Subjects were expected to progress to the next level of Thera-Band resistance after they were able to complete one set of 10-15 repetitions. The exercise regimen involved slow repetitions that emphasized caution with regards to safety during the concentric and eccentric phases of movement. The extra time provided an opportunity for the subjects to focus on safety, movement and proper breathing. For instance, subjects were allowed 90 seconds of rest between sets before starting the next exercise. The order of exercises performed consisted of: 1) chest press, 2) biceps curl, 3) triceps extension, 4) leg squats, 5) hip adduction and 6) hip abduction. Appendix F contains a copy of the Thera-Band resistance exercises.

Upper arm exercises were utilized with looped resistive elastic bands. This intervention involved the primary use of the biceps, triceps and deltoid muscles through a full range of motion. A looped resistive elastic band, chair of normal height, and a door were used for this procedure.

The subject performed one set of 10-15 repetitions for all exercises. Control group subjects were asked to maintain their normal daily activities and do not participate in any Thera-Band resistance training program during the study.

Chest Press Exercise

The subject was asked to sit upright with both legs on the floor with knees slightly bent, look straight ahead and relax to initiate the chest press exercise. The Thera-Band was placed around the back of the chair at the level of the upper thoracic area while the subject held the ends with both hands in the front. The subject was asked from this position to lower grip to side of chest, with the Thera-Band taut while keeping elbows out away from body then press to a near straight-arm position. The subject was asked to exhale during extension, inhale during flexion, while exercising at a comfortable pace. The researcher kneeled in front of the subject and observed for proper movement, safety and breathing. The repetition was voided and the correct demonstration provided if the subject failed to utilize the proper techniques.

Triceps Extension Exercise

The subject was asked to stand upright with knees slightly bent, look straight ahead and relax to start the triceps extension exercise. The Thera-Band was tied in a knot and attached to the top of a closed door while the subject held the other end in one hand. The subject was asked to stand at least two to three steps away from the door or at a comfortable position for the necessary resistance to exercise. The subject was asked with upper arm stationary, extend to straight-arm position. The researcher informed the subject to exhale during extension (downward movements) and inhale during flexion (upward movements) while exercising at a comfortable pace. The subject was observed for proper movement, safety and breathing throughout the exercise. The repetition was voided and the correct demonstration given if the subject failed to demonstrate the proper techniques.

Biceps Curl Exercise

The subject was asked to stand upright with knees slightly bent, look straight ahead and remain calm to initiate the biceps curls exercise. The Thera-Band was placed under the subject foot or attached to a stable structure such as a chair or table leg while the subject held the other end in one hand standing up. The subject was asked from straight-arm position, curl grip to shoulder keeping arm in line with torso. The researcher reminded the subject to exhale during flexion (upward movements) and inhale during extension (downward movements) while exercising at a comfortable pace. The subject was observed for proper movement, safety and breathing during the repetitions. The repetition was terminated and the correct demonstration provided if the subject failed to use the proper techniques.

Lower extremity exercises were utilized with looped resistive elastic bands. This intervention involved the primary use of the quadriceps and biceps femoris muscles, gastrocnemius and soleus muscles through a full range of motion. A looped resistive elastic band, chair of normal height and a door were used for this procedure. All subjects started with the yellow resistance elastic Thera-Band.

Hip Adduction Exercise

The subject was asked to stand upright, knees slightly bent, look straight ahead and relax to initiate the hip adduction exercise. The researcher asked the subject to secure one end of the Thera-Band in a closed doorjamb and the opposite end around the ankle. The subject was asked to stand parallel to the door and using the nearest arm lean against the door for support if needed. The researcher asked the subject to bring leg across body and slowly return to starting position. The subject was asked to exhale during adduction (inward movements) and inhale during abduction (outward movements). The researcher observed the subject for proper movements, safety and breathing. The repetition was voided and the correct demonstration provided if the subject failed to demonstrate the proper techniques.

Hip Abduction Exercise

The subject was asked to stand upright, knees slightly bent, look straight ahead and relax to begin the hip abduction exercise. The subject was asked to place the Thera-Band around the leg and the opposite end secured in a closed doorjamb, stand sideways from the door and extend leg out to the side. The researcher informed the subject to exhale during abduction (outward movements) and inhale during adduction (inward movements) while exercising at a comfortable pace. The subject was observed for proper movements, safety and breathing. The repetition was voided and the correct demonstration provided if the subject failed to demonstrate the proper techniques.

Leg Squats Exercise

The subject was asked to sit upright with both legs on the floor, knees slightly bent, look straight ahead and relax to initiate the leg squats exercise. The researcher asked the subject to place the Thera-Band under both feet and hold the ends in both hands with equal distance while sitting down. The subject was asked from this position to use their leg muscles to raise their body upward until a mild stretch was felt. The researcher asked the subject to exhale during extension (upward movements) and inhale during flexion (downward movements) while exercising at a comfortable pace. The subject was observed for proper movement, safety and breathing during the exercise. The repetition was terminated and the correct demonstration provided if the subject failed to demonstrate the proper techniques.

A demonstration repetition was performed prior to all exercise assessments. The researcher held the Thera-Band with both hands for one-two minutes after the repetition to answer potential questions of the subject. The subject was expected to demonstrate the proper movements, safety and breathing for each exercise before proceeding to the next exercise. The subject performed one set of 10-15 repetitions for all exercises. All subjects were asked to breathe normally, use safety and proper technique, good posture and immediately stop the exercise if significant pain occurs.

All subjects were given pretest and posttest assessments the first and tenth week for sit and stand ability and arm curl strength using the biceps muscles. The first objective test was the arm curl assessment. Females used the five-pound weight and males lifted the eight-pound weight. The number of times a five to eight pound weight is lifted in 30 seconds using the biceps muscles was used to measure upper body strength (Rikli & Jones, 1999). This intervention involved the primary use of the biceps muscles through a full range of motion. A stopwatch, 17-inch armless chair with a firm surface and no slope to the seat and a five or eight pound weight were used for this procedure.

The subject was asked to sit upright, knees slightly bent, look straight ahead and remain calm to initiate the biceps curls exercise. A five to eight pound weight was placed in the palm of the dominant hand of the subject. The subject was asked from straight-arm position, curl grip (palm facing upwards) towards shoulder keeping upper arm in line with torso. The researcher reminded the subject to exhale during flexion (upward movements) and inhale during extension (downward movements) while exercising at a comfortable pace. A demonstration repetition was performed prior to the biceps curl exercise assessment. The researcher held the weight with one hand for one-two minutes after the repetition to answer potential questions of the subject. The subject was expected to demonstrate the proper movements, safety and breathing for the exercise. The subject was asked to perform the maximum number of biceps curls as possible during the 30-second time allotment. The assessment was terminated after 30 seconds elapsed. The subject was given one trial to perform as many biceps curls as possible.

The subject was observed for proper movement, safety and breathing during the repetitions. For example, a successful exercise repetition involved the subject completing the entire concentric and eccentric phases of the exercise. The attempt was voided and the assessment terminated if the subject failed to achieve the full concentric and eccentric phases of the exercise. All subjects were reminded to breathe normally, use safety and proper technique, good posture and immediately stop the exercise if significant pain occurs.

The second objective test was the sit and stand assessment. The sit and stand test was used to measure lower body strength. This intervention involved the primary use of the quadriceps and biceps femoris muscles, gastrocnemius and soleus muscles through a full range of motion. A stopwatch and 17-inch armless chair with a firm surface and no slope to the seat were used for this procedure.

The subject was asked to sit upright with both feet on the floor as if they were ready to stand from the chair, arms folded, look straight ahead and relax to initiate the sit and stand test. This position was marked and remained constant over all trials. The researcher asked the subjects to sit with their backs resting squarely against the back of the chair. A demonstration was performed prior to the sit and stand exercise assessment. The researcher paused for one-two minutes after the trial to answer potential questions of the subject. The subject was expected to demonstrate the proper movements, safety and breathing for this exercise. The subject performed the maximum number of sit and stands during the 30-second time allotment. The assessment was terminated after 30 seconds elapsed. The number of sit and stands were recorded after one trial.

All subjects were given a set of exercise assessment instructions prior to attempting this test (Weiner et al., 1993). The researcher asked the subject to exhale during extension (upward movements) and inhale during flexion (downward movements) while exercising at a comfortable pace. The subject was observed for proper movement, safety and breathing throughout the exercise. Successful trials were defined as a rise to a standing position without unfolding the arms. The trial was terminated and the correct demonstration provided if the arms became unfolded or if the subject lifted off from the chair then fell back. All subjects were asked to breathe normally, use safety and proper technique, good posture and immediately stop the exercise if significant pain occurs.

An immediate cool down was provided for each subject after the assessment procedure was completed. The researcher visually observed the subject during this time for any abnormal physical or mental reactions to the evaluation such as dizziness, lightheadedness, fainting,

confusion, pallor or nausea. The researcher departed the testing site after ten minutes if no abnormal reactions occurred.

Compliance

Subjects unable to complete the prescribed sets and repetitions were asked to perform as many sets as possible. The subjects recorded the number of sets and repetitions on an "exercise activity chart" provided by the researcher, which helped to build the subjects level of confidence from the previous workout. The exercise activity chart can be located in Appendix D. It is assumed the records subjects maintain on the exercise activity chart accurately reflected their compliance with the exercise program. Those subjects not able to do the appropriate number of repetitions (10-15) and sets (one) were asked to do their best to make repetitions and set increases each session. Subjects were encouraged to exercise to fatigue with safety being of utmost concern.

Each chart covered a one-week period and was returned to the instructor via a self-addressed, stamped envelope. Exercise adherence was calculated as the number of chart periods that the subject exercise with the agreed upon level of resistance (Thera-Band) divided by the total number of chart periods. Ten chart periods was used for this ten-week intervention. A high adherence rate was achieved with 100 percent of subjects adhering to the exercise prescription. All subjects were strongly informed prior to participating to perform all exercises as prescribed (two times a week). Subjects were reminded the exercises could be conducted at their convenience on any day of the week with a minimal of 48 hours of rest between sessions.

The subjects were given a copy of the researcher schedule for the program structure. One-on-one sessions, telephone contacts, assessment sessions, training sessions and pretest and posttest measurements were included in the schedule. Appendix A contains a copy of this schedule.

Medical Outcomes Study SF-36 Health Survey

Health-related quality of life was assessed with the Medical Outcomes Study 36-Items Short Form Health-Related Quality of Life Survey (SF-36). The questionnaire consisted of 36 items. Ten items measure Physical Function, four items assess Role Physical, two items make up Bodily Pain and five items measure General Health perceptions. Four items assessed Vitality, two items made up Social Functioning, three items measured Role Emotional, five items assessed Mental Health and one item entailed reported change. All 36 items varied in format. For example, question one, a general health measurement, asked the subject "In general, would you say your health is:" "Excellent, Very Good, Good, Fair, or Poor?" Question four, a physical function measurement, asked the subject "During the past four weeks, have you had any, of the following problems with your work or other regular daily activities as a result of your physical health?" The responses were Yes or No. Each scale was scored separately. The scores ranged from 0 to 100. A 100 indicated a favorable health state and 0 the least favorable health state. The Medical Outcomes Study 36-Items Short Form Health-Related Quality of Life Survey can be found in Appendix G.

Reverse scoring was used for ten items to show higher scores for better health. For instance, item two stated, "Compared to one year ago, how would you rate your health in general now?" A score of six instead of one was given for an answer of "Much better." Item 24 asked, "Have you been a very nervous person?" a normal score of one was given for a response of "All of the time" and a score of six for "None of the time."

The researcher administered the Medical Outcomes Study 36-Items Short Form Health-Related Quality of Life Survey (SF-36) in written format to all subjects. Each subject was asked to answer all 36 items to the best of their ability. The survey was conducted at the subject home. Each subject was allowed adequate time to complete the survey.

The researcher reviewed each survey to ensure data completeness. A missing scale score was given if one-half or more of the items were not answered. A person specific estimate or

mean of the non-missing items was substituted if less than one-half of the items were not completed.

Data Collection Plan and Recording

All subjects were given pretest and posttest assessments for health-related quality of life using the Medical Outcomes Study 36-Items Short Form Health Survey, sit and stand ability, and the number of times a five to eight pound weight is lifted using the biceps muscles. The number of times a five to eight pound weight is lifted in 30 seconds using the biceps muscles was used to measure upper body strength (Rikli & Jones, 1999). Subjects were asked to perform the maximum number of biceps curls as possible during the 30-second time allotment. The assessment was terminated after 30 seconds elapsed. The subject received one trial to perform as many biceps curls as possible. The number of repetitions in 30 seconds the subject completed by rising from a chair with no arm support was used to assess lower body strength (Rikli & Jones, 1999). The assessment was terminated after 30 seconds elapsed. The number of sit and stands were recorded after one trial. All pretest and posttest measurements were recorded on an assessment sheet. Appendix C contains a copy of the assessment sheet.

Experimental subjects were asked to complete as many repetitions as possible and strive to advance to the next level of resistance during each contact. The subjects recorded the number of sets and repetitions on an "exercise activity chart" provided by the researcher, which help to build the subjects level of confidence from the previous workout. The exercise activity chart can be viewed in Appendix D.

Analysis of Data

Health-Related Quality of Life and muscular strength data were analyzed with a repeated measures analysis of variance that examined the results over time based on the following variables: Time (Pretest verse Posttest), Group (Control Group verse Experimental Group) and Group X Time (interaction effect). Alpha value was set at .05 ($P < .05$). A Student Newman-Keuls

post-hoc test procedure was used to determine where significant differences existed for the variables.

Chapter IV

FINDINGS

The purpose of this study was to determine the effects of Thera-Band resistance training on health-related quality of life and muscular strength in adults ages 60-80. Subjects were given two health-related quality of life tests and two muscular strength assessments. The mean age and standard deviation of the subjects was 69.97 ± 6.20 years. The means and standard deviations for all three tests administered to the subjects can be found in Appendix I. Tests included the Medical Outcomes Study 36-Items Short Form Health-Related Quality Of Life Survey, arm curl and sit and stand assessments.

Data was obtained from 38 subjects, 14 men and 24 women. Four hypotheses were tested to determine if a significant difference existed, over time, in health-related quality of life and muscular strength following a 10-week Thera-Band resistance exercise program. A repeated measures analysis of variance was used to analyze the data as indicated by the scores on each test. Significant mean differences were evaluated using the Student Newman-Keuls post-hoc test procedure. The means and standard deviations for subjects' age and level of exercise experience are listed as follows:

Table 1

SUMMARY OF MEANS FOR AGE AND EXERCISE EXPERIENCE

Gender	Age	Exercise Experience
	Mean SD	Mean SD
Females (n=24)	70.92 ± 6.92	1.50 ± .51
Males (n=14)	68.36 ± 6.07	1.29 ± .47

Subjects were instructed to record the color of Thera-Band used and the number of repetitions for each exercise. Each chart covered a one-week period and was returned to the instructor via a self-addressed, stamped envelope. Exercise adherence was calculated as the number of chart periods that the subject exercise with the agreed upon level of resistance (Thera-Band) divided by the total number of chart periods. Ten chart periods was used for this ten-week intervention. A high adherence rate was achieved with 100 percent of subjects adhering to the exercise prescription. All subjects were strongly informed prior to participating to perform all exercises as prescribed (two times a week). Subjects were reminded the exercises could be conducted at their convenience on any day of the week with a minimal of 48 hours of rest between sessions.

Physical Component Summary Scale

The first hypothesis tested in this study used a 0.05 level of significance. The hypothesis was assessed to determine if a significant difference existed among the control group and experimental group, pretest and posttest time periods and groups across time (interaction effect).

Hypothesis 1: There will be no significant difference between the control group and experimental group on average scores of the physical component summary scale before and after the treatment.

The Medical Outcomes Study 36-Items Short Form Health-Related Quality of Life Survey consisted of two parts: (1) Physical Component Summary Scale and (2) Mental Component Summary Scale. The two summary scores represent ten Health-Related Quality of Life measures from the Medical Outcomes Study (Stewart & Ware, 1992). All measures were scored on a scale of 0 to 100. A 100 indicates a favorable health state and 0 the least favorable health state.

Higher scores point to better health. The means and standard deviations for the physical component summary scale are listed as follows:

Table 2

SUMMARY OF PHYSICAL COMPONENT SUMMARY SCALE MEAN SCORES

Group	Pre-Test Mean SD	Post-Test Mean SD	Marginal Mean
Control	41.9 ± 10.43	43.7 ± 11.37	42.8 ± 10.90
Exper.	43.2 ± 9.87	48.8 ± 5.84	46.00 ± 7.86
	42.5 ± 10.05	46.1 ± 9.41	

Table 3

ANALYSIS OF VARIANCE: PRETEST-POSTEST PHYSICAL COMPONENT SUMMARY SCALE, ALL GROUPS

Source	SS	df	MS	F	Sig.
Group	195.5	1	195.5	1.26	.034*
Error	5571.2	36	154.8		
Time	261.9	1	261.9	7.96	.008*
G x T	68.2	1	68.2	2.07	.159
Error	1184.4	36	32.9		
Total	7281.2	75			

* $P < 0.05$

The main effect of group was significant and the main effect of time was significant at the 0.05 probability level. The interaction effect of group across time was not significant. Both groups significantly improved their post-test summary scores ($P < .05$); however, there was no significant difference by group ($P < .05$). Therefore, post-hoc test procedures were not performed. The null hypothesis was accepted. There was not a significant difference between the control group and experimental group on average scores of the physical component summary scale before and after the treatment. A repeated measures analysis of variance indicated the groups did not differ significantly from the pretest to the posttest on the physical component summary scale.

Mental Component Summary Scale

The second hypothesis tested in this study used a 0.05 level of significance. The hypothesis was assessed to determine if a significant difference existed among the control group and experimental group, pretest and posttest time periods and groups across time (interaction effect).

Hypothesis 2: There will be no significant difference between the control group and experimental group on average scores of the mental component summary scale before and after the treatment.

The means and standard deviations for the mental component summary scale are listed as follows:

Table 4

SUMMARY OF MENTAL COMPONENT SUMMARY SCALE MEAN SCORES

Group	Pre-Test Mean SD	Post-Test Mean SD	Marginal Mean
Control	53.9 ± 8.32	58.6 ± 7.35	56.2 ± 7.84
Exper.	57.2 ± 8.35	58.7 ± 5.16	58.0 ± 6.76
	55.5 ± 8.39	58.7 ± 6.33	

Table 5

ANALYSIS OF VARIANCE: PRETEST-POSTEST MENTAL COMPONENT SUMMARY SCALE, ALL GROUPS

Source	SS	df	MS	F	Sig.
Group	51.0	1	51.0	0.67	.42
Error	2763.4	36	76.8		
Time	184.4	1	184.4	5.45	.025*
G x T	48.1	1	48.1	1.42	.24
Error	1218.3	36	33.8		
Total	4265.2	75			

* $P < 0.05$

The main effects of group and time were significant at the 0.05 probability level. The interaction effect of the groups across the time period was not significant at the 0.05 probability level. Both groups significantly improved their post-test summary scores ($P < .05$); however, there was no significant difference ($P < .05$) by group. Therefore, post-hoc test procedures were not performed. The null hypothesis was accepted. There was not a significant difference between the control group and experimental group on the mental component summary scale after the treatment.

Sit and Stand Test

The third hypothesis tested in this study used a 0.05 level of significance. The hypothesis was assessed to determine if a significant difference existed among the control group and experimental group, pretest and posttest time periods and groups across time (interaction effect).

Hypothesis 3: There will be no significant difference between the control group and experimental group on the sit and stand test before and after the treatment.

The sit and stand test was used to assess lower body strength. The intervention involved the primary use of the quadriceps and biceps femoris muscles, gastrocnemius and soleus

muscles through a full range of motion. Subjects performed the maximum number of sit and stands during a 30-second time period. The assessment was terminated after 30 seconds had elapsed. The means and standard deviations for the sit and stand test are as follows:

Table 6

SUMMARY OF SIT AND STAND TEST MEAN SCORES

Group	Pre-Test Mean SD	Post-Test Mean SD	Marginal Mean
Control	13.2 ± 2.33	12.5 ± 2.44	12.8 ± 2.38
Exper.	14.2 ± 3.70	16.1 ± 3.51	15.2 ± 3.60
	13.7 ± 3.05	14.2 ± 3.47	

Table 7

ANALYSIS OF VARIANCE: PRETEST-POSTEST SIT AND STAND TEST, ALL GROUPS

Source	SS	df	MS	F	Sig.
Group	99.3	1	99.26	5.66	.023*
Error	631.9	36	17.55		
Time	7.4	1	7.34	9.94	.003*
G x T	33.1	1	33.12	44.88	.000*
Error	26.6	36	0.74		
Total	798.3	75			

* $P < 0.05$

The main effect of group and the main effect of time were significant at the 0.05 probability level. Also, group and time interaction effect was significant at the 0.05 probability level. Both groups significantly ($P < .05$) improved their post-test summary scores. Also, statistical

analysis showed there was a significant ($P < .05$) by group from pre-test to post-test. Student Newman-Keuls post-hoc test procedure was performed to determine where the significant difference existed. The post-hoc test procedure indicated there was a significant decrease ($P < .05$) in the control group average score from pretest to posttest. The experimental group average score significantly increased from pretest to posttest. The null hypothesis was rejected. There is a significant difference between the control group and experimental group on average scores of the sit and stand test before and after the treatment.

Arm Curl Test

The fourth hypothesis tested in this study used a 0.05 level of significance. The hypothesis was assessed to determine if a significant difference existed among the control group and experimental group, pretest and posttest time periods and groups across time (interaction effect).

Hypothesis 4: There will be no significant difference between the control group and experimental group on the number of times a five to eight pound weight is lifted using the biceps muscles before and after the treatment.

The number of times a five to eight pound weight is lifted in 30 seconds using the biceps muscles was used to measure upper body strength (Rikli & Jones, 1999). The assessment involved the primary use of the biceps muscles through a full range of motion. All subjects performed the maximum number of biceps curls as possible during a 30-second time period. The assessment was terminated after 30 seconds elapsed. Subjects received one trial to perform as many biceps curls as possible. The means and standard deviations for the arm curl test are as follows:

Table 8

SUMMARY OF ARM CURL TEST MEAN SCORES

Group	Pre-Test Mean SD	Post-Test Mean SD	Marginal Mean
Control	19.0 ± 4.11	17.3 ± 4.67	18.2 ± 4.39
Exper.	20.9 ± 6.57	22.7 ± 6.82	21.8 ± 6.70
	19.9 ± 5.42	19.9 ± 6.33	

Table 9

ANALYSIS OF VARIANCE: PRETEST-POSTEST ARM CURL TEST, ALL GROUPS

Source	SS	df	MS	F	Sig.
Group	249.74	1	249.74	4.14	.049*
Error	2172.41	36	60.34		
Time	0.03	1	0.03	0.01	.907
G x T	60.82	1	60.82	25.42	.000*
Error	86.12	36	2.39		
Total	2569.12	75			

* $P < 0.05$

The main effect of group was significant but the main effect of time was not significant at the 0.05 probability level. Also, group and time interaction effect was significant at the 0.05 probability level. Both groups significantly ($P < .05$) improved their post-test summary scores. Also, statistical analysis showed there was a significant ($P < .05$) by group from pre-test to post-test. Student Newman-Keuls post-hoc test procedure was performed to determine where the significant difference existed. The post-hoc test procedure indicated there was a significant decrease in the control group average score and a significant increase in the experimental group average score from pretest to posttest. The null hypothesis was rejected. There is a significant

difference between the control group and experimental group on the number of times a five to eight pound weight is lifted using the biceps muscles before and after the treatment.

Discussion of Research Findings

This study investigated the effects of Thera-Band resistance training on health-related quality of life and muscular strength in older African Americans. Consistent with previous research in this area (Jette et al, 1996) there was not a significant difference between the experimental group change in mental health functioning ($F(1,36) = 1.42$, $p < .24$) and physical health functioning ($F(1,36) = 2.07$, $p < .159$) following a 10 week Thera-Band resistance training program compared to the control group. For instance, Jette et al. (1996) found there was not a significant decrease in nervousness and tension for older adults after a 12-15 week home-based (low supervision) elastic band resistance program. Also, Mihalko and McAuley (1996) found less reported negative affect and greater positive affect for the experimental group following an 8-week resistance training program, but the results did not differ significantly from the control group that attended a separate movement class. This was similar to the results found in this study. Many subjects smiled, laughed and were pleased to have participated in this research. The majority of subjects expressed a desire to continue using the Thera-Bands and assessment weights following their participation in the study.

Damush & Damush (1999) reported there was not a significant difference in self-reported physical health functioning between the control group and experimental group in a study on older adults. This may be due to a ceiling effect because the subjects were non-disabled community-dwelling elderly persons. Jette et al., (1996) did not find a significant difference on self-reported physical functioning between the experimental group and control group except for social functioning. However, this intervention found that several dimensions of psychological health improved, particularly for men and older subjects. Although, there was not a significant difference between the control group and experimental group on physical health functioning many male subjects in this study indicated their appreciation for the program with smiles and statements such as "I need to exercise" or my "Physician states I should start an exercise program." Most

requested one-on-one counseling and a tailored exercise prescription during posttest assessments. Blumenthal et al. (1989) reported similar results where older male subjects showed a significant difference in perceived anger after their participation in the program. It is believed that changes in mental health functioning develop over a longer period of resistance training.

In addition, a repeated measures analysis of variance showed the experimental group significantly increased their muscular strength scores from pretest to posttest (Group X Time interaction) on the sit and stand test ($F(1,36) = 44.88$, $p < .000$) and arm curl test ($F(1,36) = 25.42$, $p < .000$) compared to the control group. Similar results were found in a randomized control trial of 102 apparently healthy community-dwelling adults 66 to 87 years of age (Jette et al., 1996). A videotaped, home-based, resistance-training program with Thera-Bands was used to report on its effectiveness in improving muscle strength. Effectiveness was based on change in upper and lower extremity muscle strength. Findings revealed a trend of overall increase in knee extension torque (3.2 ± 1.2 verse 0.2 ± 1.1; P value .074), knee flexion (5.8 ± 1.2 verse 3.3 ± 1.1; P value .117) and maintenance of shoulder flexion torque ($-.03 \pm 0.7$ verse -1.9 ± 0.6; P value .067) following the intervention for the exercise group compared to the control group. Also, data analysis showed that adults aged 72 years or less demonstrated a ten percent improvement in knee extensor strength ($P = .007$) compared to the control group. There was not a significant difference in knee extensor torque for subjects 72 years of age and older in the control group or experimental group.

Damush & Damush (1999) performed an eight-week strength-training program using elastic bands in 62 community-dwelling women with a mean age of 68 years. Random assignment was used for all subjects to either an exercise group or control group. Pretest and posttest measurements were given for muscular strength. A three-repetition maximum was used to assess maximum strength by measuring the maximum amount of weight moved in three consecutive repetitions with correct form through the full range of motion for each exercise (Prately et al., 1994). Subjects achieved their maximum when they were unable to complete an additional three repetitions with full range of motion for each exercise and perceived the effort to

be "Somewhat Hard" on the Borg scale. Strength was measure in both hands with a Jamar hand dynamometer. Subjects were informed to grip the instrument with their maximal effort. Grip strength was assessed three times in each hand with the highest values being retained for analysis. A repeated measures analysis of variance was computed to determine baseline differences between the exercise group and control group and the effects of resistance training on strength changes. Boneferroni adjustment indicated the effects had to be significant at the .01 probability level to protect against a Type 1 error. There was not a significant difference at baseline for the groups on any strength scores: latissimus dorsi ($p < .67$), pectorals ($p < .47$), quadriceps ($p < .23$), left grip ($p < .92$) and right grip ($p < .45$). Strength significantly increased for the exercise group compared to the waiting list control group on pretest to posttest assessments for the latissimus dorsi ($p < .0001$), pectorals ($p < .01$) and quadriceps ($p < .0001$). In addition, the exercise group on average had a 19.7% increase in latissimus dorsi strength, 27.7% increase in quadriceps strength and a 16.5% increase in pectoral strength after participation in the eight-week strength training intervention. These results show that modest strength gains in apparently healthy older adults can be achieved with inexpensive equipment in a short time period. Consistent with this research, strength gains occurred for the experimental group compared to the control group following a 10-week elastic band resistance-training program.

Morganti et al (1995) performed a progressive resistance-training program for 39 non-disabled older adults. Subjects were randomly assigned to a control group or progressive resistance-training group that trained twice a week for one year. Assessments were done at baseline, six months, and 12 months. The resistance-training group trained at 80 percent of one repetition maximum or more on the lateral pull down, knee extensor and double leg press apparatus. Alpha was set at .05 ($P < .05$). A repeated measures analysis of variance showed that one repetition maximum, significantly increased for all muscle groups trained in the exercise group compared to the control group ($P < .0001$). Increases of $73.7 \pm 12\%$, $35.1 \pm 3\%$ and $77.0 \pm 5\%$, respectively, for knee extension, double leg press and latissimus pull-down in the progressive resistance training group and $12.7\% \pm 8\%$, $3.7\% \pm 3\%$, and $18.4\% \pm 4\%$, respectively for the control group, were observed. It is estimated that 50 percent of the gains occurred during

the first three months for the knee extensor and lateral pull down exercises and 40 percent for the double leg press. The data revealed that high-intensity strength training results in significant strength gains in postmenopausal women. Also, Simonsick et al. (1993) found that strength training improves muscle strength, which helps older adults maintain their functioning and mobility during late-life. Subjects indicated they felt more physically fit and somewhat stronger after participating in this study. It is believed the Thera-Band resistance training program used in this study provided older subjects needed strength to perform activities of daily living (ADL) and instrumental activities of daily living (IADL) with greater ease.

In Conclusion

The purpose of this study was to determine the effects of Thera-Band resistance training on health-related quality of life and muscular strength in adults ages 60-80. The results will be discussed to make clear the findings. In addition, this research is compared to previous studies to point out similarities and differences and shed new light on the benefits of Thera-Band resistance training for older African Americans.

A repeated measure analysis of variance was utilized to analyze the data in this study. Two out of four analysis of variance tests (muscular strength assessments) showed that a significant difference ($p < 0.05$) occurred, over time, within the groups and is considered to be a result of the treatment effect. The Student Newman-Keuls post-hoc test procedure indicated significant muscular strength differences, over time, on the arm curl and sit and stand tests among the experimental group.

It is believed that healthy elderly women might be at, or near the threshold of knee extensor strength required for rising from a chair (Young, 1986). Subjects initial complaints included a feeling of not being able to stand from a sitting position and needing a brief warm-up. Though, subjects smiled, laughed, asked several questions and were pleased to have made gains following the intervention. Most subjects requested information related to future Thera-Band resistance training. Individual exercise prescriptions and one-on-one counseling sessions were given for subjects that wanted the assistance.

The arm curl test was used to determine the number of times a five to eight pound weight could be lifted in thirty seconds using the biceps muscles, which measures upper body strength (Rikli & Jones, 1999). Men used the eight-pound and women lifted the five-pound weight during both assessments. Many subjects experienced elation and stated the weight felt light or not very hard to lift during the tests. A five to eight pound weight was used to prevent injury in this older adult group. Pretest and posttest assessments began with a warm-up set prior to the test. Damush & Damush (1999) recommend the strength test start with a warm-up set to avoid injury and familiarize the subjects with the weight. Subjects stated they better understood of what they were to do after a demonstration. Most subjects wanted information on obtaining their own weight following the intervention.

In addition, post-hoc test procedures showed there was not a significant change in health-related quality of life for either the control group or experimental group following this ten-week intervention. These findings are consistent with previous studies. For instance, Damush & Damush (1999) performed an eight-week resistance training intervention using Thera-Bands in 62 community-dwelling older adults. Pretest and posttest assessments were given for health-related quality of life. Analysis of variance showed no significant differences between groups at baseline for all the Health-Related Quality of Life scales. Also, results showed no significant difference between the exercise group changes in mental health functioning compared to the control group following the eight-week intervention.

Jette, Lachman, Giorgetti, Assmann et al. (1999) conducted a six-month study to find out if a in-home resistance training program achieved quality of life benefits in older adults with disabilities. Two hundred and fifteen subjects were randomly assigned to either resistance training or a control group. There was not a significant difference between the resistance-training group and control group on psychological mood states for pretest and posttest scores. Psychological benefits did not occur from the program. Prior literature indicates that psychological change has occurred primarily for subjects that started with moderate or clinical levels of depression. All subjects were "apparently healthy" that participated in this study. It is possible that an overall significant change in mental health scores did not occur for the experimental group

compared to the control group because they were independent community-dwelling older adults. In addition, it is believed the social surroundings may have affected the subjects overall quality of life. The home-based environment used in this research may have negatively affected the health-related quality of life outcomes. For example, subjects were asked to maintain their normal daily activities with the exception of Thera-Band resistance training, performed at home, for the experimental group. It is recommended that subjects attend a scheduled peer group activity outside the home to provide a social network, sense of meaning and belonging. This could positively affect self-reported mental and physical health functioning. Thera-Band resistance training may provide strength maintenance needed to participate in organized external activities.

Several subjects asked for help when answering certain questions on the survey. The majority of subjects stated they were not depressed, socially withdrawn, nor felt downhearted and blue when responding to particular items on the survey. Immediate reactions remained the same to these questions during pretest and posttest assessments. Subjects hesitated then suddenly wrote down their answer after recognizing the query. For example, most subjects believed that during the past 4 weeks they felt calm and peaceful.

Chapter V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The goal of this study was to determine the effect Thera-Band resistance training has on health-related quality of life and muscular strength in adults ages 60-80. Random assignment was used for forty older African Americans: control group or experimental group. The attrition rate was small with only two subjects not completing the research. The reasons included ill health and physician recommendation to discontinue. Groups were tested twice on health-related quality of life and muscular strength ability. The muscular strength measures consisted of the arm curl and sit and stand tests. The Medical Outcomes Study 36-Items Short Form Health-Related Quality of Life Survey consisted of two parts: physical component summary scale and mental component summary scale. All subjects received pretest and posttest assessments for each test.

Discussion of Hypotheses

Several comparisons were made between the control group and experimental group to determine the treatment effect. A repeated measures analysis of variance was computed to evaluate differences between the groups on the pretest and posttest. Group was the between-group factor and time was the within-group factor. Student Newman-Keuls post-hoc test procedure indicated the effects had to be significant at the .05 level to protect against a Type I error (rejecting a true null hypothesis). The decision to accept or reject the null hypotheses based on the results are listed below:

Hypothesis 1: There will be no significant difference between the control group and experimental group on average scores of the physical component summary scale before and after the treatment.

The null hypothesis was not rejected. There was not a significant difference between the control group and experimental group on average scores of the physical component summary scale before and after the treatment ($F(1,36) = 2.07$, $p < .159$).

Hypothesis 2: There will be no significant difference between the control group and experimental group on average scores of the mental component summary scale before and after the treatment.

The null hypothesis was not rejected. There was not a significant difference between the control group and experimental group on average scores of the mental component summary scale before and after the treatment ($F(1,36) = 1.42$, $p < .24$).

Hypothesis 3: There will be no significant difference between the control group and experimental group on average scores of the sit and stand test before and after the treatment.

The null hypothesis was rejected. There was a significant difference between the control group and experimental group on average scores of the sit and stand test before and after the treatment ($F(1,36) = 44.88$, $p < .000$). Student Newman-Keuls post-hoc test procedure showed that the experimental group scores significantly increased and the control group scores significantly decreased from pretest to posttest assessments.

Hypothesis 4: There will be no significant difference between the control group and experimental group on average scores on the number of times a five to eight pound weight is lifted using the biceps muscles before and after the treatment.

The null hypothesis was rejected. There was a significant difference between the control group and experimental group on average scores on the number of times a five to eight pound weight is lifted using the biceps muscles before and after the treatment ($F(1,36) = 25.42$, $p < .000$). Student Newman-Keuls post-hoc test procedure showed that the experimental group average scores significantly increased and the control group scores significantly decreased from pretest to posttest assessments.

Conclusions

In conclusion, Thera-Band resistance training proved to be an effective mode of exercise for older African Americans participating in this investigation. Subjects improved their overall muscular strength scores from pretest to posttest following this ten-week intervention. For instance, statistical analysis showed the experimental group significantly increased their muscular strength scores (Group X Time interaction) on the sit and stand test ($F(1,36) = 44.88$, $p < .000$). Three age categories are used to represent older adults: 1) young old or persons 65 to 74 years of age, 2) old or persons 75 to 84 years of age and 3) oldest-old or persons 85 years of age and older. The mean age and standard deviation of subjects in this study was 69.97 ± 6.20 years. It is possible that overall scores on the sit and stand test improved in this study because the mean age of the subjects were between 65 to 74 years of age. This age group is considered to be more physically and mentally intact relative to their counterparts. Many subjects smiled, laughed and reported they felt somewhat stronger after the treatment. For example, Mrs. S. eagerly opening her door during an initial visit stated "Come in and make yourself at home. I need some exercise very badly! I hardly do much physical activity." Some asked if they could keep the assessment weights used in the muscular strength tests. Mrs. B. stated "Remember, I want that weight when you are done using it." Subjects were willing to demonstrate their improved physical abilities when performing the maximum number of repetitions during the study.

A repeated measures analysis of variance showed there is not a significant increase in health-related quality of life scores for either the control group or experimental group at the posttest. However, subjects indicated they felt about the same or somewhat better after participating in the exercise program. They greatly appreciated the opportunity to have been involved in this study. Many subjects expressed a desire to continue using the Thera-Bands after the completion of the study. For example, Mr. P stated, "I was waiting for you to come back. Now, how is it done, I would like another demonstration of that exercise (referring to the hip abduction and adduction exercises). He is a very quiet man that and was thankful to have participated in the study. It was a new experience for most of these subjects. Many subjects asked if they could keep the assessment weights at the end of the study. They were informed about local retail

outlets and fitness centers where they could purchase the equipment and get additional information about Thera-Band resistance training.

One-on-one counseling sessions and tailored exercise prescriptions were given for subjects that requested further assistance. One-on-one counseling sessions involved the researcher demonstrating proper form and technique for all exercises. In addition, subjects were allowed to keep the Thera-Bands used throughout the study. This was done to encourage future participation in Thera-Band resistance training.

Recommendations

There are four recommendations for health care professionals and persons interested in Thera-Band resistance training for older African Americans. First, future studies using Thera-Bands should be done in groups with specific health conditions to better ascertain the effectiveness of elastic bands on health-related quality of life. Cardiac and pulmonary victims and persons with sport-related injuries represent groups that could benefit from Thera-Band resistance training.

Second, muscular strength test assessments for older adults should be done using the physical fitness tests in this research. Many subjects smiled, laughed and expressed a sense of contentment after completion of the test. Subjects were ready to participate and complete as many repetitions as possible in the time allowed. In addition, subjects were very interested in comparing their pretest and posttest scores.

Third, a survey that contains fewer questions may be an alternative when assessing health-related quality of life for older adults. The Medical Outcomes Study 36-Items Short Form Health-Related Quality of Life survey consists of 11 questions made up of 36 items. A small number of subjects asked how long it should take to complete the survey before starting. A shorter version of the instrument may be more suitable for this older group.

Fourth, heavier weights could be utilized during the muscular strength test assessments when determining muscular strength ability and exercise-induced benefits. Some subjects asked if the amount of weight being lifted could be increased. The researcher explained that female

subjects should lift the five-pound weight and male subjects use the eight-pound weight. However, the rate of repetitions for these subjects slowed down following a brief warm-up and coaching. A heavier weight is an alternative for males in this older adult group.

Concluding Comment

There are a few changes that could me made if this study was conducted a second time. First, more insight may be gained if the upper age limit was extended. Many subjects were excluded from this research because of their age. All subjects ranged in age from 60-80 that participated in this study. Research shows that older adults are the fastest growing segment of our population. More specific, longevity has significantly increased for members of the oldest-old age group, persons 85 and older, relative to young-old, individuals 65-74 years of age and the old or persons 75-84 years of age. It is well documented that chronic conditions and disability increases during old age. Thera-Band resistance training is an ideal mode of exercise for frail older adults. Second, I would study individuals or groups with specific health conditions to better determine the effects of Thera-Band resistance training on health-related quality of life and muscular strength in older adults. All subjects were "apparently healthy" that participated in this research. Prior studies show that psychological change has occurred mainly for subjects that started a resistance program with moderate or clinical levels of depression. Foreseeable study groups include older individuals residing in their homes and receiving psychological interventions, nursing homes, mental heath treatment facilities and Alzheimer's units. Finally, future Thera-Band resistance training programs should be conducted on persons of various ethnic groups. Hispanic Americans, Asian Americans, Native Americans and Latino Americans represent potential study groups. For example, Hispanic Americans are rapidly increasing in numbers throughout the United States. A lack of accessibility and finances are barriers to health care delivery for these individuals. Health care professionals need to be sensitive to the needs of minority elderly populations. Thera-Band resistance training is a safe and inexpensive intervention that should be an option when providing rehabilitative services for different ethnic groups.

There are a few occurrences that evolved during this study, which provided me more insight and a better understanding of older adults. First, it is essential that one becomes an active listener. Many subjects routinely discussed all their health conditions and other life concerns during each contact and prior to the assessments. For instance, Mrs. G. pointing to one knee stated "I had arthritis in this leg several years ago, but it is fine now... I can walk to my doctors office (located about a mile away) all by myself." It took her sometime to get to the door on certain occasions but was very talkative soon afterwards. Second, some frustration and disappointment was encountered with the Physician Consent and Release Form. For instance, Mrs. B. stated that "I can't participate in this study. My doctor want sign the form. He did not give a reason, maybe I can call him back." A personal visit was made to the physician's office and supporting documentation of the study was given out. Her physician eventually signed the form allowing Mrs. B. to participate in the study.

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APPENDIXES

APPENDIX A

INTRODUCTORY TRAINING PACKET FOR SUBJECTS

OKALHOMA STATE UNIVERSITY
HEALTH PROMOTION RESEARCH INVESTIAGTION

TITLE: THE EFFECTS OF THERA-BAND RESISTANCE TRAINING ON HEALTH-RELATED QUALITY OF LIFE AND MUSCULAR STRENGTH IN ADULTS AGES 60-80

I. SUBJECTS

1. Females and Males Between Ages 60-80

II. ASSESSMENTS

1. Health-Related Quality of Life
2. Sit and Stand Test
3. Arm Curl Assessment

III. PROGRAM

1. No Monetary Dues
2. Ten Weeks/20 Exercise Sessions
3. Performed Two Times a Week
4. 25-30 Minute Exercise Sessions
5. Conducted at Subjects Home

IV. TIMELINE

1. One on One Meeting	-October
2. Training Session	-October
3. Pre-testing	-October
4. Intervention	-October
5. Post-testing	-January
6. 2d One on One Meeting	-January

V. PERSONNEL

1. Joseph Jackson (Dept. HPEL) **(h) 332-4736**

PROGRAM AGENDA

1. October 5th or 7th — Subject Time Convenience

Distribute Packets Consisting Of:

- Resistance Training Benefits for Older Adults
- Exercise Activity Chart
- Informed Consent Form **(Returned no later than 14th or 16th)**
- Physician Release Form **(Returned no later than October 21st)**
- Demographic Data Sheet **(Returned no later than 14th or 16th)**

Pre-Test Assessments:

- Health-Related Quality of Life
- Sit and Stand Test
- Arm Curl Assessment

2. October 23d — (Monday)

Resistance Training Begins:

- Two Days a Week (Any Day of the Week)
- 25-30 Minutes each Exercise Session
- Performed in the Subjects Home
- Two Warm-up and Cool down Stretches and Six Exercises

3. January 2d or 4th — Preferably in Morning

Post-Test Assessments:

- Health-Related Quality of Life
- Sit and Stand Test
- Arm Curl Assessment

*****All Subjects Will Be Measured*****

4. Date To Be Announced — (Final Meeting)

- Summary Session
- Certificates/Awards
- Disseminate Literature On Thera-Band Exercise Maintenance

CONTROL GROUP DATA SHEET

This research will include a **No Intervention or Control Group.** Subjects will be randomly assigned to either a control group or experimental group (Thera-Band exercises). Control group subjects will be expected to follow these guidelines:

1. Maintain your normal activities of daily living.
2. **Do not participate** in any Thera-Band resistance training program during the study.
3. Complete the **pretest and posttest measurements** for this investigation.
4. Take part in the Summary Session.

ESSENTIAL DATES!

Pre-Test Measurements

• October 7th	Health-Related Quality of Life
• October 7th	Sit and Stand Test and Arm Curl Assessment

Post-Test Measurements

• January 2d	Health-Related Quality of Life
• January 2d	Sit and Stand Test and Arm Curl Assessment

DEMOGRAPHIC DATA SHEET

Instructions: Carefully read all questions and respond to the best of your ability. **(Please do not forget to answer all questions).**

1. **Print** your **Complete Name:**_____ **Tele. No.** _____

2. **Circle** your **Gender:** Female Male

3. Indicate your **Present Age:**_____

4. Have you **participated** in a resistance-training (Thera-Band exercise) program during the last six months?

   Yes

   No

5. When was the last time you **participated** in a resistance training (Thera-Band exercise) program? **Circle the number which best indicates your response.**

   1. Less than 1 year ago
   2. 1 to 5 years ago
   3. 5 to 10 years ago
   4. 10 to 15 years ago
   5. More than 15 years ago
   6. Never

6. Do you **exercise** (i.e., walking, running, dancing, basketball, aquatics, etc.) at least **2 times a week?**

   Yes

   No

7. Do you **presently** take medications that could affect your ability to exercise? **List any medication(s) that could cause (nausea, dizziness, lightheadedness, confusion, rapid heart rate, etc.)**

Medication	Symptom(s)
_____	_____
_____	_____
_____	_____
_____	_____

8. Do you **presently have** or **had** any **Physical Health** limitations that could affect your ability to exercise?

Current	Past
_____	_____
_____	_____
_____	_____
_____	_____

SUBJECT INFORMED CONSENT

I, _____, hereby authorize Joseph Jackson, or associates and assistants of his, to perform the following strength resistance training treatment.

The title of this study is called "The Effects of Thera-Band Resistance Training on Health-Related Quality of Life and Muscular Strength in Adults Ages 60-80." The purpose of this study is to determine the effects Thera-Band resistance training has on health-related quality of life and muscular strength. This study will be conducted through Oklahoma State University.

If chosen for the test group you will exercise for ten weeks using Thera-Bands, which helps to improve the quantity and quality of life (the investigator will demonstrate all exercises for the experimental group). You will exercise at home, favorably, in a large room. You will exercise two times a week on any day, preferably during the morning hours. If you are chosen to the group not participating in the Thera-Band exercises you will be asked to maintain your normal daily activities. You will not participate in any Thera-Band or resistance exercise program during the study.

You will start with the yellow Thera-Band or lightest resistance then go to the next level of resistance if you are able. You will be measured twice during the study, before and following the ten-week exercise period. You will be tested on the Medical Outcomes Study 36 Item Short-Form Health Survey (SF-36), which measures health-related quality of life, sit and stand test for muscular flexibility and number of times a five to eight pound weight is lifted to assess muscular strength. Your scores will remain private and will be made available to you during the final week of the program if you want them. Your scores will never, at any time, be made public.

For questions, comments, and concerns, you may contact Joseph Jackson, at (580) 233-2410 or Dr. Frank Kulling at 405-744-5502. Also, you may contact Sharon Bacher, IRB Executive Secretary, Oklahoma State University, 203 Whitehurst, Stillwater, OK 74078. Phone: 405-744-5700.

I understand that participation for this study is voluntary and that I will not be penalized if I choose not to participate. I also understand that I am free to withdraw my consent and end my participation in this project at any time without penalty after I notify the project director.

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: _____ Time: _____ (a.m./p.m.)

Signed Name: _____
Signature of person authorized to sign for subject, if required

Witness (es) if required: _____

I certify that I have personally explained all elements of this form to the subject or his/her representative before requesting the subject or his/her representative to sign it.

Signed: _____
Project director

PHYSICIAN'S CONSENT AND RELEASE FORM

The program in which your patient, _____, would like to participate is a resistance-training (strength) program for apparently healthy older adults between the ages of 60-80. This program will consist of six different exercises utilizing looped resistive elastic bands. Your patient will exercise two times a week for approximately 25-30 minutes each session if chosen for the treatment group. Within that time period, 15 minutes will be set aside for warm-up and cool-down activity. Intensity will be gradual and progressive in nature with all subjects starting with the minimal resistance. The exercises will be performed at the subject home, which will allow for normal breathing, flexibility, convenience, and brief intervals of rest throughout. The control group will be asked to maintain their normal activities of daily living. They will not receive the treatment.

Pretest and posttest will be required of your patient for health-related quality of life, which consists of subjective responses of physical and mental function. In addition, two muscular assessments will be performed for upper and lower body strength. The subjects will be closely supervised at all times throughout this study.

Please list any contraindications or medical conditions pertaining to this patient's ability to participate in this program:

_____

_____

_____

_____

_____

Thank you

_____ _____

Physician's Signature Date

AUTHORIZATION FOR THE RELEASE

OF

MEDICAL RECORDS

Date: _____

I hereby authorize:

Name of physician/clinic: _____

Address: _____

City, State, Zip: _____

To release any information, including copies of records that may include medical treatment for psychiatric, alcohol and drug abuse information regarding other insurance coverage about the patient. This also includes the authorization to release information which may include, but are not limited to, diseases such as hepatitis, syphilis, gonorrhea, Human Immunodeficiency Virus (HIV) infection, or AIDS, rendered to me or my dependents to:

Joseph L. Jackson

Oklahoma State University

Health Promotion Research Investigation

Post Office Box 5904

Enid, OK 73702-5904

A photo static copy of this authorization shall be as valid as the original.

Name of Patient: _____

Patient Social Security Number: _____ - _____ - _____

Patient Date of Birth: _____

Signature of Patient: _____

Signature of Person Receiving this Document: _____

APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL

Oklahoma State University
Institutional Review Board

Protocol Expires: 10/3/01

Date : Wednesday, October 04, 2000 IRB Application No ED0129

Proposal Title: THE EFFECTS OF THERA-BAND RESISTANCE TRAINING ON HEALTH-RELATED QUALITY OF LIFE AND MUSCULAR STRENGTH IN ADULTS AGES 60 - 80

Principal Investigator(s) :

Joseph Jackson
104 Colvin
Stillwater, OK 74078

Frank Kulling
104 Colvin
Stillwater, OK 74078

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s) : Approved

Signature : Carol Olson

Carol Olson, Director of University Research Compliance

Wednesday, October 04, 2000
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

APPENDIX C

SUBJECT ASSESSMENT SHEET

ASSESSMENT SHEET

NAME:_____ **ASSESSMENT DATE:**_____

GENDER: FEMALE MALE AGE:_____ **LOCATION:**_____

ASSESSMENT TECHNICIAN:_____

OBJECTIVE MEASURES **PRETEST AND POSTTEST SCORES**

ASSESSMENT ITEMS	PRETEST	POSTTEST
1. SIT AND STAND TEST		
2. ARM CURL ASSESSMENT		

SF-36 HEALTH SURVEY **PRETEST AND POSTTEST SCORES**

ASSESSMENT ITEMS	PRETEST	POSTTEST
1. PHYSICAL COMPONENT SUMMARY SCALE		
2. MENTAL COMPONENT SUMMARY SCALE		

APPENDIX D

EXERCISE ACTIVITY CHART

WEEKLY EXERCISE ACTIVITY CHART

WEEK:_____

Day	Time	Chest Press	Biceps Curl	Triceps Extension	Leg Squats	Hip Adduction	Hip Abduction	ALL Done
Sun.								
Mon.								
Tue.								
Wed.								
Thur								
Fri.								
Sat.								

Please code the appropriate letter(s) for the designated Thera-Band used during the exercise. Also, indicate the number of times the exercise was performed.

CODE:

Y = Yellow
R = Red
BL = Blue
G = Green
B = Black

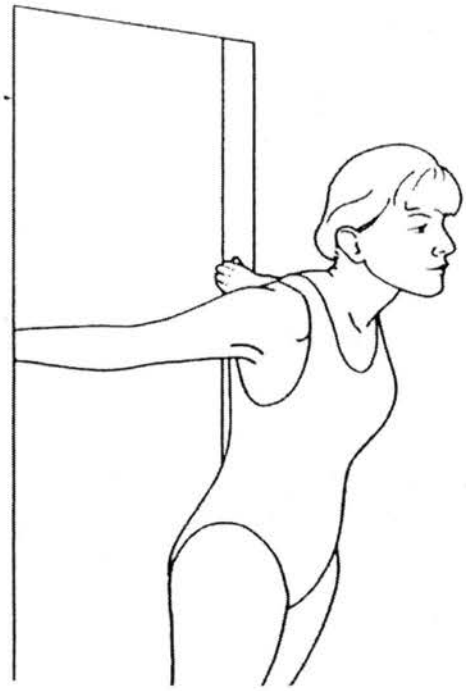
REPETITIONS:

11 = 11 Repetitions
12 = 12 Repetitions
13 = 13 Repetitions
14 = 14 Repetitions
15 = 15 Repetitions

APPENDIX E

WARM-UP AND COOL DOWN ACTIVITIES

PECTORALS STRETCH

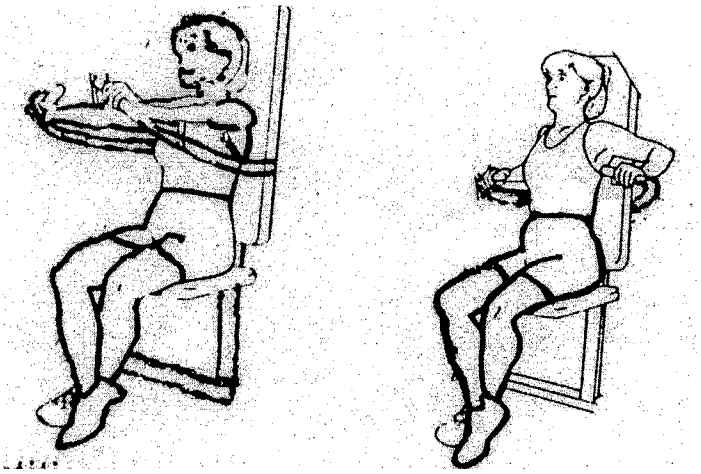


LEG SQUATS STRETCH

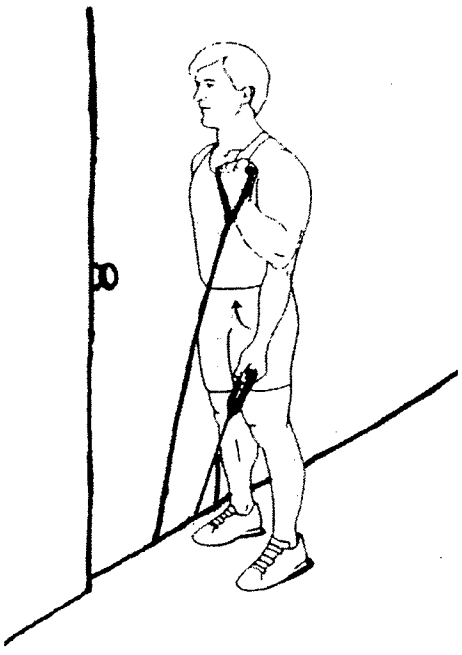
APPENDIX F

THERA-BAND RESISTANCE EXERCISES

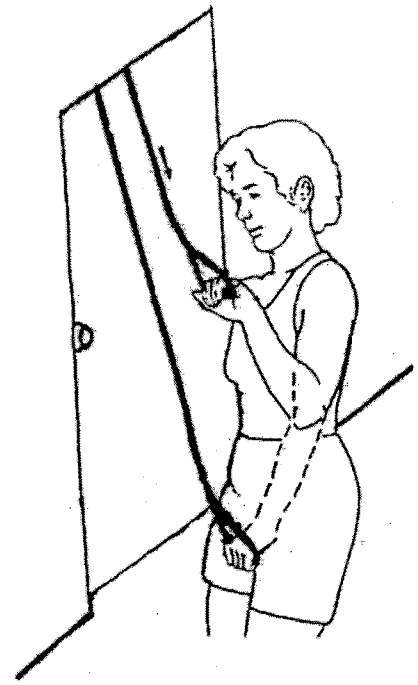
CHEST PRESS EXERCISES



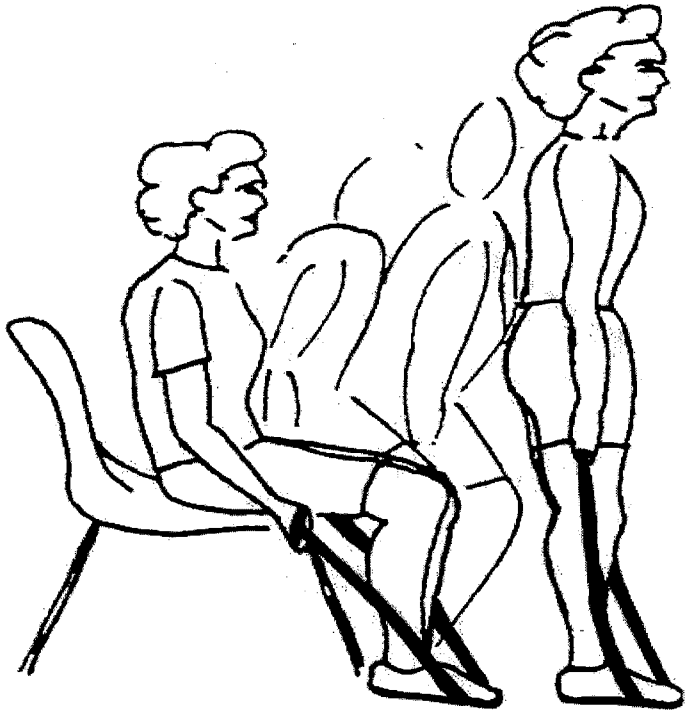
BICEPS CURL EXERCISES



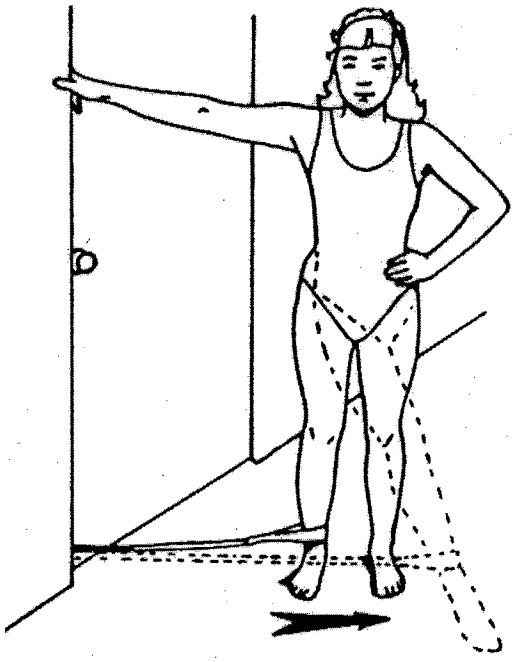
TRICEPS EXTENSION EXERCISES



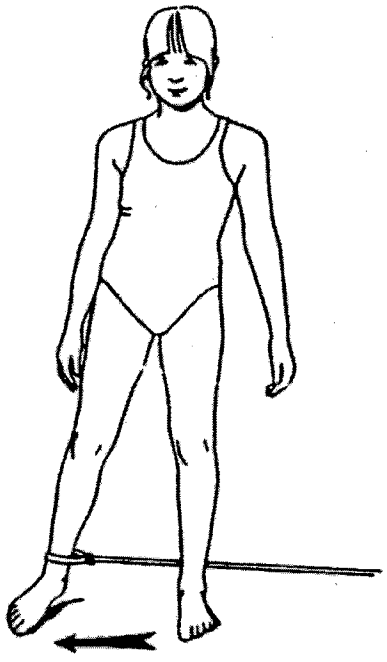
LEG SQUAT EXERCISES



HIP ADDUCTION EXERCISES



HIP ABDUCTION EXERCISES



APPENDIX G

MEDICAL OUTCOMES STUDY 36-ITEMS SHORT FORM

HEALTH-RELATED QUALITY OF LIFE SURVEY

MEDICAL OUTCOMES STUDY SHORT FORM 36-ITEMS
HEALTH-RELATED QUALITY OF LIFE SURVEY (SF-36)

1. In general would **you say your health** is:

O Excellent O Very Good O Good O Fair O Poor

2. **Compared to one year ago,** how would you rate your health in general now?

O Much Better O Better O About the same O Worse O Much Worse

3. The following items are about activities you might do during a typical day. Does **your health now limit you** in these activities? If so, how much?

	Limited a lot	Limited a little	Not at all
a. Vigorous Activities: running, lifting heavy objects, participating in strenuous sports	O	O	O
b. Moderate Activities: moving a table, pushing a vacuum cleaner, bowling, or playing golf	O	O	O
c. Lifting or carrying groceries	O	O	O
d. Climbing several flights of stairs	O	O	O
e. Climbing one flight of stairs	O	O	O
f. Bending, kneeling, or stooping	O	O	O
g. Walking more than a mile	O	O	O
h. Walking several blocks	O	O	O
i. Walking one block	O	O	O
j. Bathing or dressing yourself	O	O	O

4. During the **past 4 weeks,** have you had any of the following problems with your work or other daily activities as a result of your physical health?

	Yes	No
a. Cut down on the **amount of time** you spend on work or other activities	O	O
b. **Accomplished less** than you would like	O	O
c. Were limited in the **kind** of work or other activities	O	O
d. Had **difficulty** performing the work or other activities (i.e., it took extra effort)	O	O

5. During the **past 4 weeks,** have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

	Yes	No
a. Cut down on the **amount of time** you spend on work or other activities	O	O
b. **Accomplished less than** you would like	O	O
c. Did not do work or other activities as carefully as usual	O	O

6. During the **past 4 weeks,** to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

O Not at all O Slightly O Moderately O Quite a bit O Extremely

7. How much **bodily** pain have you had during the **past 4 weeks**?
O None O Very mild O Mild O Moderate O Severe O Very severe

8. During the **past 4 weeks,** how much did pain interfere with your normal work (E.g., both work outside the home and housework)?

O Not at all O A little bit O Moderately O Quite a bit O Extremely

9. These questions are about how you feel and how things have been with you during the **past 4 weeks.** For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the **past 4 weeks.**

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
a. Did you feel full pep?	O	O	O	O	O	O
b. Have you been a very nervous person?	O	O	O	O	O	O
c. Have you felt so down in the dumps that nothing could cheer you up?	O	O	O	O	O	O
d. Have you felt calm and peaceful?	O	O	O	O	O	O
e. Did you have a lot of energy?	O	O	O	O	O	O
f. Have you felt downhearted and blue?	O	O	O	O	O	O
g. Did you feel worn out?	O	O	O	O	O	O
h. Have you been a happy person?	O	O	O	O	O	O
i. Did you feel tired?	O	O	O	O	O	O

10. During the **past 4 weeks,** how much of the time has your **physical health** or **emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)?

O All of the time O Most of the time O Some of the time O A little of the time O None of the time

11. How TRUE or FALSE is **each** of the following statements for you?

		Definitely true	Mostly true	Do not know	Mostly false	Definitely false
a.	I seem to get sick a little easier than others	O	O	O	O	O
b.	I am as healthy as anybody I know	O	O	O	O	O
c.	I expect my health to get worse	O	O	O	O	O
d.	My health is excellent	O	O	O	O	O

APPENDIX H

BORG SCALE

BORG RATINGS OF PERCEIVED EXERTION (RPE)

6	
7	Very, very light
8	
9	Very light
10	
11	Fairly light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Very, very hard
20	

APPENDIX I

OVERALL VIEW OF MOS SF-36 HEALTH SURVEY, SIT AND STAND TEST AND ARM CURL ASSESSMENT

Control Group

	Pre-Test	Post-Test
	Mean SD	Mean SD
PCS Summary Scale	41.9 ± 10.43	43.7 ± 11.37
MCS Summary Scale	53.9 ± 8.32	58.6 ± 7.35
Sit and Stand Test	13.2 ± 2.33	12.5 ± 2.44
Arm Curl Assessment	19.0 ± 4.11	17.3 ± 4.67

Experimental Group

	Pre-Test	Post-Test
	Mean SD	Mean SD
PCS Summary Scale	43.2 ± 9.87	48.8 ± 5.84
MCS Summary Scale	57.2 ± 8.35	58.7 ± 5.16
Sit and Stand Test	14.2 ± 3.70	16.1 ± 3.51
Arm Curl Assessment	20.9 ± 6.57	22.7 ± 6.82

2.

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