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Linda D. Bane Frizzell

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EFFECTS OF AN EXERCISE PROGRAM ON MENTALLY IMPAIRED OLDER ADULTS IN A LONG-TERM CARE FACILITY

By
Linda D. Bane Frizzell
Master of Science, Bemidji State University, 1988

A Dissertation
Submitted to the Graduate Faculty
of the
University of North Dakota
in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Grand Forks, North Dakota
December
1991
This dissertation submitted by Linda D. Bane Frizzell in partial fulfillment of the requirements for the Degree of Doctor of Philosophy from the University of North Dakota has been read by the Faculty Advisory Committee under whom the work had been done, and is hereby approved.

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This dissertation meets the standards for appearance and conforms to the style and format requirements of the Graduate School of the University of North Dakota, and is hereby approved.

Hamry Knoll
Dean of the Graduate School

11-21-92
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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS ........................................................................ vii
LIST OF TABLES ...................................................................................... viii
ACKNOWLEDGEMENTS .......................................................................... x
ABSTRACT .............................................................................................. xii

CHAPTER

I. INTRODUCTION .................................................................................. 1
   Purpose of the Study ........................................................................ 5
   Statement of the Problem .............................................................. 6
   Hypothesis ....................................................................................... 8
   Assumptions .................................................................................... 8
   Definition of Terms ......................................................................... 9
   Delimitations of the Study ............................................................ 14

II. REVIEW OF LITERATURE .................................................................. 16
   Exercise Programming Factors for Older Adults .......................... 16
   Physiological Implications of Aging and Exercise ...................... 29
   Mental and Cognitive Functioning with Age .................................. 39
   Physiological and Behavioral Changes of Alzheimer's Disease in Relation to Physical Movement ........................................................................ 46

III. METHODS AND PROCEDURES ...................................................... 56
   Description of Subjects .................................................................... 57
   Instrumentation ............................................................................... 58
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation of Subjects</td>
<td>60</td>
</tr>
<tr>
<td>Test Administration</td>
<td>61</td>
</tr>
<tr>
<td>Procedures</td>
<td>64</td>
</tr>
<tr>
<td>Design and Analysis</td>
<td>67</td>
</tr>
<tr>
<td>IV. RESULTS</td>
<td>68</td>
</tr>
<tr>
<td>Comparative Data</td>
<td>69</td>
</tr>
<tr>
<td>Life Satisfaction Assessment</td>
<td>80</td>
</tr>
<tr>
<td>Case Studies</td>
<td>88</td>
</tr>
<tr>
<td>V. DISCUSSION</td>
<td>121</td>
</tr>
<tr>
<td>Summary</td>
<td>121</td>
</tr>
<tr>
<td>Conclusions</td>
<td>125</td>
</tr>
<tr>
<td>Recommendations</td>
<td>127</td>
</tr>
<tr>
<td>Limitations</td>
<td>129</td>
</tr>
<tr>
<td>Implications for Further Research</td>
<td>131</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>133</td>
</tr>
<tr>
<td>A. ILLUSTRATION OF INSTRUMENT USED FOR</td>
<td>134</td>
</tr>
<tr>
<td>MEASURING MODIFIED SIT AND REACH</td>
<td></td>
</tr>
<tr>
<td>B. CONSENT FORM</td>
<td>135</td>
</tr>
<tr>
<td>C. UNIVERSITY OF NORTH DAKOTA'S INSTITUTIONAL REVIEW BOARD</td>
<td>136</td>
</tr>
<tr>
<td>PROJECT APPROVAL FORM</td>
<td></td>
</tr>
<tr>
<td>D. DATA FOR SPSSX PROGRAM</td>
<td>137</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>140</td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1.</td>
<td>Mean of Right and Left Shoulder Flexibility of Mentally Impaired Persons</td>
</tr>
<tr>
<td></td>
<td>Available for Testing</td>
</tr>
<tr>
<td>2.</td>
<td>Range - Right Shoulder Flexibility of Mentally Impaired Persons Available</td>
</tr>
<tr>
<td></td>
<td>for Testing</td>
</tr>
<tr>
<td>3.</td>
<td>Range - Left Shoulder Flexibility of Mentally Impaired Persons Available</td>
</tr>
<tr>
<td></td>
<td>for Testing</td>
</tr>
<tr>
<td>4.</td>
<td>Mean of Right and Left Grip Strength of Mentally Impaired Persons Available</td>
</tr>
<tr>
<td></td>
<td>for Testing</td>
</tr>
<tr>
<td>5.</td>
<td>Range - Right Hand Grip Strength of Mentally Impaired Persons Available</td>
</tr>
<tr>
<td></td>
<td>for Testing</td>
</tr>
<tr>
<td>6.</td>
<td>Range - Left Hand Grip Strength of Mentally Impaired Persons Available</td>
</tr>
<tr>
<td></td>
<td>for Testing</td>
</tr>
<tr>
<td>7.</td>
<td>Mean of Modified Sit and Reach Flexibility of Mentally Impaired Persons</td>
</tr>
<tr>
<td></td>
<td>Available for Testing</td>
</tr>
<tr>
<td>8.</td>
<td>Range - Modified Sit and Reach Flexibility of Mentally Impaired Persons</td>
</tr>
<tr>
<td></td>
<td>Available for Testing</td>
</tr>
<tr>
<td>9.</td>
<td>Illustration of Instrument Used for Measuring Modified Sit and Reach</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
</tr>
<tr>
<td>Table</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>1.</td>
<td>Characteristics of Subjects</td>
</tr>
<tr>
<td>2.</td>
<td>Right Shoulder Flexibility for Persons (Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments)</td>
</tr>
<tr>
<td>3.</td>
<td>Left Shoulder Flexibility for Persons (Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments)</td>
</tr>
<tr>
<td>4.</td>
<td>Right Shoulder Paired t-test for Persons (Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments)</td>
</tr>
<tr>
<td>5.</td>
<td>Left Shoulder Paired t-test for Persons (Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments)</td>
</tr>
<tr>
<td>6.</td>
<td>Right Hand Grip Strength for Persons (Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments)</td>
</tr>
</tbody>
</table>
7. Left Hand Grip Strength for Persons Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments ................................. 79

8. Right Hand Grip Strength Paired t-test for Persons Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments ................................................. 83

9. Left Hand Grip Strength Paired t-test for Persons Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments ................................................. 83

10. Modified Sit and Reach Flexibility for Persons Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments ................................................. 84

11. Modified Sit and Reach Flexibility Paired t-test for Persons Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments ................................................. 87

12. Scores for Pretest and Posttest of Eight Subjects on the Life Satisfaction Scale ............................... 89
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To my parents:
Howard and Dorothy
ABSTRACT

This study is a contradistinction to research which assesses the effects of exercise only on older adults who are in good health. This study examined the effect of an eight-week exercise program on 24 individuals with mental impairments, primarily Alzheimer's disease and dementia. Subjects were volunteers who resided in a long-term care skilled nursing facility (SNF). Group composition was 7 males, mean age 83.29 and 17 females, mean age 88.71; mental and physical function levels varied from supervised to total dependence of care. Six variables were tested: right and left shoulder flexibility, right and left hand grip strength, modified sit and reach flexibility, and life satisfaction. Subjects participated in a low intensity exercise program three days a week, with physical variables measured weekly. The data were analyzed in two stages. Only aggregate data were analyzed each week because group composition was inconsistent at any given point at time of measurement, principally due to participants' handicapping conditions and current physical health, but also due to participants' occasional refusal to participate on a given day. After the analysis of aggregate data is reported, individual subject case studies are presented, a necessity due to the population and participation rates. Results indicate that performance on physical variables using a means and standard deviation comparison to charting weekly progress did not show significant improvement. Pre- and posttests of right and left shoulder flexibility, right and left grip strength,
and modified sit and reach were computed using a paired $t$-test. Significance was reached only for right shoulder flexibility $t = 1.92$, $p < .005$. A life satisfaction assessment was administered as a pre- and posttest for the exercise program. Not all subjects were assessed due to cognition limitations; however, all but one of those assessed showed improvement in perceived life satisfaction ($t = 8.91$, $p < .001$).

Results suggest that physical functions of flexibility and strength can improve in people with Alzheimer's disease and dementia; however, more research is needed to determine possible contributions of physical exercise to cognitive functioning in individuals with progressive cognitive impairments. Additionally, longitudinal research may provide information to determine if physical exercise has a preventative or postponing effect on the characteristics of Alzheimer's disease and dementia.
CHAPTER I
INTRODUCTION

The value of physical exercise for healthy older adults has been well established by professionals in a variety of health-related fields. However, few professionals have addressed the exercise needs of the older mentally impaired, diseased, or disabled adult. Most studies involve older adults who live in the public sector (non-institutionalized) and are termed in "good health." This study attempted to define the current bases for physical exercise and activity for the healthy older adult and to use that data as a basis for developing physical exercises and activities for the mentally impaired older adult.

Research studies for the older adult population remain limited even though the proportion of people reaching the age of 65 is dramatically increasing. By the year 2000 the number of persons over age 65 will total 36 million or 13.2 percent of our citizenry (DiGilio & Howe, 1984; Ross, 1983). Further, this population growth is predicted to continue to increase disproportionately to other cohorts into the next century (Boarman, 1989; Daniel, 1983; DiGilio & Howe, 1984; Forman, 1981; Heitmann, 1982; Piscopo, 1985). As the older adult population moves away from "minority" status, its greater numbers can presumably work to create viable social,
political, and personal improvements in their quality of life. The older adult of the future, including the mentally impaired, diseased, and disabled older adult, should be able to expect more services, including trained professionals, to address their needs. Other characteristics of the general emerging population of older adults is that they are better educated, have more funds to purchase services, are less passive and more politically active, and are less dependent upon others for their living environment (Pisco, 1985). Additional factors influencing the lifestyle of the older population include fixed incomes, inadequate quality of housing, high suicide rates, inflation-reduced buying power, rising medical costs, social isolation, and negative stereotypes of non-working adults.

Included in this age 60+ cohort are older adults who are mentally impaired, diseased, or disabled. Eleven percent of the total United States population are moderately or severely disabled, with approximately 40% of those being over the age of 60 (Kemp, 1983). Kemp also reported that the chances of a person with an early life disability living to older age have also increased. Some epidemiologic studies have found that between 4 and 6% of all older adults age 65 and older in this country suffer from an organic brain syndrome. Toseland, Derico, and Owen (1984) reported that percentages of mental impairments are higher for those older individuals seen in inpatient and outpatient health and mental health facilities, reaching as high as 50%. Wright and Whalley (1984) claimed that senile dementia is now a major public health problem, affecting one in twenty of those over age 65, and one in four of
those over age 80. Alzheimer's disease accounts for as many as 90,000-100,000 deaths in the United States per year (Toseland et al., 1984).

Evidence is mounting that regular physical exercise is an important component for maintenance of physical and emotional well being (Blumenthal, Emery, Madden, George, Coleman, Riddle, McKee, Reasoner, & Williams, 1989; Brown, Cundiff, & Thompson, 1989; MacLean, 1982). Exercise programs are becoming an integral part of the care of the institutionalized elderly (LaRocque & Campagna, 1983), adding to the need for diversified exercise programming. This diversity creates a problem for those who program exercises for older adults because their needs and goals are likely to be different from those of the younger population. Successful models for health promotion are often built upon new ideas and new approaches suggested by the older adults themselves (Koss, 1983).

For regular physical exercise to be accepted by the older adult as an integral part of everyday life, social policy must also be accepting, allowing unrestricted participation in physical exercise. Nations and cultures vary greatly in their opinions about who is responsible for providing health promotion and health care for the older adult (Koss, 1991). Sensitivity to cultural influences should be considered when developing an exercise program for older adults.

Gender composition is another factor to consider when formulating exercise programs. Because they have a longer life expectancy, women may be the primary clientele of those conducting
exercise programs for the elderly. The combination of female gender and old age functions as a socially constructed category defining and delimiting appropriate physical behavior (Vertinsky & Auman, 1988) that should be considered when designing exercise programs for elderly women.

Exercise has a preventive effect on the incidence and progression of chronic diseases often related to the aging process (Brown et al., 1989). Active people, both low and high intensity exercisers, have significantly lower coronary artery disease (CAD) than do sedentary individuals. Additionally, exercise plays an important role in the treatment of hypertension, obesity, hypercholesterolemia, myocardial infarction, and congestive heart failure (Goldfine, Ward, Taylor, Carlucci, & Rippe, 1991). Dustman, Ruhling, Russell, Shearer, Bonekat, Shigeoka, Wood, and Bradford (1984) found a marked improvement in neuropsychological function and physical fitness in previously sedentary individuals aged 55-70 years after a four-month aerobic exercise program. Molloy, Beerschoten, Borrie, Crilly, and Cape (1988) found that physically fit elderly scored higher on tests of fluid intelligence than age-matched sedentary controls. Rikli and Edwards (1991) suggested that sedentary individuals can realize the benefits of exercise participation and significantly reverse certain motor and cognitive declines in performance at almost any age. Further, exercise can benefit disabled persons who have lifestyles similar to the nondisabled population but who, because they have been burdened with a disability, are more likely to "age" faster (Kemp, 1983).
Exercise is known to preserve many physiological responses in the healthy elderly; yet, those with physical impairments are often discouraged from exercising (Thompson, Crist, Marsh, & Rosenthal, 1988). McPhillips, Pellettera, Barret-Connor, Wingard, and Criqui (1989) found that exercise frequency was lower in those with a history of chronic disease, obesity, or current cigarette smoking; yet, exercise was positively associated with physical and emotional functioning and self-rated health.

Little is known about the extent to which older adults engage in exercise, despite recent enthusiasm for exercise among people of all ages (McPhillips et al., 1989). The most important aspect of physical activity may be personal fitness goals of the older adult. These goals are likely to include the maintenance of stamina, improved appearance, better elimination, better sleep and, especially important, the sensation of feeling good (Clarke, 1986).

**Purpose of the Study**

The benefits of physical exercise programming for older adults are well documented in this paper. However, few studies have been conducted to ascertain the needs and assess the limitations of the mentally impaired older adult and, in particular, the increasing number of individuals with dementia specifically of the Alzheimer's type.

The purpose of this study was to see if an eight-week exercise program could demonstrate an effect on satisfaction and quality of life for older adults classified as having mental impairments and to
provide a demonstration of a comprehensive exercise program for Alzheimer's- and dementia-afflicted older adults living in a long-term care facility.

This study was designed to demonstrate an exercise program that would improve physical flexibility of the shoulders, back, and posterior legs, and improve grip strength. Improvements in flexibility and strength promote independence of daily functioning. Shoulder girdle flexibility is needed to maintain the ability to feed, dress, groom, and perform everyday duties and activities of daily living (ADLs). Back and posterior leg flexibility (sit and reach fitness) are necessary to perform such daily procedures as tying shoes, picking up objects on the floor, and sitting in a chair. Grip strength is fundamental for efficient performance of daily functions such as personal hygiene, feeding, writing, and operating wheelchairs. The exercises incorporated in this study were tailored to promote physical components of flexibility and strength, helping to produce independence of daily functioning and improve quality of life. A secondary purpose of this study was to note any improvement of self-esteem and perceived life satisfaction from physical movement participation.

**Statement of the Problem**

The intent of this research was to see if an eight-week exercise program could affect satisfaction and quality of life for older adults classified as having mental impairments. The majority of this population in the United States live in residential facilities
where health care is driven by reimbursement mechanisms, usually focusing exclusively on treatment and rehabilitation of the diagnosed condition with little attention to enhancing the general well-being of the resident (Taylor-Nicholson, Brannon, Mahoney, & Bucher, 1990). Nursing home residents have generally not been targeted for health promotion programs, even though evidence suggests that many nursing home residents can return to a less restrictive environment if proactive discharge planning takes place early in their stay (Rodin, 1986). LaRocque and Campagna (1983) stated that institutions continue to be structured in a way that fosters dependency and that that dependency may contribute to and accelerate the physical deterioration of the elderly. Institutions must initiate preventive measures to help residents maintain their present state of health and, whenever possible, improve their condition.

Health care and education professionals have tended to overlook the needs and requirements of the mentally impaired for physical exercise and activity programs. Conversely, for the institutionalized elderly, many daily tasks which could provide movement opportunities are often handled by the institution staff. The resident, therefore, becomes dependent on the staff and loses incentive to initiate and to participate in activities (LaRocque & Campagna, 1983). Older adults succumb to decreased physical activity; inactivity becomes more pronounced as a person ages, especially in females over age 65 (Vertinsky & Auman, 1988). Motivation is needed to promote the physical activity essential for
improving quality of life. Meaningful experiences designed to meet the requirements and abilities of all older adults are necessary to promote regular participation in physically active pursuits and thus extend independence, functional abilities, and improved life satisfaction.

**Hypothesis**

It is necessary to develop meaningful movement experiences especially designed to meet the diverse requirements and abilities of older individuals with mental impairments in order to establish regular participation in physically active pursuits which will ameliorate the dependence, stress, physical complications, and mental anguish experienced by them. It is hypothesized that, as a result of participation in an exercise program, there will be improvement in life satisfaction, shoulder flexibility, grip strength, and back and posterior leg flexibility in the mentally impaired, older population.

**Assumptions**

The following assumptions were made regarding this study:

1. The grip dynamometer was calibrated correctly (Quinton, 0-200 ft. lbs.).
2. Other activities of the subjects did not confound the results.
3. Medications were not used to improve physical or mental measurements.
4. The subjects gave maximum effort during measurement.
Definitions of Terms

**Amyloid Degeneration:** degeneration of organs or tissues from deposition of amyloid. Structures are waxy and translucent, having hyaline appearance. Liver, spleen, and kidneys are usually involved, but any tissue may be infiltrated (Taber's, 1985).

**Atherosclerosis:** a form of arteriosclerosis characterized by a variable combination of changes of the intima of arteries, not arterioles, consisting of the focal accumulation of lipids, complex carbohydrates, blood and blood products, fibrous tissue and calcium deposits, and associated with changes in the media of the arteries (Taber's, 1985).

**Atrial Fibrillation:** irregular and rapid randomized contractions of the atria working independently of the ventricles (Taber's, 1985).

**Biological Aging:** refers to the organism's life expectancy or its ability to survive. Cells, organ systems, and people age biologically at varying rates depending upon genetic, environmental, and lifestyle factors (Kemp, 1983).

**Bradykinesia:** extremely slow movement (Taber's, 1985).

**Bruit:** an adventitious sound of venous or arterial origin of the heart on auscultation (Taber's, 1985).

**Catecholamines:** biologically active amines, epinephrine and norepinephrine, derived from the amino acid tyrosine. They have a marked effect on the nervous and cardiovascular systems, metabolic rate, temperature, and smooth muscle (Taber's, 1985).

**Cellulitis:** inflammation of cellular or connective tissue, spreading as in erysipelas. An infection in or close to the skin is usually
localized by the body defense mechanisms. However, if inflammation spreads through the tissue, the process is called cellulitis (Taber's, 1985).

**Chronotropic:** influencing rate of occurrence of an event (e.g., heart rate) (Taber's, 1985).

**Contracture:** permanent contraction of a muscle due to spasm or paralysis, or a condition of fixed high resistance to the passive stretch of a muscle, as may result from fibrosis of tissues surrounding a joint (Taber's, 1985).

**Corpus Striatum:** structure in the cerebral hemispheres consisting of two basal ganglia (the caudate and lentiform nuclei), and the fibers of the internal capsule that separate them (Taber's, 1985).

**Crus Cerebri:** either of the two peduncles connecting the cerebrum with the pons (Taber's, 1985).

**Coupled Rhythm:** condition in which every other heartbeat produces no pulse at the wrist (Taber's, 1985).

**Dopamine Hydrochloride:** a catecholamine synthesized by the adrenal gland. It is the immediate precursor in the synthesis of norepinephrine. Dopamine hydrochloride acts to increase blood pressure, especially systolic pressure, and to increase urinary output. A catecholamine neurotransmitter or brain messenger implicated in some forms of psychosis and abnormal movement disorders (Taber's, 1985).

**Epinephrine:** a hormone secreted by the adrenal medulla in response to splanchnic stimulation. This substance and norepinephrine are the two active hormones produced by the adrenal medulla. It causes
some of the physiological expressions of fear and anxiety and has been found to be in excess in some anxiety disorders. Epinephrine is employed therapeutically as a vasoconstrictor, as a cardiac stimulant, and to relax bronchioles (Taber's, 1985).

**Extrapyramidal**: outside the pyramidal tracts of the central nervous system (Taber's, 1985).

**Frank-Starling Mechanism**: the force of the heartbeat is determined primarily by length of the fibers constituting its muscular wall, i.e., an increase in diastolic filling increases force of heartbeat (Taber's, 1985).

**Hypercholesterolemia**: excessive amount of cholesterol in the blood (Taber's, 1985).

**Inotropic**: influencing force of musculature contractibility (Taber's, 1985).

**Maximum Heart Rate Reserve (HR_{max})**: calculated difference between resting and maximum heart rate. To estimate training intensity, a percentage of this value is added to the resting heart rate and is expressed as a percentage of HR_{max} reserve (American College of Sports Medicine, 1990).

**Metastasis**: movement of bacteria or body cells (especially cancer cells) from one part of the body to another (Taber's, 1985).

**METs**: a means of expressing an exercise load using a ratio of exercise metabolic load to resting metabolic rate. Resting metabolic rate is approximately 3.5 milliliters (ml) of oxygen (O_2)
consumption per minute/per kilogram body weight (deVries, 1986):

\[
\text{METs} = \frac{\text{Oxygen (O}_2\text{) required for exercise}}{\text{Oxygen (O}_2\text{) required for rest}} = \frac{\text{Volume of } O_2 \text{ at exercise in ml } \times \text{Kg}^{-1} \times \text{min}^{-1}}{3.5 \text{ ml } \times \text{Kg}^{-1} \times \text{min}^{-1}}
\]

**Myelodysplasia:** defective formation of the spinal cord (Taber's, 1985).

**Myoclonus:** twitching or clonic spasm of a muscle or group of muscles (Taber's, 1985).

**Nigrostriatal:** concerning a bundle of nerve fibers that connect the substantia nigra of the brain to the corpus striatum (Taber's, 1985).

**Norepinephrine:** a hormone produced by the adrenal medulla, similar in chemical and pharmacological properties to epinephrine, but chiefly a vasoconstrictor that has little effect on cardiac output. A catecholamine, it is a neurotransmitter; a disturbance in its metabolism at important brain sites has been implicated in affective disorders (Taber's, 1985).

**Phlebitis:** inflammation of a vein (Taber's, 1985).

**Physical Fitness:** that facet of fitness that is the physical work capacity of an individual (assumed or measured), defined as the maximum level of physical work of which an individual is capable (Spirduso, 1980).

**Physical Work Capacity:** a measure of aerobic capacity reported in terms of oxygen consumption per kilogram per body weight per minute (Spirduso, 1980).
**Psychological Aging:** changes with age in the organism's adaptive capacities, such as learning, problem solving, the ability to cope with stressors (Kemp, 1983).

**Psychomotor Speed:** a rubric describing the speed with which an individual can perform a task which involves reacting motorically to an environmental stimulus (Spirduso, 1980).

**Pyramidal Tract:** one of three descending tracts (lateral, ventral, ventrolateral) of the spinal cord. Consists of fibers arising from giant pyramidal cells of Betz and present in the motor area of the cerebral cortex (Taber's, 1985).

**Serotonin:** a chemical, 5-hydroxytryptamine (5-HT), present in platelets, gastrointestinal mucosa, mast cells, and carcinoid tumors. Serotonin is a potent vasoconstrictor. It is thought to be involved in neural mechanisms important in sleep and sensory perception (Taber's, 1985).

**Social Aging:** a person's ability to fulfill social roles and expectations (Kemp, 1983).

**Stenosis:** constriction or narrowing of a passage or orifice (Taber's, 1985).

**Substantia Nigra:** black substance in a section of the crus cerebri (Taber's, 1985).

**Transient Ischemic Attack (TIA):** temporary interference with blood supply to the brain. The symptoms of neurological deficit may last for only a few moments or several hours (Taber's, 1985).
Venostasis: trapping of blood in an extremity by compression of veins, a method sometimes employed for reducing the amount of blood in circulation (Taber's, 1985).

Volume of Maximum Oxygen Consumption (VO₂max): maximum oxygen uptake, used to estimate training intensity; a percentage of this value is added to the resting heart rate and is expressed as a percentage of HRmax reserve (American College of Sports Medicine, 1990).

Watt (w): a measurement of exercise load equal to:

1w work load = 6.12 Kg - m/min or approx. 6 Kg - m/min
50w work load = approximately 300 kg - m/min
746w work load = 1 horsepower (deVries, 1986).

Delimitations of the Study

The study was subject to the following delimitations:

1. The duration of the study was eight weeks.
2. The rate of absenteeism was beyond the control of the researcher.
3. Physical variables were measured only once per week.
4. A diagnosis was obtained from medical records.
5. Accepted social limitations were influential on exercise participation.
6. Subjects were selected from a group of clinically diagnosed mentally impaired older adults who volunteered to participate in an exercise program.
7. The selection of subjects was from one long-term care facility.

8. The subjects were required to be compatible with other subjects in the exercise group.

5. The number of subjects was only 24.
CHAPTER II
REVIEW OF LITERATURE

The research reviewed in this chapter summarizes studies related to physical activity and exercise for adults age 65 and older. This review includes current research studies for the healthy older adult in addition to the limited available research concerning the mentally impaired, diseased, or disabled older adult. Due to limited research studies involving mentally impaired, diseased, or disabled older adults, programs for physical activity and exercise for the healthy older adults are presented as a foundation upon which to expand or base theories and to guide program designs. This review of literature contains the following topics: exercise programming factors for older adults, physiological implications of aging and exercise, mental and cognitive functioning of the older adult and the relationship to physical movement, and physiological and behavioral changes related to Alzheimer's disease and the impact of these changes on physical movement.

Exercise Programming Factors for Older Adults

A properly designed exercise program can have many physical and emotional benefits for the older adult. Physical fitness programming for the geriatric population will enhance physiological
function and will likely result in aiding the individual to achieve a more independent lifestyle (Brown et al., 1989). Nakamura, Moritani, and Kanetaka (1989) suggested that regular physical activity may provide physiological improvements which in turn might reduce the rate of aging in older individuals.

Many of the health problems of the older adult can be attributed to atrophy and misuse of the motor and vital systems of the body resulting from a lack of proper regular recreation and exercise (Heitmann, 1982). Increasing evidence indicates that exercise has a preventive effect on the incidence and progression of chronic diseases often related to the aging process, including coronary artery disease, hypertension, and adult-onset diabetes mellitus (Brown et al., 1989). Additionally, improved vigor and self-satisfaction with physical and mental health appear to be correlated with exercise among the elderly (McPhillips et al., 1989). In a study by Blumenthal et al. (1989), the subjects in an exercise group perceived themselves as improving their physical health, looking better, improving sleep, and having more energy, more endurance, and more flexibility. Socially, the subjects reported improved family relations, better sex lives, less loneliness, and improved social life. Psychologically, the subjects reported improved mood, improved self-confidence, improved life satisfaction, and improved memory and concentration. In contrast, the control group perceived relatively little change.

Some direct exercise benefits include increased efficiency of the heart and circulatory system, increased number of high density
lipoproteins, increased efficiency of thyroid gland, increased efficiency in use of insulin, better tolerance to stress, enhanced quality of sleep, better flexibility, and increased joy of living. Exercise tends to decrease obesity and body fat, arterial blood pressure, heart rate, low density lipoproteins cholesterol, symptoms of depression, risk of osteoporosis, and social isolation (DiGilio & Howze, 1984). Additionally, other positive effects of physical activity which are especially meaningful for older persons include released nervous tension, less chronic fatigue, greater endurance and agility, increased flexibility and coordination, improved self esteem, and more socialization and fun (Snodgrass, 1987).

Clark (1986) found that regular physical exercise is more important for older adults than for younger adults because of the older adults' declining physical capability at a time when they wish to remain in control of their lives. As a result of the pursuit and demand of exercise programs for older adults, recommendations and position statements have been written to ensure comprehensive development of safe programs. The American Alliance for Health, Physical Education, Recreation and Dance Committee on Aging adopted several General Guidelines for Exercise Programs for Older Persons (age 50 and older):

1. Each participant in the program should be periodically monitored for signs of stress (unduly high heart rate, nausea, difficulty in breathing, pallor, or pain). Participants should be taught to monitor their own heart rate and to recognize and report irregularities to their exercise leader.
2. Every exercise program must have a well-defined emergency plan for exercise leaders to follow in case of cardiac arrest or other accidents.

3. Adequate supervision must be available for exercise programs. Exercise leaders should be trained in cardiopulmonary resuscitation techniques, or, at the very minimum, CPR-trained personnel should be in close proximity to the exercise program (Penner, 1990). In 1990 the American Alliance for Health, Physical Education, Recreation and Dance published the *Functional Fitness Assessment for Adults Over 60 Years.* This assessment identifies seven physical fitness parameters: (a) flexibility, (b) endurance, (c) strength, (d) balance, (e) gait, (f) reaction time, and (g) posture. Measuring techniques were also provided. Individual results from the test could be compared to age and gender norms so that present condition as well as function change over time could be assessed. Although, this assessment would be applicable to all older adults, including mentally impaired, diseased, and disabled older adults, the protocols should not be altered when using the norms to evaluate performance. (Osness, Adrian, Clark, Hoeger, Raab, & Wiswell, 1990, p. ii)

The American College of Sports Medicine (1990) issued a position stand based on the existing evidence concerning exercise prescription for healthy adults and the need for guidelines. The following recommendations were issued about quantity and quality of training for developing and maintaining cardiopulmonary fitness and body composition in the healthy adult:

1. Frequency of training: 3 to 5 days per week.
2. Intensity of training: 60 to 90% of maximum heart rate (HR$_{\text{max}}$), or 50 to 85% of maximum oxygen uptake (VO$_{2\text{max}}$) HR$_{\text{max}}$ reserve.
3. Duration of training: 20 to 60 minutes of continuous aerobic activity. Duration is dependent on the intensity of the activity; thus, lower intensity activity should be conducted over a longer period of time. Because of the importance of "total fitness" and the fact that it is more readily attained in longer duration programs, and because of the potential hazards and compliance problems associated
with high intensity activity, lower to moderate intensity activity of longer duration is recommended for the non-athletic adult.

4. Mode of activity: Any activity that uses large muscle groups, that can be maintained continuously, and is rhythmical and aerobic in nature, e.g., walking-hiking, running-jogging, cycling-bicycling, cross country skiing, dancing, rope skipping, rowing, stair climbing, swimming, skating, and various endurance game activities.

5. Resistance training: Strength training of a moderate intensity, sufficient to develop and maintain fat free weight (FFW), should be an integral part of an adult fitness program. One set of 8-12 repetitions of eight to ten exercises that condition the major muscle groups at least two times per week is the recommended minimum. (p. 1)

Before older adults begin an exercise program, it is recommended that they have a pre-exercise assessment of current individual capabilities, limitations, personal and family health history, and medications (Leslie, 1989). Van Camp and Boyer (1989) included a medical evaluation that pays special attention to the cardiovascular, pulmonary, musculoskeletal, and neurologic systems. If the medical evaluation identifies disorders and limitations, further assessment is indicated to determine their pathophysiologic severity and significance. If high susceptibility to coronary artery disease (CAD) exists, further assessment is required; a resting and exercise ECG may be needed to assist in exercise prescription. Additional pre-exercise assessments may include laboratory tests such as urinalysis and counts of serum lipids, triglycerides, cholesterol, blood glucose, and blood cell.

The pre-exercise assessment can also aid the older adult in determining the type of exercise program that should be initiated,
either aerobic (high or low intensity) or strength training, depending on the individual's health, level of fitness, and interests (Dychtwald, 1986). The elderly, because of physical limitations and potential for physical problems, require more individualization of their exercise programs than do younger adults (Brown et al., 1984; St. Clair, 1986; Van Camp & Boyer, 1989).

Previously sedentary exercise participants must begin an exercise program slowly and, because the benefits of exercise appear to remain only as long as one continues to exercise, lifetime exercise participation is the goal (Dychtwald, 1986). Participant adherence to an exercise program may be dependent on level of intensity. Because fitness can be attained and maintained at low intensity levels, experience with older adults indicates that lower intensity activities such as group exercises, tennis, walking, jogging, swimming, and badminton are most desired, in contrast to a high intensity cardiovascular fitness program (Wakat & Odom, 1982). Additionally, Wakat and Odom (1982) found that programs which focus on lifetime skills and stretch and balance types of activity are generally more effective in providing not only physiological improvements but also psychosocial benefits. Van Camp and Boyer (1989) concur, reiterating that the elderly person's ability to attain a sufficiently high exercise intensity is the least important factor in a successful program and should not be overemphasized. Programs limited to cardiovascular fitness are valuable and desirable for some individuals but do not always provide for more than physiological improvement (Wakat & Odom, 1982).
Cardiovascular endurance can be achieved at lower intensity levels by maintaining the exercise for a longer duration (Monahan, 1987). This enables the exercisers to regulate their own intensity safely and to improve cardiovascular fitness.

Badenhop, Cleary, Schaal, Fox, and Bartels (1983) studied a group of 32 volunteers over age 60 for nine weeks to determine physiological adjustments to high or low intensity exercise. They found that exercising at a lower intensity (30%-45% of heart rate range, HRR) is an adequate training stimulus in older individuals and produces changes in VO$_{2\text{max}}$ that are comparable to those elicited by high intensity training (60%-75% of HRR). Seals, Hagberg, Hurley, Ehsani, and Holloszy (1984) found that moderate daily physical activity (40% of heart rate reserve) over a six-month period can result in a small but significant increase in VO$_{2\text{max}}$ (12%), while an additional six months of high intensity training (75% of heart rate reserve) can show an additional improvement (18%). Haber, Honiger, Klicpera, and Niederberger (1984) trained 12 subjects for 12 weeks, three times a week at 60% VO$_{2\text{max}}$ and concluded that, for healthy people between 67-76 years, a significant endurance effect is possible when training workload and training time are increased systematically to maintain a consistent 60% VO$_{2\text{max}}$. Regular aerobic exercise retards the usual loss in aerobic power and presents important implications for the aging population in relation to social, economic, and health benefits (Kasch, Boyer, Van Camp, Verity, & Wallace, 1990). Van Camp and Boyer (1989) also concluded that the
usually observed decline in exercise capacity among the elderly is
neither inevitable nor, if it has already occurred, permanent.

Typically, older adults display somewhat different effects
from overexertion from exercise. Primary potential problems among
older exercisers are cardiovascular, musculoskeletal, and thermal
control. An intensity level should be regarded by the exerciser as a
comfortable one that could be continued for many minutes. It should
also allow the exerciser to converse easily using the "talk test" (if
intensity is too high, the exerciser will be short of breath, making
the ability to talk difficult) as a guideline to either increase or
reduce the intensity level of the exercise (Van Camp & Boyer, 1989).

If an individual is prescribed a program that is too intense, of
little interest, or results in an injury, the program is of little value.
Clearly, participation in physical activity must be based on
developmental rather than age appropriateness, and age stereotypes
and other social barriers must be eliminated if participation in
physical activity is to occur throughout the life span of each
individual (Ostrow, 1982).

Monahan (1987) questioned the beneficial goals of exercise: Is
fitness from exercise the ability to exercise vigorously, or is it the
ability to carry out everyday routine? In the past, exercise
programs for older adults tended to focus primarily on flexibility
and neglected cardiovascular endurance essential for cardiac health
and muscular strength necessary for preventing bone fractures
(DiGilio & Howze, 1984). Many elderly patients are unable to
tolerate vigorous physical exercise but are able to participate in
lighter exercise for longer periods of time than do their younger counterparts (McPhillips et al., 1989). For example, fast walking may offer adequate aerobic training stimulus for most older adults (Porcari, McCarron, Kline, Freedson, Ward, Ross, & Rippe, 1987). Rhythmic exercise promotes safe, unconscious movement of limbs through a natural motion performed harmoniously to music, encouraging good posture, improving strength, flexibility, balance, and coordination as well as providing outlets for expression and socialization (LaRocque & Campagna, 1983). Simple exercises that prevent contractures and, as far as possible, that correct present contractures can be easy to learn and perform, enhancing individual motivation to continue exercising (Lonnerbland, 1984).

Diesfeldt and Diesfeldt-Groenendijk (1977) found that memory improved after a single bout of 40 minutes of very light exercise in debilitated patients who could not tolerate vigorous activity. Dustman et al. (1984) found that the physically unfit elderly can participate in a program of regular exercise at an intensity sufficient to improve their physical fitness level significantly and that exercise can improve their mental, as well as physical, functioning.

The optimum type, duration, and frequency of physical activity largely depends on the medical status of the individual (Piscopo, 1985). Thus, motivation, realistic goals, everyday functioning, and physical condition become determining factors in exercise prescription. Logically, exercise prescription should start with basic needs such as developing skills to perform tasks of everyday
living and then progress to moderate and later to vigorous exercise, depending on the capacity, motivation, and goals of the participant.

An exercise program should be as enjoyable as possible because exercise programs, including those for the elderly, have high dropout rates. Older persons who have been accustomed to a more sedentary lifestyle may be hesitant to participate. Some techniques to help alleviate this problem are leader enthusiasm, one-to-one contact (both listening and interacting), development of trust, responsiveness and evidence of caring, and creation of an atmosphere of joy, relaxation, and fun (Snodgrass, 1987). In a study by McPhillips et al. (1989) 1,140 persons, aged 50-93, living in an adult community, were studied to determine participation in exercise. They found that the rates of moderate and heavy exercise decreased with age. However, rates of participation in, and duration of, light exercise actually increased.

Other social concerns arise when developing an exercise program for the 65+ cohort with implications that will not only affect continued participation but initial entry into an exercise program. Evidence points to a declining involvement in physical activity with advancing age because of the underlying dynamic social forces that pressure individuals to disengage from physical activity (Gorman & Daniel, 1983; Ostrow, 1982). Many older adults have no prior exercise experience and therefore have not developed the necessary skills to participate in these activities (DiGilio & Howze, 1984; Heitmann, 1982). DiGilio and Howze (1984) found that many older adults believe that exercise will cause them to eat more,
that their need for exercise diminishes as they age, that light, sporadic exercise is overrated as beneficial, and that they are too old to receive benefit from exercise. Individual perception of personal physical ability to exercise is also a factor that influences exercise participation. Additionally, Marti et al. (1989) found that a subject's self-rating of higher ability to do heavy work when they were younger was a significant predictor of physical ability 20 years later.

Another cohort characteristic is gender proportion. There are many more females over the age of 65 than males. Elderly women as well as men can gain major benefits from activity and physical exercise. These benefits include a reduced susceptibility to illness, a better mental outlook, improved thinking processes, and a greater resistance to a variety of serious lifestyle diseases, as well as feelings of well being and improved self-image (Spirduso, 1983). Clarifying the factors that contribute to physical activity participation throughout the lifestyle is a complex and difficult undertaking. A better understanding of elderly women's conditioned beliefs about physical activity is clearly fundamental in planning health promotion for the elderly (Vertinsky & Auman, 1988).

Exercise programming for the diseased and disabled older adult must be diverse, as this population has many special needs. Kemp (1983) added that disabled persons have frequently lacked strenuous physical exercise as a result of being disabled. As a consequence, these individuals have not developed cardiac and respiratory reserves. Exercise can be an important factor in promoting life
satisfaction for disabled and handicapped older adults. Considerations must be given to individuals with all the usual categorical handicapping conditions including the following: blindness and partially sightedness, deafness and hard of hearing, mildly, moderately, and severely/profoundly mental retardation, cerebral palsy, spinal cord injury, amputation, emotionally disturbed and behaviorally disoriented, various health-related problems such as asthma, diabetes, and seizure disorders, cardiac and respiratory deficiencies, stroke and other brain-related disorders, Alzheimer's disease, and multiple conditions found in various combinations (Leslie, 1989). The mentally ill older adult may demonstrate numerous behavioral deviations. These behaviors may include multiple maladaptive behaviors, aggression, self-injurious behaviors, property destruction, noncompliance, inappropriate sexual behaviors, running away, verbal abuse, physical abuse, stealing, lying, and behaviors that endanger others. Consultations with other health care providers to determine history, medications, physical limitations, preferred approaches to therapy, and precautions to be taken to avoid deviant behavior can support comprehensive programming (Davis, 1988) including exercise for the mentally ill older adult.

Exercise prescription for those with handicapping conditions depends upon the participants' ability to understand and execute the correct motor command to a given stimulus. The type of specific handicap or illness and corresponding medication must be understood by the facilitator in order to provide an appropriate exercise.
prescription. Modification of exercise programs should be expected in order to provide for varying levels of skills and varying abilities to receive and interpret stimuli to produce a successful response (Leslie, 1989).

Retarded older adults may require more time to become familiar with and understand exercise movements. Reid, Seidl, and Montgomery (1989) suggested that adequate time be given for familiarization with equipment, movement skill, and re-familiarization with task during physical fitness testing. Individuals with common chronic diseases such as degenerative joint disease, hypertension, emphysema, hypothyroidism, diabetes mellitus, dizziness, and ataxia also require prescribed exercise programs that allow for individual adaptations to elicit the desired response.

Older adults who have experienced strokes, heart attacks, amputations, fractures, sensory deficits, and other sometimes temporary functional limitations are also in the disabled category. The option of cardiovascular rehabilitation through exercise is often overlooked for elderly cardiac patients (Williams & Sketch, 1990). Some elderly persons fear sudden death as a result of exercising. Exercise-induced sudden death in individuals older than 40 years of age is almost always due to atherosclerosis, which is usually preceded by chest pain or discomfort or a history of cardiac events (Herbert & Froelicher, 1991). An exercise program can gradually help cardiac patients overcome anxiety if the program addresses not only physiological needs but also the patients' needs for
reassurance, support, and contact with other people (Williams & Sketch, 1990).

Even elderly cardiac patients and patients on beta-blockers may accrue moderate physiological benefits from exercise, such as weight loss, reduced body fat, lowering of resting heart rate, and increased forced expiratory volume (FEV) (Williams & Sketch, 1990). Lonnerbland (1984) claimed that if physically passive patients can be persuaded to maintain muscle and joint function by adhering to a simple exercise program, their risk of becoming dependent and requiring institutionalization is lowered.

Exercise program opportunities are sought by older adults for many different reasons. Basic exercise programming must include the perspectives, goals, interests, limitations, and strengths of the participants. Opportunities for older adults to play, have fun, be with others, and do things which brought pleasure and satisfaction in their earlier years must not be overlooked as important reasons for older adults, with or without handicapping conditions, to seek activity and exercise (Leslie, 1989).

Physiological Implications of Aging and Exercise

Peak physiological function in normal healthy individuals is reached at approximately age 30 after which, in sedentary persons, physiological capabilities decline, resulting in functional decreases in work capacity, cardiac output, heart rate, blood pressure, respiration, basal metabolic rate, musculature, nerve conduction, flexibility, bone density, and total body water (Smith & Zook, 1986).
Not all older individuals demonstrate the same characteristics. For example, muscle strength in trained athletes declines after age 60 to 65 but declines at an earlier age in sedentary individuals (Work, 1989). As a product of aging, the body becomes progressively inept in its ability to respond to physiological challenges (Posner, Gorman, Klein, & Woldow, 1986). An emerging and significant body of research suggests that some of the symptoms of old age may be controlled or partially reversed through good physical conditioning (Birren, Woods, & Williams, 1980; Kasch et al., 1990; Schiamberg, 1983; Spirduso, 1980; Thompson et al., 1988).

Age-related bone loss is recognized as a serious problem (Rikli & McManis, 1990) for women over 60 and men over 80. More than six million elderly men and women in the United States have a significant degree of bone loss (Smith & Zook, 1986). Smith and Zook added that men over 50 lose about 0.4% of bone mass per year and women lose approximately one to two percent of bone mass per year after age 35. Stillman, Lohman, Slaughter, and Massey (1986) concluded that a high level of physical activity could be a factor in reducing age-related bone loss and in preserving lean body mass in women.

Kavanagh and Shephard (1990) investigated the effects of age and sports participation on functional loss in master's level athletes ages 30-79 years (noting that their activity patterns and performance levels are typical of the general public that is interested in moderate physical activity). They found that lean body mass remained relatively constant for both men and women until
ages 70 to 79, when it decreased 4 to 5 kg. Percent of body fat remained relatively constant in women, all of whom were substantially above the desired values for athletes. The older men did not differ greatly from sedentary young men, although their sample showed a small increase in predicted percent body fat in the older age categories. Forced vital lung capacity (FVC) and forced expiratory volume in one second (FEV₁) showed a steady decline with age, with a slightly faster decline among those in their 70s.

Lipid and lipoprotein responses to endurance training have been widely studied in young and middle-aged men and women. However, there is little information about responses to training among people older than 60 (Whitehurst & Menendez, 1991). In a study by Blumenthal et al. (1989), favorable results, including lowered low density lipoprotein cholesterol (LDL) and raised high density lipoprotein cholesterol (HDL) levels, were observed among aerobic (70% HRR) exercise participants (N = 33) after 4 months of training. The control group's (N = 34) cholesterol levels remained the same, while the yoga group's (N = 34) cholesterol levels increased. A study by Whitehurst and Menendez (1991) found similar results in 31 older women (M = 69 ± 5.4 years) in total cholesterol triglycerides, HDL, and LDL concentrations. The exercise group walked at 70% to 80% of max HRR three times per week for eight weeks and had a significant improvement in triglyceride and HDL levels, while the control group did not. In contrast, Cunningham, Rechnitzer, Howard, and Donner (1987) studied 224 men aged 55-65 years old who had just retired. Subjects were divided into two groups, an exercise and a control
group. The exercise group trained three times per week for one year while the control group continued without intervention. Blood cholesterol and HDL were compared after one year of retirement and were found to be the same in both groups.

Old age is seen as a time of physiological and mental decline. However, significant mental deterioration is not a part of normal aging. Rather, much of the decline may be due to subclinical disease and inappropriate lifestyle (Posner et al., 1986). Spirduso, MacRae, Prewitt, and Osborne (1983) hypothesized that exercise effects on neurotransmitters may, in fact, postpone age-related degradation of psychomotor reactivity and that it may do this, at least in part, by preserving the nigrostriatal dopaminergic system (a bundle of nerve fibers that binds with dopamine for normal conduction of motor responses). Clinical landmarks of an aging motor system closely resemble diseases of the extrapyramidal system, notably the basal ganglia (Spirduso, 1983). These changes in this structure affect the ability to receive and transmit neural impulses, thereby affecting sensory perception (Leslie, 1989). Age- and/or disease-related deterioration of the cardiovascular system, including anthropathies and atherosclerotic changes, reduces the cerebral blood flow. Older persons' cerebral oxygen consumption is decreased and cerebral resistance to blood flow is increased (Spirduso, 1980). Spirduso, MacRae, Prewitt, and Osborne (1988) suggested that trophic effects of chronic physical activity on brain neurotransmitter function are far from clear, but preliminary evidence indicates that chronic adaptations of neurotransmitter systems in the physiological
response to systemic exercise bouts may be considerable. Indirect evidence indicates a relationship between exercise and psychomotor performance from the ameliorative effects of supplemental oxygenation (from increased blood flow during exercise) on psychomotor performance, as well as other cognitive functions (Spirduso, 1980). This theory is supported by evidence that the physically fit elderly score higher on tests of fluid intelligence than do age-matched sedentary controls (Molloy et al., 1988). Dustman et al. (1984) found that, as a result of an aerobic conditioning program, 55 to 70 year olds' VO_{2max} levels could be increased, suggesting an improved transport and utilization of oxygen to the brain and other body tissues. Oxygen is recognized as necessary for complete glucose metabolism and as an important substrate for turnover of neurotransmitters essential for cognitive and motor activities (Dustman et al., 1984). Spirduso et al. (1988) found that enhanced physical fitness appears to be related to psychomotor performance reflected primarily by the basic speed of the sensory and motor apparatus as a person conducts simple discriminations and choice tasks. Both men and women who are active exercisers identify the stimulus and initiate a motor command faster than their sedentary counterparts. Moreover, they also have muscular contraction characteristics that consume less time in simple reaction time responses.

Many studies have shown that exercise training in older adults is capable of producing significant increases in aerobic capacities (Badenhop et al., 1982; Porcari et al., 1987). These studies have
found varying degrees of declines in $VO_{2\text{max}}$ with age and various improvements in cardiorespiratory abilities with exercise. Several studies have found that varying degrees of intensity of exercise result in variations of $VO_{2\text{max}}$ results with initial condition of subjects. Posner et al. (1986) cautioned that physiological parameters vary with age; resting metabolic rates in the elderly differ from those in the young, as do their responses to submaximal and maximal exercise.

Kavanagh and Shephard (1990) found a difference in annual change of aerobic power when comparing master's athletes to sedentary individuals. Master's athletes (aged 30-69 years) averaged an overall loss of aerobic power of 0.35 ml • kg\(^{-1}\) • min\(^{-1}\) compared to a rate reported for sedentary populations of 0.5 to 0.6 ml • kg\(^{-1}\) • min\(^{-1}\). Posner et al. (1986) reported similar findings of aerobic capacities of older athletes (mean age 59) at 60% higher than those of sedentary middle-aged men and only 15% lower than those of athletes in their 20s. Kasch et al. (1990) found in a group of 15 exercisers, observed from age 45 to age 68, a decline of 13% $VO_{2\text{max}}$ (44.4 to 38.6 ml • kg\(^{-1}\) • min\(^{-1}\)) but found a decline of 41% (34.2 to 20.3 ml • kg\(^{-1}\) • min\(^{-1}\)) in a group of non-exercisers observed from age 52 to 70. Haber, Honiger, Klicpera, and Niederberger (1984) concluded that, despite low absolute values of maximal aerobic power in 67- to 76-year-old untrained people, the percent increase in exercise capacity and $VO_{2\text{max}}$ that can be obtained through aerobic exercise training is the same as that in much younger persons. Additionally, Cunningham, Rechnitzer, Howard, and Donner (1987)
Badenhop et al. (1982) found that further training at lower intensities may not produce improvement in subjects who have an above average aerobic capacity for their particular age. However, subjects with lower initial capacities will likely respond to lower levels of exercise intensity because these levels represent a substantial increase in daily caloric expenditures. In conjunction with a presumed decrease in cardiac adaptability to training, peripheral training effects could be expected to be relatively more important in older individuals with lower initial capacities than in healthy young subjects. This is because the extent of adaptability to training is markedly reduced in the elderly so that even minimal training will produce favorable changes in aerobic capacity. As previously mentioned, many studies have documented a gradual decrease in maximal exercise (functional) capacity and VO$_{2\text{max}}$ with aging. However, there are other important factors that affect older persons in their abilities to maintain physical movement:

1. Decrease in blood flow to skeletal muscle.
2. Abnormalities of skeletal muscle metabolism due to hormone changes.
4. Limitations related to the pulmonary or musculoskeletal system.
5. Psychological factors.
6. Decrease in lean body mass.
Cardiac amyloidosis, mitral valve ring calcifications, basophilic degeneration of the myocardium, and coronary artery atherosclerosis are typically found in the elderly; however, not all older people develop these conditions (Weisfeldt, 1980). Alterations in cardiac valves associated with age include focal fibrous thickening at the margins of the valve closure, calcific deposits in the bases of the aortic cusps, and calcification of the mitral valve annulus and leaflets. The aortic valve is the one most affected with hemodynamically significant aortic stenosis or heart block if the calcification extends into the ventricular septum (Van Camp & Boyer, 1989).

The hemodynamic profile accompanying exercise is altered by age and can be explained by an age-related diminution in the cardiovascular response to β-adrenergic stimulation (Rodeheffer, Gerstenblith, Becker, Fleg, Weisfeldt, & Lakatta, 1984). In a study by Korkushdo, Frolkis, and Yaroshenko (1988), 30 males, aged 60 to 74 years, suffering from ischemic heart disease (IHD) and stable exertional angina pectoris, displayed increased basal levels of adrenocorticotropic hormone (ACTH), cortisol, and met-enkephalins. During exercise, the IHD group experienced a rise in ACTH and cortisol levels, while an age matched non-diseased control group did not. A relationship was found between changes in the hemodynamic system and function of the pituitary-adrenal system in the IHD group during exercise. β-adrenoblockers were also found to lead to augmentation of tolerance to exercise in IHD subjects, not only at the expense of economizing the hemodynamic shifts, but also due to
changes in hormonal supply in exercise and suppression of stable hormonal tension. Another conclusion was that the described increase in ACTH and cortisol contents is typical for stress reactions, implying or suggesting that IHD patients are in a continual state of functional strain. Ventricular volumes generally remain unchanged with aging; however, the diameter of the left atrium increases and the left ventricular wall thickens, probably because of left ventricular hypertrophy from increasing systolic blood pressure and decreased periphery compliance (Van Camp & Boyer, 1989). Rodeheffer et al. (1984) showed that there were no age-related changes in cardiac output, end-systolic volumes, or ejection fraction at rest or during vigorous exercise of 125w (25w = 150 kpm \cdot min^{-1}) in the 61 participants in their Baltimore Longitudinal Study of Aging. Cardiac output was apparently not related to age, but there were age-related increases in end-diastolic volume and stroke volume, and an age-related decrease in heart rate.

In both submaximal and maximal exercise, left ventricular systolic function may be expected to decrease in the elderly. Blood pressure changes with maximal exercise are parallel to those observed at submaximal exercise workloads, with an increase in systolic blood pressure and no change in diastolic blood pressure (Van Camp & Boyer, 1989). However, Posner et al. (1986) found a small decline in both systolic and diastolic blood pressure after a 16-week exercise program in individuals aged 60 to 100 years old. Compared with younger individuals, the older person's cardiovascular system appears to respond to submaximal exercise
with an attenuated chronotropic response (i.e., decreased heart rate) and augmented stroke volume by means of increased end-diastolic volume without change in end-systolic volume (Van Camp & Boyer, 1989). With maximal exercise, the cardiovascular system of the elderly appears to compensate for its decrease in chronotropic responsiveness with an increased use of the Frank-Starling mechanism to augment stroke volume and thus maintain cardiac output (Rodeheffer et al., 1984).

Michelsen, Hurlen, Stugaard, and Otterstad (1989) found that the mean cumulative work total (1208w) among healthy females was similar among subjects less than 50 years old but significantly reduced among subjects older than 50 (947w). In addition, the older group had a significantly higher systolic blood pressure and a lower maximal heart rate at the end point of exercise; these are known to be limiting factors for exercise to the elderly. Michelsen et al. (1989) concluded that the age-related reduction of physical performance in apparently healthy females is not gradual but occurs rather abruptly at age 50. Recognition that this age is the time of menopause in most subjects provides a possible explanation of age-related reduction of β-sympathetic stimulation (because of a reduction in estrogen which stimulates sympathicomimetic activity) which causes diminished reduction in systemic resistance and a lower maximal heart rate during exercise.

Van Camp and Boyer (1989) summarized the age-related normal physiologic changes and responses of the cardiovascular system:
1. Left ventricular function is well preserved in the absence of disease.
2. The myocardium does not atrophy; rather, left ventricular hypertrophy develops.
3. There is a decreased responsiveness of cardiovascular tissue to β-sympathetic stimuli that causes decreases in cardiac inotropic and chronotropic responses and in peripheral vasodilation responses.
4. Treatment with β-adrenergic blocking agents and digitalis may be less beneficial than in younger patients.
5. Abnormal diastolic function, decreased rate of ventricular relaxation, and decreased sympathetic responsiveness may compromise the aged heart's ability to tolerate disease.
6. Increased use of the Frank-Starling mechanism preserves cardiac output, despite a decrease in the heart rate during maximal exercise.
7. Most of the physiologic determinants of exercise capacity are well preserved. (p. 129)

In summary, physiological findings suggest that aging per se does not exert major influences on the often observed decline in functional capacity including cerebral integrity of older persons (Kasch et al., 1988; Posner et al., 1986; Schiamberg, 1983; Spirduso, 1980; Van Camp & Boyer, 1989). Physiological improvements gained through participation in regular physical activity may, in fact, reduce the rate of aging (Nakamura, Moritani, & Kanetaka, 1989).

Mental and Cognitive Functioning with Age

In normal aging, cells of the central nervous system, cardiovascular, immune, and skeletal systems serve as "pacemakers." "Pacemakers" are "post-mitotic" cells which no longer divide after maturity (about age 20) and whose longevity depends upon their integrity and ability for self-repair (Kemp,
In aging, 20-30% of the brain cells that produce the neurotransmitter dopamine are lost by age 60 (Spirduso, 1983). Dustman et al. (1984) reported that oxygen is utilized directly for the synthesis and degradation of dopamine, norepinephrine, and serotonin. Hypoxia has been shown to cause a decline in acetylcholine metabolism, and the reduced activity level associated with senescence can reduce the flow of oxygen to the brain. Thus, an increase in cerebral oxygen might result in improved neuropsychological function because of increased turnover of neurotransmitters dependent upon oxygen for metabolism (Folkins & Sime, 1981). In the study by Dustman et al. (1984), the effects of a four-month aerobic exercise conditioning program on neuropsychological test performance, depression indices, sensory thresholds, and visual acuity of 55- to 70-year-old sedentary individuals were evaluated. The aerobically trained subjects demonstrated significantly greater improvement on the neuropsychological test battery than the nonexercising control subjects, although depression scores, sensory thresholds, and visual acuity were not changed by aerobic exercise. The authors suggested that the effect of aerobic exercise training was on central rather than on peripheral function, speculating that aerobic exercise promoted increased cerebral metabolic activity with a resulting improvement in neuropsychological test scores.

Biological system functioning is maximal until the age of reproduction and then slowly declines (Kemp, 1983). These aging processes can be well marked in some tissues and barely discernable
in others, so that the features of aging could be further subdivided into those that are cell- or tissue-specific and those that affect several cell types or tissues (Wright & Whalley, 1984). Each organ system has a built-in reserve capacity, and people usually do not reach dysfunctional states until only 20-30% of capacity remains (Kemp, 1983). Kemp (1983) reasoned that the reserve capacity level is near a critical limit before a dysfunctional status occurs. This explains why an older person may often appear to be functioning well until a "minor" injury or illness, such as a broken hip or kidney failure, leads to a dramatic decline and even death. It has been suggested that physical activity is an effective intervention to reverse or at least slow certain age-related declines in cognitive and motor performance (Dustman et al., 1984; Molloy et al., 1988; Rikli & Edwards, 1991; Taylor, Sallis, & Needle, 1985).

Some researchers have tried to draw a relationship between natural aging and pathological changes as a way to explain the aging process. These include changes in physiology, cell structure, and bodily functions. One explanation of pathological change may be the structural and functional changes found with Parkinson's disease as appearing to be characteristic of accelerated aging. Mortimer's (1988) study did not support this view but did report that bradykinesia is a prevalent characteristic strongly correlated with aging and Parkinson's disease. Another finding was that normal age-related cell loss in the substantia nigra implies that the degree of neuronal loss required for manifestation of the clinical syndrome of Parkinsonism would not be reached until well over age 100.
(Mortimer, 1988; Spirduso, 1983). The clinical landmarks of an aging motor system closely resemble diseases of the extrapyramidal system, notably the basal ganglia. The nigrostriatal dopaminergic system is impaired in both Parkinson's disease and in aging and has been shown to be substantially involved in movement stimulation (Mortimer, 1988; Spirduso, 1983). Mortimer (1988) found that movements involving primarily proximal musculature (i.e., walking and whole-arm reaching movements in the pursuit task) showed the greatest decline with age, while those movements involving more distal musculature declined less with age. These distal movements become hesitant and slow and are accompanied in many instances by postural flexion and fine tremors of the hands, chin, or head (Mortimer, 1988; Spirduso, 1983).

Wright and Whalley (1984) suggested that the association between premature aging and Alzheimer's type neuropathology in Down syndrome indicates that in at least one instance the two conditions may be interrelated, as the neuropathological changes cannot be accounted for on the basis of other abnormalities in Down syndrome. Neuropathology associated with mental retardation results in fewer healthy neurons originally, and, if the rate of aging remains the same compared to the general population, the result would be an appearance of premature aging in this group (Kemp, 1983). Additionally, mentally retarded individuals, because of an increase in the prevalence of institutionalization which itself affects intellectual performance, may appear more impaired intellectually at an earlier age (Kemp, 1983). However, this
difference may be cohort specific. Future cohorts may display different characteristics with deinstitutionalization begun during the 1980s resulting in far fewer persons housed in institutions today.

The biological processes which are the basis of health are subject to individual self-control in a broad and far-reaching manner, which makes muscular activity and exercise a primary component of lifespan health and well being for older adults (Schiamberg, 1983). MacLean (1982) claims that physical aging is a result of the individual's genetic makeup, but it is also the product of the influences of exercise, nutrition, drug intake, environments (both physical and social), and the effects of stresses caused by retirement, relocation, and loss of role or friends.

Other personality changes occur in the elderly due to organic brain disorders and senile dementia (Leslie, 1989). Senile dementia is a major public health problem (Taylor, Sallis, & Needle, 1985), affecting one in twenty of those over 65 years of age and one in four of those aged 80 or more (Wright & Whalley, 1984). Organic brain disorders typically affect memory and perception and are associated with brain damage or impaired cerebral function. The individual typically displays anxiety, confusion, and time disorientation and also experiences a deterioration in intellectual function, judgment, and memory (Leslie, 1989).

Diesfeldt and Diesfeldt-Groenendijk (1977) conducted a study of adults (M = 82 years) with mental (organic brain syndrome) and physical handicaps living in a psychogeriatric nursing home. These
adults were divided into two equal groups, control and exercise, and were tested for free recall, visuomotor coordination, and recognition. The results after four weeks showed that, in the free recall test, the exercise group had improved more than the control group. The exercise group showed better retrieval activity and improved cognitive performance. Visuomotor abilities did not significantly improve.

Exercise, rather than being a simple end product of organic or mental functioning, may dominate (both biochemically and physiologically) all aspects of energy exchange and muscular function and is essential for integration of these functions on a developmental and physiological systems basis (Folkins & Sime, 1981; Schiamberg, 1983). The decline in physical and cognitive abilities with aging would seem to be governed by physical conditioning as well as by age. The physically fit elderly score higher on tests of fluid intelligence than age-matched sedentary controls. Additionally, elderly patients who have taken part in exercise programs have shown improvement in mental function (Molloy et al., 1988).

Clarkson-Smith and Hartley (1989) investigated the relationship between physical exercise and cognitive abilities of 62 sedentary and 62 vigorous exercisers (ages 51-91). They found the performance of the exercisers was significantly better on measures of reasoning, working memory, and reaction time. Rikli and Edwards (1991) compared the effects of a three-year exercise program on motor performance and cognitive processing speed of 31 (ages 57-
female volunteers who were first-time enrollees in an exercise class against 17 female volunteers (ages 59-81) who were enrolled in a non-exercise hobby class. Pretest to posttest scores of the exercise subjects tended to improve over the three-year study, whereas the scores of the control (non-exercise, hobby group) declined. The authors theorized that the speed of cognitive processing is known to be especially sensitive to oxygen level, as evidenced by slower reaction times for persons at high altitudes and for individuals with cardiorespiratory or other obstructive pulmonary diseases. They concluded that it appeared that physical activity is an effective intervention to reversing or at least slowing certain age-related declines in both cognitive and motor performance.

Folkins and Sime (1981) and MacLean (1982) added that, in order to maintain positive mental health and emotional equilibrium, the older person, like any other individual, needs experiences that provide a sense of identity and worth, recognition, new experience and adventure, security, meaningful involvement, and social interaction and integration—a chance to grow within his or her potential in order to promote mental health, cognition, functionability, and improved quality of life. Taylor et al. (1985) concurred and suggested that vigorous physical activity could have important primary preventive benefits by making people less susceptible to other factors that might produce mental illness and could also have secondary preventive effects in improving functioning in people with mental illness.
Physiological and Behavioral Changes of Alzheimer's Disease in Relation to Physical Movement

Dementia may be caused by a number of disorders such as Alzheimer's disease, Jakob-Creutzfeldt's disease, Huntington's chorea, Parkinson's disease, and Pick's disease. Although the symptoms exhibited are often similar, the onset, course, and treatment of these conditions differ significantly from one another (Toseland et al., 1984). Wright and Whalley (1984) reported that dementia has been used as a criterion of aging. This view has been supported by neuropathological studies that have consistently demonstrated that features of Alzheimer's type dementia often occur in brains of nondemented elderly, and a progressive loss of surface area of neuronal dendrites also occurs as a prelude to neuronal loss in Alzheimer's and non-Alzheimer's populations. Other researchers suggested that heredity may be a factor. Cohen (1987) reported that there is a genetic basis at least with a small subgroup of families where the disease has more frequently occurred and is identified through the discovery of a genetic marker on chromosome 21 in those particular families. A review of the literature suggests that a significant relationship exists between Alzheimer's and Down syndrome (Bauer & Shea, 1986; Silverstein, Herlos, Miller, Nasuta, Williams, & White, 1988; Zigman, Schupf, Lubin, & Silverman, 1987). Both are associated with selective loss of cholinergic neurons (those neurons stimulated by acetylcholine), more frequent chromosomal aberrations, and inadequate development of the hippocampus (the part of the brain concerned with memory) (Bauer &
The neuropathological characteristics of Alzheimer's disease are also found in the brains of individuals with Down syndrome who die after the age of 35 years, but the clinical manifestations of Alzheimer's disease often do not appear (Silverstein et al., 1988). Wright and Whalley (1984) stated that it is difficult to demonstrate evidence of behavior decline in middle-aged persons with Down syndrome, although autopsy reports from adults with Down syndrome after age 40 show a 96-98% incidence of Alzheimer's type changes. Zigman et al. (1987) suggested that the method for determining behavior changes in individuals with Down syndrome may require modification because of the memory criteria and cognitive loss criteria which are appropriate for the general population but may be inappropriate for many mentally retarded persons.

Alzheimer's disease is a major medical and social problem (Seltzer, Rheaume, Volicer, Fabiszewski, Lyon, Brown, & Volicer, 1988) and is not a normal part of aging (Cohen, 1987). The disease is the cause of serious confusion and forgetfulness in some 2.5 million American adults. Because aging is the principal risk factor associated with Alzheimer's disease, the number of patients with Alzheimer's disease is growing at least as fast as the older United States population (Mortimer, Hepburn, & Maletta, 1985; National Institute on Aging, 1986). In a report to the National Institute on Aging, Dr. Bruce Schoenberg (1986) reported that twice as many women as men had Alzheimer's disease, and the number of
Alzheimer's patients increases with advancing age, from 1% among people 40 years and older to 7% among those 80 years and older.

The disease was first reported by Alois Alzheimer at the turn of the century. It begins with a loss of recent memory and is followed by difficulties with abstraction, problem solving, and judgment (Goreham & Rathge, 1986). Alzheimer's disease is the most common cause of all dementias and is rarely seen in persons below the age of 50 (Rosser, Iversen, Reynolds, Mountjoy, & Roth, 1984). Alzheimer's disease is irreversible and generally averages 8 to 10 years of progressive degeneration, aphasia, and apraxias, ending in a vegetative state (Goreham & Rathge, 1986). Volicer, Seltzer, Rheaume, Fabiszewski, Herz, Shapiro, and Innis (1987) found that half of the Alzheimer's patients were unable to dress themselves five years after onset of symptoms and unable to sleep regularly six years after onset. By seven years after onset, 50% had developed rigidity in passive movement, and by eight years half were unable to feed themselves or walk without assistance. By nine to ten years after onset, 50% had developed contractures of the limbs and were mute, and by 12 years half of those who survived had lost eye contact with caregivers (N = 88, Mean age 68.2).

One of the most important but neglected research areas of health care delivery is cost effective health care for the elderly with all forms of dementia (Mortimer, Hepburn, & Maletta, 1985). The 1986 report on Alzheimer's disease to the National Institute on Aging speculated that 35 billion dollars were spent the previous year on the care of Alzheimer's patients; however, this figure did
not include the emotional and social costs of the disease, which could reach another 39 billion dollars. These indirect costs represent cost of relatives visiting patients in nursing homes, transportation of patients for needed medical services, and premature death due to dementia. Alzheimer's patients frequently require institutionalization during the advanced stages of the disease which will, as the population increases, create a precipitous increase in demand for nursing home placement and in placement costs in the next several decades (Seltzer et al., 1989; Volicer et al., 1987).

No single test is able to diagnose Alzheimer's disease. It is the most difficult to diagnose in the early stages as patients seen in medical centers have had the disease for a few years, which has allowed the physicians to follow them for some time before making a diagnosis (Mortimer et al., 1985). Vitaliano, Russo, Breen, Vitiello, and Prinz (1986) followed a group of 15 mildly functionally impaired Alzheimer's disease patients and 22 control subjects matched by age, gender, and education for two years. They found that measures of memory and attention deficits accounted for much of the impairment in the Alzheimer's patients. These measures continued to decline with age while the control subjects showed little decline. They concluded that it is possible to diagnose Alzheimer's disease accurately in its mild form. Physicians who suspect Alzheimer's use a variety of tests, including medical history, clinical examination, blood and other laboratory tests, psychological tests, and radiologic scans (National Institute on
Aging, 1986). To this point, the only definite test to confirm Alzheimer’s disease is a post-mortem examination of brain tissue. The cause of Alzheimer’s disease remains unknown. Microscopic brain tissue changes have been described in Alzheimer’s disease since Alzheimer first reported them in 1906. These changes consist of plaques, senile or neurotic, which are degenerating nerve cells combined with a form of protein called amyloid and neurofibrillary tangles which are nerve cell malformations. The brains of Alzheimer’s patients of all ages reveal these characteristics on autopsy examinations (Cohen, 1987; Rossor, Iversen, Reynolds, Mountjoy, & Roth, 1984).

A neurochemical analysis of postmortem brain cortical biopsy tissue samples has contributed to an understanding of the selectivity of neuronal degeneration. It was generally thought that the younger the patient at the onset of dementia, the more severe and rapid its progression with prominence of dysphasias, apraxias, and agnosias (Wright & Whalley, 1984). However, Rossor et al. (1984) found evidence that does not support the concept of Alzheimer’s disease representing an acceleration of the aging process. They studied the brains of 49 Alzheimer’s patients and of 54 normal patients. The Alzheimer’s group exhibited noticeably reduced activity of the cholinergic marker enzyme, choline acetyltransferase in the cerebral cortex, and reduced cortical concentrations of noradrenaline, γ-aminobutyric acid, and somatosatin. The results showed that the older Alzheimer’s patients (dying in their ninth and tenth decades) had a cholinergic
deficit confined to the temporal lobe and hippocampus, together with a reduced concentration of somatostatin confined to the temporal cortex. By contrast, they found that the younger Alzheimer's patients (dying in their seventh and eighth decades) had more widespread and profound cholinergic deficit together with the abnormalities of noradrenaline, γ-aminobutyric acid, and additional somatostatin. Thus, the comparison of the young Alzheimer's subjects with the older control subjects did not support the concept of Alzheimer's disease being representative of an accelerated aging process.

In the treatment of Alzheimer's disease, several studies have shown that individuals respond positively to low-stress environments. An environment can interfere with coping, adding to the level of impairment. Therefore, modifying the surrounding can reduce stress imposed by environmental factors. Placing different cues in the immediate environment to combat memory loss can reduce stress and disorganization, alleviating agitation (Cohen, 1987). Cleary et al. (1988) found that patients with Alzheimer's disease responded positively to a living unit that had a regular routine and reduced stimulation. Weight loss was curtailed, agitation was diminished, restraint use was reduced, and wandering was no longer a concern of staff or other patients.

Respite care has been used as a modality for care/treatment of Alzheimer's individuals. Respite was originally developed to help alleviate stress in family caregivers of frail elderly or chronically ill individuals; it has also been utilized as a way of sharing limited
medical resources among a larger number of patients (Seltzer et al., 1988). There has been concern that patients who used a respite program would worsen because the burden of relocation would lead to earlier need for long-term institutionalization. However, Seltzer et al. (1988) used a respite program for management of individuals with clinical diagnosis of Alzheimer's disease. Cognitive and functional status levels were assessed by standardized measures just prior to admission and the conclusion of a two-week, in-hospital respite program. Patients participated in the usual ward activities, including recreational and occupational therapy. Results showed that the patients with the lowest levels of performance tended to show the most improvement on some of the measures at the end of respite, whereas patients with higher initial levels of performance tended to show a slight worsening. One reason for this reaction may be found in a theory of environment interactions, where personal competence levels may react adversely to environmental pressure. Individuals of high competence will show maximum performance over a larger range of environmental situations than will a less competent person. The less competent the individual, the greater the impact of environmental factors (Cavanaugh, 1990). In Seltzer's (1988) study, in which the higher functioning individuals showed a slight worsening, there may have been too little environmental pressure for their competency level which would, in theory, cause maladaptive behavior (Cavanaugh, 1990).
McBroom (1987) suggests that physical activity is very important as a means to prevent or slow down the debilitating effects of Alzheimer's disease. Patients who exercise regularly appear to be calmer and less agitated. They also maintain their motor skills longer, have more regular sleep patterns, and experience better elimination regularity. As a possible correlation to similar neurological structures, Bauer and Shea (1986) suggested that leisure and recreational activities should be provided for individuals with Down syndrome, allowing them to be as active as possible but ensuring a format for successful participation. Those with Alzheimer's should be able to experience successful participation by modifying previous activities to be appropriate to present abilities (e.g., a golfer may no longer be able to keep score but can hit the ball and walk) (McBroom, 1987).

Considerations of safety are important when working with Alzheimer's patients because of the need to protect the person from wandering, using stairways, and subsequently falling (Cohen, 1987). Another factor is gait and balance in senile dementia of Alzheimer's type. Visser (1983) found that individuals moderately afflicted with Alzheimer's (N = 11) had significantly shorter step length, lower gait speed, lower stepping frequency, greater step-to-step variability, greater double support ratio, and greater path sway. These findings are consistent with the theory that transcortical pathways participating in the integration of gait are damaged in senile dementia of Alzheimer's, thereby possibly explaining Alzheimer's patients' increased incidence of falls.
Numerous studies of non-Alzheimer's afflicted populations have shown improvement in cognitive function with physical exercise. In a three-year study, Rikli and Edwards (1991) found that previously sedentary subjects improved their reaction time, slowed age-related declines in motor performance, and improved speed of cognitive processing by exercising at ACSM recommended intensity levels three times per week. Clarkson-Smith and Hartley (1989) hypothesized that the performance of vigorous exercisers would be superior to that of sedentary individuals on measures of reasoning, working memory, and reaction time. Diesfeldt and Diesfeldt-Groenendijk (1977) found that older subjects (average age 82) with mental and physical handicaps showed improvement in a free-recall test after exercising for one month.

In summary, this review of literature suggests that physical exercise may produce desirable outcomes to alleviate or slow the process of Alzheimer's disease. Studies have shown that exercise is effective in reversing, or at least slowing, certain age-related declines in motor performance and in speed of cognitive performance. Exercise may also have an ameliorative effect on the symptoms of Parkinson's disease which shows similar structural degradations to Alzheimer's disease. Rehabilitative effects of exercise may be due to an increase in oxygen to the brain as well as increasing the cerebral metabolic activity which results in improvement in neurological functioning. Regular exercise has psychological benefits such as decreased depression and confusion, as well as the capacity to increase self-esteem and personal worth.
Lastly, the use of exercise can provide individuals with a modality that could improve or maintain their functionability and independence in everyday life, thus promoting quality of life and life satisfaction.
CHAPTER III
METHODS AND PROCEDURES

The purpose of this study was to provide a demonstration of an exercise program for mentally impaired older adults living in a long-term care facility. This study evaluated the effects of an eight-week exercise program on motor performance and life satisfaction of 24 men and women residing in a long-term care facility. Variables tested were shoulder flexibility, sit and reach flexibility, grip strength, and life satisfaction.

The study was designed to demonstrate methods of support and encouragement and to provide guidance in the development and conduct of programs in movement-related activities and leisure based on the needs, interests, and inherent capacities of the older adult who is mentally impaired. Additional goals of this study were to facilitate public and professional understanding of and appreciation for the importance and value of movement-related activities and leisure skills and to emphasize the complexity of adapting exercise programs to conform to individual differences. Finally, this researcher hopes that this study will encourage interest in research to enrich the depth and scope of movement-related activities and leisure programs for the mentally impaired older adult.
Description of Subjects

The subjects (N = 24) were all volunteers who expressed an interest in physical activity and exercise. The subjects were all residents of a 160-bed long-term care facility that had an activity program as a regularly scheduled program.

The subjects participated in an exercise program three days per week for eight weeks. On one day each week the exercise program was held in a 30' x 40' multipurpose room centrally located in the facility. A smaller 20' x 30' activity room adjacent to this large room was used on the other two days. The subjects all had freedom of movement about the single level facility, although some did not have independent physical mobility abilities. These two rooms were designated for the exercise program to ensure adequate space and to provide for a consistent environment.

The subjects' ages ranged from 73 years to 96 years of age, (M = 87.96). There were 7 males (age range 73-95, M = 86.14) and 17 females (age range 75-96, M = 88.71).

The subjects were all diagnosed as mentally impaired:

9 - Alzheimer's
6 - dementia
2 - cerebrovascular accident
2 - cerebrovascular accident/dementia
2 - chronic brain syndrome
1 - dementia/Parkinson's
1 - organic brain syndrome/Parkinson's disease
Of the sixteen subjects whose educational backgrounds were available, the range of education varied from third grade to teaching and nursing certificates. The mean education level was 9.19 years. Eight of the 24 subjects did not have educational records in their charts.

**Instrumentation**

The Life Satisfaction Scale (LSS, Lohann, 1989) interview was used for the pre- and posttest. The LSS is an assessment that measures perceived satisfaction with life. The assessment is quick and easy to give, as it is one page in length with 32 questions (e.g., "I feel just miserable most of the time" agree or disagree). The assessment is designed to establish a person's baseline of satisfaction with life to compare with the results of the same assessment questionnaire over a period of time. The same form was used for both interviews, and any changes in answers were noted.

To test shoulder flexibility, the subjects raised their arms one at a time and reached as high on a 1" x 2" x 6' wooden board as they could. A standard cloth measuring tape was affixed to one side to determine distance reached. The subjects remained seated in either their wheelchairs or on standard folding chairs if they were ambulatory subjects.

A Quinton Dynamometer was used to determine grip strength. A dynamometer is commonly used by professionals to assess the strength of finger flexion used in motions such as in grasping, squeezing, or closing the hand. Operation is simple; the subject
holds the instrument independently in one hand and squeezes the two handles together. The scale records both kilograms and foot pounds. Foot pounds were used as the measurement of choice because of the subjects' clearer understanding of foot pounds and confusion over kilogram measurements.

To test back and posterior upper leg flexibility (sit and reach), a standard yard stick was used with a plastic 90° angle attached perpendicular to the 0" end and another 90° angle attached to the 20" mark. The 90° plastic angle at the 20" mark was to allow the subjects to sit on the floor and place their heels against the angle to produce a reliable measure. The 90° angle at the 0" end of the yardstick was used for subjects who could not sit on the floor to be measured; it was placed against a subject's knees while the subject was on a chair (see Appendix A for an illustration of the measuring device).

The use of a similar measuring device is recommended by AAHPERD in their Functional Fitness Assessment for Adults Over 60 Years (1990). They recommend using a yardstick, chalk, or masking tape on the floor, with a mark taped or drawn 20" from the 0" end of the measurement device, as a reference point for heel placement. This researcher adapted this concept and used the yardstick with 90° plastic angles to allow for a portable measuring instrument. This device was also used to measure more ambulatory individuals.
Orientation of Subjects

The researcher read the subjects' case histories previous to meeting the subjects in order to familiarize herself with their life experiences and to better relate and adapt terminology used in explaining the exercise program and movements for the exercises. The researcher also obtained permission from each subject's physician and guardian to engage in moderate to low energy seated exercises. The researcher obtained a written consent form from each subject signed by the subject and his or her guardian (sample in Appendix B). Additionally, the researcher reviewed any limitations or conditions (e.g., physical, psychological, emotional, behavioral, and medications) that would contraindicate exercise participation.

Two weeks before the start of the research project, the researcher met with the subjects who had volunteered to be in the exercise program. The objective was for the researcher to answer any questions the subjects had and to develop rapport, promoting a relaxed environment by becoming acquainted with the subjects.

The researcher provided the subjects with a verbal and written description and reason for conducting this research project. Subjects were reassured that there would be no risk to their health and that they could withdraw from the project at any time. The researcher explained that she would interview each person before and after the study to assess level of life satisfaction. The subjects were verbally assured that they did not have to answer any questions that made them uncomfortable.
The exercises and games that would be incorporated each week for eight weeks were explained in detail to the subjects. The subjects were told that they would be measured weekly for eight weeks for shoulder flexibility, back and leg flexibility, and grip strength. The researcher let the subjects examine at their leisure the equipment that would be used during the study, and she demonstrated its application. The researcher assured the subjects that all equipment was age appropriate and that extreme care would be given to respect each subject's dignity and promote self-respect.

Additionally, approval to conduct this research was obtained from the University of North Dakota's Institutional Review Board (see Appendix C).

**Test Administration**

One week before the exercise program started, the subjects were all given the LSS. The interview was given verbally with the researcher reading the question (in second person) to the subject. Each subject was interviewed one at a time in a quiet private area (either his or her private room or an empty day room). Not all of the subjects could respond with appropriate answers to the questions, nor could some remain on task long enough for all questions to be read (32 questions). Those subjects who could not respond appropriately \((N = 16)\), were not included in the life satisfaction analysis. The eight subjects who did complete the life satisfaction pretest were given a posttest consisting of the same questionnaire.
The subjects were tested on the first day of the exercise training for shoulder, elbow, and finger flexibility, using the 6' measuring stick described in the instrumentation section. The subjects were in a seated position and were requested to extend their arm as high up the stick as they could reach while remaining seated. After a measurement was obtained, the same procedure was repeated for the opposite arm. This measurement was taken every week for eight weeks. The subjects used their same wheelchairs or, if they were ambulatory, the same folding chairs every week for measurement. The measurement stick was placed adjacent to the head of the humerus each time a measurement was taken. Subjects were given warm-up stretching exercises prior to being measured. Subjects were allowed adequate time to stretch and reach as far as possible for measurement.

The next measurement taken was grip strength. Subjects took up to three practice tries on the dynamometer for warm-up before being measured. Then subjects were told to squeeze the handles of the dynamometer together as hard as they could for measurement. Subjects were given three tries on each hand with the best effort recorded for each.

The last measurement taken was for sit and reach flexibility. The subjects were either assisted to the floor for measurement, or they were measured in a seated position if they could not safely be transferred to the floor. The subjects were measured with a modified yard stick as described in the instrumentation section. The subjects who were measured on the floor were instructed to place
their heels in the 90° plastic angle that was attached to the yardstick at the 20" mark (the same basic protocol as the AAHPERD assessment for older adults). They were then instructed to bend forward with both hands together, one on top of the other and reach forward as far as they could while keeping their legs straight. Each subject was given adequate time to warm up and stretch prior to test administration. The measurement was taken at the farthest point the subject could hold the stretch for two seconds.

The subjects who could not be seated on the floor were measured in the seated position using the same instrument but with the 0" end of the yardstick with plastic 90° angle held against their bent knees by the researcher. The researcher then requested the subject to bend forward as far as possible with one hand on top of the other, sliding their hands forward as far as possible. The measurement was taken at the farthest point the subject could hold the stretch for two seconds. These subjects were also given adequate time to warm up and stretch prior to measurement. Warm up and stretching for both groups consisted of performing similar movements of muscles to be stretched using static techniques for five seconds with three repetitions.

All three of these measurements—shoulder flexibility, grip strength, and sit and reach flexibility—were taken each week for eight weeks during the exercise program. The pretest was the first day of the first week of the exercise program with subsequent measures taken midweek; the posttest was the last day of the eighth week of the exercise program.
Procedures

The subjects were scheduled to participate in a moderate to low intensity exercise class on Tuesday and Thursday for an eight-week period. (Wednesdays were used for testing; see Test Administration.) The time of day was the same as the institution's regular time for activities and lasted for 30 minutes each day. The subjects were involved only in exercises that were done from a seated position.

The subjects were seated in a large circle with the researcher and other staff in the center to provide visual and verbal reinforcement. Every exercise period began with a five-minute warm-up consisting of static stretching of arms, legs, back, and neck. Subjects who required assistance in moving limbs were assisted by staff and the researcher using a passive range of motion (PROM) technique to ensure subject readiness for exercise.

On Tuesdays the activity was a game with a large multicolored lightweight vinyl 4' beach ball. The lightweight ball was used to protect subjects who did not have fast reaction times or did not or could not respond to the action of the ball when it was passed to them. Subjects could be bumped by this ball and not sustain any injuries. The subjects were encouraged to throw, punch, push, or hit with their head, shoulder, knee, or foot the two 4' balls around the circle to other subjects or staff. There was only one rule to the game: everyone had to remain seated. If the ball went out of the circle, it was retrieved by a staff person. The subjects received verbal encouragement and acknowledgement every time they touched
the ball. No movement was judged to be "bad." Subjects' names were used as additional reinforcement and recognition when they actively attempted any participation in the game. The size and colors of the balls were visually stimulating for the subjects and stimulated responses to participate as well as verbal enunciations of pleasure and laughter.

Wednesdays were used for measurements but always began with a five-minute warm up (see procedure in Test Administration) before measurements were taken. The subjects were all assembled in one of the activity rooms for measurements and were encouraged to support each other's attempts as well as watch others being measured. The researcher verbally encouraged the subjects to perform to the best of their abilities and always concluded measurements with positive compliments for each subject's efforts.

On Thursdays of each week, the subjects used exercise stretch bands that were made by the researcher of surgical rubber tubing. Two sizes of rubber tubing were used, a small 1/8" diameter and a 1/4" diameter latex composition stretch tubing. The smaller diameter tubing was used by the subjects who had low arm strength while the larger diameter tubing was used by those who effortlessly stretched the small diameter tubing. Handles of plastic electrical conduit were clinched to the ends of the tubing to provide an easy grip for the subjects. The plastic conduit ranged from 3/8" to 1" diameter to accommodate differing hand sizes and abilities to flex fingers due to arthritis or other functional difficulties.
The subjects were seated in a circle; the researcher visually and verbally demonstrated the use of the exercise bands in the center of the circle. The researcher and other staff provided any individual instruction and assistance in understanding the use of the exercise bands. The subjects were verbally encouraged to stretch the exercise band as far as they could, holding the exercise band in front of their chest and moving their arms laterally. Two sets of five repetitions were the minimum, with some subjects able to accomplish a maximum of five sets of five repetitions. Some hemiplegic subjects did not do the lateral arm movements. Instead they had the exercise band fastened at one end to either their foot or wheelchair bracket; they then performed arm curls on the unaffected side for a minimum of two sets of five repetitions to a maximum of five sets of five repetitions.

All subjects were able to do the single arm overhead press. Those who were not bilateral had the exercise band once again hooked to their foot or wheelchair; then they raised their arm as high over their head as they could stretch the exercise band with their palm out. Those who had use of both arms and hands held one end of the exercise band at waist level and raised their other hand (palm out) as far as they could stretch the exercise band over their head. Each did a minimum of one set of five repetitions to a maximum of three sets of five repetitions. Subjects were told that they could stop at any time if they felt too tired to continue or if it was too painful to participate. Verbal encouragement and praise
were given by the researcher and other staff to promote active participation.

**Design and Analysis**

The data were analyzed in two stages. First the numeric data were analyzed on the available information for a given measurement. Generally, subjects were tested weekly, but group composition was inconsistent at any given point in time, principally due to a subject's handicapping conditions and current physical health but also due to a subject's occasional refusal to participate on a given day.

After the aggregate data are presented in Chapter IV, individual subject case studies are included, a necessity due to the population and participation rates. The SPSSX system was used to compute means and standard deviations for the variables of gender composition, age, education, attendance, shoulder flexibility, grip strength, and modified sit and reach. Paired pre- and posttests of right and left shoulder flexibility, right and left grip strength, and modified sit and reach were computed using a t-test (see Appendix D for raw data).

Additional data are discussed and compared for each subject in case study format, including a description of the subject and discussion of individual weekly measurements. The combination of numerical and descriptive results was needed to produce a comprehensive analysis of this study due to the complexity and uniqueness of the subjects.
CHAPTER IV
RESULTS

This chapter contains both comparative and descriptive data. The comparative data are useful for variable analysis but are insufficient for complete interpretation of the results. Two factors are involved in this determination: first, the sample size is small (N = 24), and second, subjects were not homogeneous. Differences included participation limitations, physical abilities, behavioral adjustments, and other characteristics that are commonplace among patients in a long-term care facility. It is useful to review the comparative data, which include means and standard deviations for gender, age, educational background, attendance at exercise sessions, shoulder flexibility, grip strength, and modified sit and reach variables. Range, means, and standard deviations of performance variables were reported for each week of the study. A paired \( t \)-test was conducted on the performance variable when pretest (week 1) and posttest (week 8) scores of the same subjects were available. Illustrations are provided to show patterns and trends of weekly measurements. The analysis of the results from the LSS assessment follows these statistical correlations. Following the comparative data are 24 case studies. Information in the case studies includes subject age, gender, education, diagnosis,
medications, physical and mental limitations, behavior during exercise sessions, and an application and analysis of comparative data from the weekly variable measurements of shoulder flexibility, grip strength, and modified sit and reach. Additionally, each case study contains a discussion of the applicability and/or results of the subject's life satisfaction assessment.

**Comparative Data**

The subjects in this study were predominantly female (71%) and in the eighth and ninth decade of life. With the exception of one individual, all were born and lived in the Midwest their entire lives. All had the opportunity of attending 24 days of this program. Table 1 shows means and standard deviations for the following variables: age, education, and attendance at exercise sessions.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Characteristics of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 24</td>
<td>Mean</td>
</tr>
<tr>
<td>Age</td>
<td>87</td>
</tr>
<tr>
<td>Education</td>
<td>8th grade ed.</td>
</tr>
<tr>
<td>Attendance at sessions</td>
<td>15.09 days</td>
</tr>
</tbody>
</table>

Results of tests of performance variables suggest that there was improvement. Right shoulder flexibility showed an
improvement from a mean of 52.72" to a mean of 62.31", a mean increase of 9.59". Left shoulder flexibility showed less improvement with an initial measurement mean of 56.73" and a final measurement mean of 60.36", a mean increase of 3.63" (see Figure 1).

Table 2 indicates ranges, means, and standard deviations for right shoulder flexibility for each week for subjects available for measurement. Similar measurements for left shoulder flexibility are shown on Table 3.

Subject composition at measurement sessions for shoulder flexibility varied, contributing to fluctuations in range of scores. Note the weekly changes in mean scores (see Figures 2 and 3).

A paired t-test using the same individuals in week 1 and week 8 found significance in improvement of right shoulder flexibility, \( t = 4.34, p < .005 \) (see Table 4). A paired t-test was used to compare left shoulder flexibility, but analysis indicated that improvement was not significant, \( t = 1.92, p > .097 \) (see Table 5).

Right hand grip strength showed an apparent numerical improvement from a mean of 8.38 ft.lbs. to a mean of 17.44 ft.lbs., a mean increase of 9.06 ft.lbs. Left hand grip strength showed similar results with an initial measurement of a mean of 4.44 ft.lbs. and a final measurement mean of 11.20 ft.lbs., a mean increase of 6.76 ft.lbs. (see Figure 4). No explanation was found for the difference in the amount of improvement for the left hand and right hand, a mean difference of 2.3 ft.lbs. Table 6 shows the range, mean, and standard deviation for right hand grip strength. Table 7 shows similar
Mean of Right and Left Shoulder Flexibility of Mentally Impaired Persons Available for Testing

FIGURE 1
TABLE 2
Right Shoulder Flexibility for Persons Available for Testing
(Varying on a Weekly Basis) Using Older Adults
With Mental Impairments

<table>
<thead>
<tr>
<th>Week</th>
<th>n</th>
<th>Range (in inches)</th>
<th>Mean (in inches)</th>
<th>SD (in inches)</th>
<th>SE Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>43-61</td>
<td>52.72</td>
<td>6.91</td>
<td>2.19</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>42-67</td>
<td>57.61</td>
<td>6.76</td>
<td>1.88</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>42-67</td>
<td>56.79</td>
<td>8.27</td>
<td>2.21</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>40-71</td>
<td>57.50</td>
<td>9.35</td>
<td>2.70</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>42-73</td>
<td>58.78</td>
<td>10.18</td>
<td>3.39</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>45-72</td>
<td>58.92</td>
<td>6.87</td>
<td>1.98</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>53-70</td>
<td>62.70</td>
<td>4.81</td>
<td>1.52</td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>51-73</td>
<td>62.31</td>
<td>5.51</td>
<td>1.53</td>
</tr>
</tbody>
</table>
TABLE 3
Left Shoulder Flexibility for Persons Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments

<table>
<thead>
<tr>
<th>Week</th>
<th>n</th>
<th>Range (in inches)</th>
<th>Mean (in inches)</th>
<th>SD (in inches)</th>
<th>SE Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td>43-63</td>
<td>56.73</td>
<td>6.51</td>
<td>1.96</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>41-66</td>
<td>57.63</td>
<td>6.88</td>
<td>1.72</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>45-71</td>
<td>58.00</td>
<td>7.89</td>
<td>2.19</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>43-73</td>
<td>58.08</td>
<td>8.64</td>
<td>2.40</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>34-70</td>
<td>55.30</td>
<td>12.69</td>
<td>4.01</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>45-73</td>
<td>59.29</td>
<td>7.74</td>
<td>2.07</td>
</tr>
<tr>
<td>7</td>
<td>11</td>
<td>54-71</td>
<td>62.64</td>
<td>4.30</td>
<td>1.30</td>
</tr>
<tr>
<td>8</td>
<td>14</td>
<td>48-72</td>
<td>60.36</td>
<td>6.91</td>
<td>1.85</td>
</tr>
</tbody>
</table>
FIGURE 2

Range - Right Shoulder Flexibility of Mentally Impaired Persons Available for Testing

<table>
<thead>
<tr>
<th>Week</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43&quot; - 61&quot;</td>
</tr>
<tr>
<td>2</td>
<td>42&quot; - 67&quot;</td>
</tr>
<tr>
<td>3</td>
<td>42&quot; - 67&quot;</td>
</tr>
<tr>
<td>4</td>
<td>40&quot; - 71&quot;</td>
</tr>
<tr>
<td>5</td>
<td>42&quot; - 73&quot;</td>
</tr>
<tr>
<td>6</td>
<td>45&quot; - 72&quot;</td>
</tr>
<tr>
<td>7</td>
<td>53&quot; - 70&quot;</td>
</tr>
<tr>
<td>8</td>
<td>51&quot; - 73&quot;</td>
</tr>
</tbody>
</table>

Inches
FIGURE 3

Range - Left Shoulder Flexibility of Mentally Impaired Persons Available for Testing

<table>
<thead>
<tr>
<th>Week</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43&quot; - 63&quot;</td>
</tr>
<tr>
<td>2</td>
<td>41&quot; - 66&quot;</td>
</tr>
<tr>
<td>3</td>
<td>45&quot; - 71&quot;</td>
</tr>
<tr>
<td>4</td>
<td>43&quot; - 73&quot;</td>
</tr>
<tr>
<td>5</td>
<td>34&quot; - 70&quot;</td>
</tr>
<tr>
<td>6</td>
<td>45&quot; - 73&quot;</td>
</tr>
<tr>
<td>7</td>
<td>54&quot; - 71&quot;</td>
</tr>
<tr>
<td>8</td>
<td>48&quot; - 72&quot;</td>
</tr>
</tbody>
</table>

inches
### TABLE 4

Right Shoulder Paired $t$-test for Persons Available for Testing
(In Week 1 and Week 8) Using Older Adults With Mental Impairments

<table>
<thead>
<tr>
<th>Week</th>
<th>Range (in inches)</th>
<th>Mean (in inches)</th>
<th>df</th>
<th>SD (in inches)</th>
<th>$t$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43-61</td>
<td>54.14</td>
<td>6</td>
<td>7.27</td>
<td>4.34</td>
</tr>
<tr>
<td>8</td>
<td>51-73</td>
<td>61.00</td>
<td></td>
<td>5.39</td>
<td>0.005</td>
</tr>
</tbody>
</table>

### TABLE 5

Left Shoulder Paired $t$-test for Persons Available for Testing
(In Week 1 and Week 8) Using Older Adults With Mental Impairments

<table>
<thead>
<tr>
<th>Week</th>
<th>Range (in inches)</th>
<th>Mean (in inches)</th>
<th>df</th>
<th>SD (in inches)</th>
<th>$t$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43-63</td>
<td>55.88</td>
<td>7</td>
<td>7.18</td>
<td>1.92</td>
</tr>
<tr>
<td>8</td>
<td>48-72</td>
<td>59.50</td>
<td></td>
<td>6.63</td>
<td>0.097</td>
</tr>
</tbody>
</table>
Mean of Right and Left Grip Strength of Mentally Impaired Persons Available for Testing
Mean of Right and Left Grip Strength of Mentally Impaired Persons
Available for Testing

FIGURE 4
TABLE 6
Right Hand Grip Strength for Persons Available for Testing
(Varying on a Weekly Basis) Using Older Adults With
Mental Impairments

<table>
<thead>
<tr>
<th>Week</th>
<th>n</th>
<th>Range (in inches)</th>
<th>Mean (in inches)</th>
<th>SD (in inches)</th>
<th>SE Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>0-25</td>
<td>8.38</td>
<td>9.69</td>
<td>3.42</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>0-35</td>
<td>8.60</td>
<td>11.05</td>
<td>2.85</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>0-60</td>
<td>11.14</td>
<td>17.22</td>
<td>4.60</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>0-72</td>
<td>13.08</td>
<td>21.57</td>
<td>5.98</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>0-74</td>
<td>14.86</td>
<td>20.88</td>
<td>5.58</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
<td>0-80</td>
<td>14.93</td>
<td>21.05</td>
<td>5.43</td>
</tr>
<tr>
<td>8</td>
<td>16</td>
<td>0-68</td>
<td>17.44</td>
<td>18.16</td>
<td>4.54</td>
</tr>
</tbody>
</table>
TABLE 7
Left Hand Grip Strength for Persons Available for Testing
(Varying on a Weekly Basis) Using Older Adults With
Mental Impairments

<table>
<thead>
<tr>
<th>Week</th>
<th>n</th>
<th>Range (in inches)</th>
<th>Mean (in inches)</th>
<th>SD (in inches)</th>
<th>SE Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>0-10</td>
<td>4.44</td>
<td>5.27</td>
<td>1.76</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>0-22</td>
<td>5.69</td>
<td>8.20</td>
<td>2.05</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>0-65</td>
<td>9.13</td>
<td>17.03</td>
<td>4.40</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
<td>0-60</td>
<td>11.21</td>
<td>18.43</td>
<td>4.93</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>0-65</td>
<td>11.17</td>
<td>17.46</td>
<td>4.67</td>
</tr>
<tr>
<td>7</td>
<td>16</td>
<td>0-68</td>
<td>9.75</td>
<td>17.35</td>
<td>4.34</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>0-70</td>
<td>11.20</td>
<td>18.45</td>
<td>4.76</td>
</tr>
</tbody>
</table>
statistics for left hand grip strength. (No measurements were taken in week five due to administration difficulties.) Subject composition varied at measurement sessions, contributing to fluctuations in range of scores (see Figures 5 and 6).

Although the data indicate an apparent improvement in grip strength, significance was not approached for right hand grip strength, \( t = 2.11, p > .103 \), or left hand grip strength, \( t = 1.00, p > .374 \) (see Tables 8 and 9).

Modified sit and reach flexibility began with an overall mean measurement of 14" and an ended with an overall mean measurement of 19.29", a mean gain of 5.29". (Table 10 shows range, means, and standard deviations for modified sit and reach.) The subject composition varied at measurement sessions, contributing to fluctuation in mean scores (see Figure 7). Ranges of scores are provided in Figure 8. Although some improvement was shown, significance levels were not reached, \( t = 1.33, p > .410 \) (see Table 11).

**Life Satisfaction Assessment**

The Life Satisfaction Scale (LSS) was used as both a pre- and posttest. Questions on the LSS are worded in the first person for individuals who are able to read and write independently as well as stay on task long enough to do the 32 questions. Instructions in the manual (Lohmann, 1989) recommend that the LSS be given orally if an individual has difficulty reading or writing independently.
Range - Right Hand Grip Strength of Mentally Impaired Persons Available for Testing

<table>
<thead>
<tr>
<th>Week</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0” - 25”</td>
</tr>
<tr>
<td>2</td>
<td>0” - 35”</td>
</tr>
<tr>
<td>3</td>
<td>0” - 60”</td>
</tr>
<tr>
<td>4</td>
<td>0” - 72”</td>
</tr>
<tr>
<td>5</td>
<td>no measurements taken</td>
</tr>
<tr>
<td>6</td>
<td>0” - 74”</td>
</tr>
<tr>
<td>7</td>
<td>0” - 80”</td>
</tr>
<tr>
<td>8</td>
<td>0” - 68”</td>
</tr>
</tbody>
</table>

Inches
FIGURE 6

Range - Left Hand Grip Strength of Mentally Impaired Persons Available for Testing

<table>
<thead>
<tr>
<th>Week</th>
<th>Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0&quot; - 10&quot;</td>
</tr>
<tr>
<td>2</td>
<td>0&quot; - 22&quot;</td>
</tr>
<tr>
<td>3</td>
<td>0&quot; - 65&quot;</td>
</tr>
<tr>
<td>4</td>
<td>0&quot; - 60&quot;</td>
</tr>
<tr>
<td>5</td>
<td>no measurements taken</td>
</tr>
<tr>
<td>6</td>
<td>0&quot; - 65&quot;</td>
</tr>
<tr>
<td>7</td>
<td>0&quot; - 68&quot;</td>
</tr>
<tr>
<td>8</td>
<td>0&quot; - 70&quot;</td>
</tr>
</tbody>
</table>

Inches
TABLE 8  
Right Hand Grip Strength Paired t-test for Persons Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments

<table>
<thead>
<tr>
<th>Week</th>
<th>Range (in inches)</th>
<th>Mean (in inches)</th>
<th>df</th>
<th>SD (in inches)</th>
<th>t = 2.11</th>
<th>p &gt; .103</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-25</td>
<td>8.40</td>
<td>4</td>
<td>10.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2-68</td>
<td>14.40</td>
<td></td>
<td>16.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 9  
Left Hand Grip Strength Paired t-test for Persons Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments

<table>
<thead>
<tr>
<th>Week</th>
<th>Range (in inches)</th>
<th>Mean (in inches)</th>
<th>df</th>
<th>SD (in inches)</th>
<th>t = 1.00</th>
<th>p &gt; .374</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-10</td>
<td>4.00</td>
<td>4</td>
<td>5.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2-70</td>
<td>2.40</td>
<td></td>
<td>4.34</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 10
Modified Sit and Reach Flexibility for Persons Available for Testing (Varying on a Weekly Basis) Using Older Adults With Mental Impairments

<table>
<thead>
<tr>
<th>Week</th>
<th>n</th>
<th>Range (in inches)</th>
<th>Mean (in inches)</th>
<th>SD (in inches)</th>
<th>SE Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>13-16</td>
<td>14.00</td>
<td>1.41</td>
<td>1.00</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>9-22</td>
<td>13.56</td>
<td>3.97</td>
<td>1.32</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>10-27</td>
<td>15.40</td>
<td>6.80</td>
<td>3.04</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>9-27</td>
<td>15.50</td>
<td>6.63</td>
<td>2.71</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>16</td>
<td>16.00</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>7-21</td>
<td>14.75</td>
<td>5.26</td>
<td>1.86</td>
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<tr>
<td>7</td>
<td>6</td>
<td>10-30</td>
<td>20.00</td>
<td>7.56</td>
<td>3.09</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>14-29</td>
<td>19.29</td>
<td>4.75</td>
<td>1.80</td>
</tr>
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</table>
Mean of Modified Sit and Reach Flexibility of Mentally Impaired Persons Available for Testing

FIGURE 7
<table>
<thead>
<tr>
<th>Week</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13&quot; - 16&quot;</td>
</tr>
<tr>
<td>2</td>
<td>9&quot; - 22&quot;</td>
</tr>
<tr>
<td>3</td>
<td>10&quot; - 27&quot;</td>
</tr>
<tr>
<td>4</td>
<td>9&quot; - 27&quot;</td>
</tr>
<tr>
<td>5</td>
<td>0&quot; - 16&quot; (n=1)</td>
</tr>
<tr>
<td>6</td>
<td>7&quot; - 21&quot;</td>
</tr>
<tr>
<td>7</td>
<td>10&quot; - 30&quot;</td>
</tr>
<tr>
<td>8</td>
<td>14&quot; - 29&quot;</td>
</tr>
</tbody>
</table>

Inches
Therefore, the researcher read the interview questions from the LSS in the second person to each subject individually. Sixteen of the 24 subjects were unable to complete the LSS interview. Reasons for inability to complete the LSS included subjects' inability to understand the questions, subjects' inappropriate answers, and some subjects' lack of capability to be stimulated to respond with either gesture or voice. One subject who completed the LSS was aphasic and responded with gestures of approval or disapproval. The results of eight subjects' responses (n = 8) were scored. A total of 32 points are possible on the LSS. The higher the score, the greater the subject's perceived satisfaction with life. The LSS does not include a standardized breakdown as to which scores indicate high, medium, or low satisfaction with life. The LSS is best used to compare perceived

### TABLE 11

Modified Sit and Reach Flexibility Paired t-test for Persons Available for Testing (In Week 1 and Week 8) Using Older Adults With Mental Impairments

<table>
<thead>
<tr>
<th>Week</th>
<th>Range (in inches)</th>
<th>Mean (in inches)</th>
<th>df</th>
<th>SD (in inches)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13-15</td>
<td>14.00</td>
<td>1</td>
<td>1.41</td>
<td>1.33</td>
<td>&gt; .410</td>
</tr>
<tr>
<td>8</td>
<td>14-29</td>
<td>18.00</td>
<td></td>
<td>2.83</td>
<td>p &gt; .410</td>
<td></td>
</tr>
</tbody>
</table>
life satisfaction of one subject from one testing time to another. Data on Table 12 provide information about the results of the LSS.

The scores on the pretest ranged from 2 to 24, with a mean score of 10.4. The eight subjects who had completed the pretest were reassessed for change in satisfaction of life after the eight-week exercise program. The scores on the posttest ranged from 5 to 25, with a mean score of 14.2. All subjects but one, whose score remained the same, showed significant improvement in perceived life satisfaction ($t = 8.91, p < .001$).

**Case Studies**

Subject #1 was a 73-year-old non-ambulatory male. Diagnosis was cerebral vascular accident (CVA), hemiplegia, hypertension, possible mild organic brain syndrome (OBS), and a history of alcohol abuse. His medications in use during the study were aspirin (ASA), diazepam, Peri-Colace, and dulcolax.

This subject had the ability to wheel himself in his wheelchair freely about the facility, but he had difficulty with spatial memory and verbal associations. His case history indicated that he had an impatient and dominant personality, which he displayed in exercise sessions by an inability to wait for his turn or remain in the exercise group the entire length of a session. He would respond best to one-to-one programming; then he would smile and converse with short verbal phrases and actively perform exercises independently.

He had poor attendance during this study, participating actively in only three sessions. However, he did observe the
Table 12
Scores for Pretest and Posttest of Eight Subjects on the Life Satisfaction Scale

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.00</td>
<td>23.00</td>
</tr>
<tr>
<td>3</td>
<td>12.00</td>
<td>15.00</td>
</tr>
<tr>
<td>6</td>
<td>24.00</td>
<td>25.00</td>
</tr>
<tr>
<td>14</td>
<td>21.00</td>
<td>21.00</td>
</tr>
<tr>
<td>10</td>
<td>17.00</td>
<td>22.00</td>
</tr>
<tr>
<td>16</td>
<td>2.00</td>
<td>5.00</td>
</tr>
<tr>
<td>20</td>
<td>6.00</td>
<td>20.00</td>
</tr>
<tr>
<td>21</td>
<td>19.00</td>
<td>25.00</td>
</tr>
</tbody>
</table>

M = 14.25  M = 19.50
exercise group by placing himself just outside the activity room and watching through the windows or by placing himself inside the room away from the group. He was always invited to join the group but would generally decline.

An objective assessment of this subject's response to the exercise program is difficult due to his unwillingness to consent to participate in fitness measurements. He was measured twice for shoulder flexibility with an initial measurement of 64" on his right arm (left arm was paralyzed), followed three weeks later with a measurement of 61" (a decline of 3"). One other measurement was obtained: 18 ft.lbs. of grip strength on his right hand, during the seventh week of the study. The subject participated in one activity/exercise session and two measurement sessions during this eight-week study.

However, his passive participation of observation may explain his improvement in the life satisfaction scale. His pretest score was 13 with a posttest score of 23. These findings would suggest that an individual choosing not to actively participate in an exercise group would show little physical change but could benefit psychologically through passive participation.

Subject #2 was a 92-year-old non-ambulatory female. Diagnosis was chronic brain syndrome, hypertension, senile dementia, hard of hearing, depression, venostasis, and early cataracts. The medication in use during the study was Peri-Colace.
This subject was confined to a wheelchair and depended on staff to wheel her. She displayed poor posture and required a safety belt in the wheelchair to avoid falling out as she tended to fall asleep regularly, requiring constant stimulation to remain awake. She required intensive stimulation before she would respond to voice, which possibly was related to the diagnosed auditory deficit. Her response to tactile stimulation was better received; she would smile and speak short phrases while the researcher was holding her hand. Her attendance was recorded as zero because she did not actively participate in any of the exercise sessions. She was present at six sessions but as a passive observer outside the circle of active participants. Whether the environment of physical activity was beneficial or not could not be determined because no measurements were obtained. She was unable to stay awake long enough and unable to comprehend the life satisfaction pretest well enough to be included in this assessment.

Subject #3 was an 89-year-old non-ambulatory male. Diagnosis was cerebral infarction, right hemiparesis, aphasia, mild dysphagia, coronary artery disease (CAD) with atrial fibrillation, hypertension, inguinal hernia, erythemia reaction, and right side visual cut. Medications in use during the study were digoxin, ASA, bethanechol, and hytrin.

This subject was wheelchair bound, and his right arm was splinted due to right hemiparesis. He was unable to speak due to aphasia but was able to express his desires with gestures. He
actively participated in 20 of the 25 exercise sessions, using only his left side. Strengthening exercises were done by hooking the stretch band to his wheelchair with a snap hook so he could exercise independently. During the beach ball activity he compensated successfully using just his left arm and leg.

His initial shoulder flexibility was measured at 59" for his left arm and improved until the fifth week to 66"; it then leveled off, ending at 64" in the eighth week (+5"). Grip strength results were difficult to interpret because the subject had difficulty operating the grip dynamometer. The initial measurement was 10 ft.lbs., second week 22 ft.lbs., third week 2 ft.lbs., fourth week 22 ft.lbs., and the seventh and final week of measurement 15 ft.lbs. (+5 ft.lbs.). He refused to be measured three of the eight weeks; on those occasions he would become visibly upset when asked to squeeze the dynamometer so it was not pursued. He was unable to be measured on the sit and reach assessment because a wheelchair lap board could not be removed without increasing his risk of falling.

This subject took the life satisfaction assessment by nodding his head vertically for approval and horizontally for disapproval to the interview questions. His pretest score was 12, and his posttest score was 15 (+3). It should be noted that the posttest life satisfaction interview was given on a day when the subject had flu symptoms and was visibly uncomfortable.

Subject #4 was an 81-year-old non-ambulatory female. Diagnosis was CVA, multifocal myoclonus, chronic atrial
fibrillations, atherosclerotic cardiac disease, left hemiparesis, right hemiparesis, hypertension, transient ischemic attacks (TIA), and Type II diabetes mellitus. Medications in use during the study were Disalcid, captopril, digoxin, nifedipine, ASA (coated), Theragran, lasix, Pamelor, Peri-Colace, potassium chloride, and Depakote.

This subject was wheelchair bound and was dependent on staff to wheel her. She stated that she was interested in physical exercise but was incompatible with the other subjects. Three attempts were made to include her in the exercise group, but her continuous loud verbal outbursts created too much stress on the other subjects, so she was dropped from the study.

The researcher did attempt to work with her one on one apart from the other subjects, but she was uncooperative and made little effort to attempt any exercises even though she had initially agreed to exercise.

Subject #5 was an 83-year-old non-ambulatory female. Diagnosis was Alzheimer’s, hypercholesterolemia, degenerative joint disease, and a history of appendectomy, kidney stone, hypothyroidism accident, obesity. Medications in use during the study were Norpramin and Senokot.

This subject was wheelchair bound and was dependent on staff to wheel her chair. Care was taken when moving her or placing her too close to other subjects, as she would grab them as well as grab doorways and handrails, which could result in injury. This behavior
demonstrated her ability to move her arms freely but when asked to perform simple voluntary motor skills with her arms, she had difficulty in responding. She did actively participate in 13 exercise sessions, smiling and laughing during the beach ball activity.

Shoulder flexibility measurements were inconsistent due to spastic responses to passive flexibility movements; if the researcher initially assisted her to move her arm very slowly up the measurement tool she could continue on her own and complete the measurement independently. Her initial measurement was 59" with both arms. In the fourth week, it dropped to 41"; by the end of the study it was above the initial measurement, at 61" for the right arm (+2") and 60" for the left arm (+1"), suggesting that these measurements were dependent on her ability to perform voluntary motor coordination. She was unable to operate the grip dynamometer, resulting in no measurements being obtained. She did have sufficient grip strength (judged by her grip on the researcher's arm) to register a reading, but she either could not comprehend the operation instructions or could not activate a voluntary motor response to obtain a reading. The subject's wheelchair was fitted with a laptop table that prevented her from falling but also prevented any sit and reach measurements from being taken.

The life satisfaction pretest was attempted, but she was unable to respond to the questions with appropriate (realistic) answers. Her verbal abilities were limited to infrequent single word responses which she also displayed during the exercise sessions.
Subject #6 was a 92-year-old semi-ambulatory female who had been a school teacher. Diagnosis was CVA/dementia, dramatic cerebral deterioration, metastasis disease, chronic degenerative arthritis of the low back, and a left eye implant. Medications in use during the study were ferrous sulfate, elavil, Thorazine, artificial tears, and a multi-vitamin.

This subject was brought to the exercise sessions in a wheelchair because of her limited ambulation ability. She actively participated in 14 sessions. She had a history of demanding behavior, and at times this behavior was displayed by her unwillingness to cooperate with the researcher, staff, and other subjects. Knowing her history, the researcher guarded against this restriction by controlling the environment and promoting an atmosphere of fun and enjoyment.

During the first measurement session, this subject sat in her wheelchair with her head down and refused to acknowledge any requests for measurement. However, she did agree to be measured in the second, fifth, and sixth weeks of the study. She was injured in an accident in her room in the seventh week of the study and was unable to continue active participation.

Shoulder flexibility improved from an initial measurement of 54" in both arms during the second week to 62" for the right arm (+8") and 61" for the left arm (+7") in the sixth week of the study. This subject had difficulty operating the grip dynamometer, which resulted in only two measurements. The week two measurement was 5 ft.lbs. on her right hand and 0 ft.lbs. on her left hand, the week
six measurement resulted in 1 ft.lb. on her right hand and 2 ft.lbs. on her left hand. Sit and reach measurements were 12" in the second week and 16" in the fifth week (+4").

The life satisfaction assessment showed a score of 24 on the pretest and 25 on the posttest. It should be noted that at the time of the posttest this subject was still recovering from her recent accident and had not returned to her previous level of functioning; this may have depressed her score on the posttest, which was given after the eighth week of the study.

Subject #7 was a 78-year-old non-ambulatory female. Diagnosis was dementia and a history of a left hip replacement. Medication in use during the study was ampicillin for the first 10 days of the study and Tylenol as she needed it.

This subject was able to wheel herself in her wheelchair but would become confused and lost within the facility. She was very pleasant and outgoing, but her conversation was not related to the present situation and was unreliable. She actively participated in 16 of the exercise sessions. She smiled and laughed during the beach ball sessions but had difficulty remaining on task unless her name was called to alert her just before it was her turn to receive the ball. During the stretch band exercises, she had to be reminded constantly to continue repetitions, not having the ability to count or regulate the number of repetitions herself.

Shoulder flexibility was measured in the second week at 54" for the right arm and 56" for the left arm and the fifth week at 60"
for the right arm (+6") and 61" for the left arm (+5"). Grip strength was finally registered on the dynamometer after six weeks of unsuccessful attempts; thus, in the seventh week, a reading of 15 ft.lbs. was obtained on her right hand and 0 ft.lbs. on her left hand. During week eight, she recorded a measurement of 18 ft.lbs. on her right hand (+3 ft.lbs.), 0 ft.lbs. (no change) on her left hand. In the sit and reach assessment her initial measurement was 9", second week 14", and fourth week back to 9" (no change).

The life satisfaction pretest was attempted; she did not appear to listen to the questions or could not comprehend the questions because her responses did not relate to the subject matter of the interview. A posttest was not attempted.

Subject #8 was a 96-year-old non-ambulatory female. Diagnosis was senile dementia, diabetes type II, generalized arteriosclerotic cardiovascular disease, chronic brain syndrome, and a history of two right hip fractures. One medication, glucotrol, was in use during the study.

This subject was dependent on staff to wheel her wheelchair, and she had limited verbal skills. She was able to converse but only after careful prompting and for only a few sentences. She smiled and nodded her head when she spoke but appeared to tire very quickly. She actively participated in 19 of the exercise sessions.

Shoulder flexibility did not vary over 3" throughout the eight weeks. Initial measurements of 59" for the right arm and 60" for the left arm were nearly the same as the final measure of 60" for
both arms. A grip strength measurement was difficult to obtain; measurements recorded in weeks two, three, and four were 2 ft.lbs. for the right hand and 0 ft.lbs. for the left hand. Then, in week eight, she registered an 18 ft.lb. reading with her right hand, bringing into question the reliability of the previous measurements. Whether she could not comprehend the dynamometer’s use or had difficulty operating it could not be determined. A sit and reach measurement was not obtained because of the restriction of the laptop table on her wheelchair.

The life satisfaction assessment was attempted, but this subject was ill with flu-like symptoms, resulting in her unwillingness to be interviewed and in her missing the first week of exercises. Her performance in the exercise session would indicate that she would have been able to complete the life satisfaction assessment if it could have been given before she started participating in the exercise sessions. Because this assessment scale uses a comparison assessment to make an evaluation, the posttest was not administered.

Subject #9 was an 82-year-old ambulatory male. Diagnosis was dementia, hypothyroidism, and a history of myelodysplasia, anemia, and alcoholism. Medications in use during the study were prazepam, ferrous sulfate, and Synthroid.

This subject had a history of unwillingness to leave his living unit. He was invited to attend each of the exercise sessions but refused until the seventh and eighth week of the study. Then he not
only agreed to attend these two sessions but participated very actively. The staff at the facility stated that this was very unusual behavior for him, especially because he showed good sportsmanship by patiently waiting his turn and not showing any signs of combative nature.

One measure of grip strength was attained (22 ft.lbs. on the left hand), but no other objective data was gathered due to his poor attendance.

He could not converse with realistic language; rather, he spoke in repetitive phrases not related to anything in the present. Thus, a valid life satisfaction assessment could not be obtained.

Subject #10 was a 90-year-old ambulatory female with a 12th grade education. Diagnosis was CVA, dementia, left visual field cut, left bruit, and confusion. The one medication in use during the study was Tylenol.

This subject was a very active participant. She would assist the researcher by pushing wheelchairs to the exercise sessions as well as offering to help in any other way. Her diagnosis did not include hard of hearing, but she required slowly spoken loud communication before she would respond. At times her conversation did not relate to factual events but to previous familial events, and her short-term memory would not retain sentences that had just been spoken. This did not deter her from being very alert and skillful in the exercise sessions; she attended 23 of the 24 sessions.
Her shoulder flexibility was measured initially at 59" for the right arm and 60" for the left arm; she continued to improve to a maximum reach of 64" for the right arm and 65" for the left arm in the sixth week of the study. Her final measurement in the eighth week was 64" for both arms (+5" and +4"). This subject had some difficulty with the grip dynamometer as evidenced by two inconsistent readings in weeks four and eight. Her initial measurement was 12 ft.lbs. on the right hand and 10 ft.lbs. on the left hand. Maximum effort was in week six with a measurement of 14 ft.lbs. on the right hand and 16 ft.lbs. on the left hand. Her final measurement was 18 ft.lbs. on the right hand (+6 ft.lbs.) and 2 ft.lbs. on the left hand (-8 ft.lbs.) in week eight. Sit and reach initial assessment was 13" with a maximum effort in week seven of 25" and a final measurement of 20" in week eight (+7").

The life satisfaction assessment was administered to this subject even though she displayed inconsistent memory associations. During the pretest interview, she was very definite about her answers, supporting those answers with matter of fact responses; her pretest score was 17. The posttest showed an improvement in her perceived life satisfaction with a score of 22 (+5). However, she did not remember being interviewed for the pretest, which used the same assessment tool.

Subject #11 was a 94-year-old non-ambulatory male. Diagnosis was Alzheimer's and a history of pneumonia and
gastrointestinal bleeding. Medications in use during this study were elavil and Tagamet.

This subject was wheelchair bound and had limited ability to wheel himself. He was constantly preoccupied with unreliable conversation to himself, which was difficult to interrupt to gain his attention. When asked a direct question, he would generally respond with a definite yes or no, but it was unclear whether he was comprehending what was asked of him. He attended 17 of the exercise sessions and would actively participate for over half of each session, generally falling asleep before the session concluded. He responded best to the beach ball activity, smiling and using both his hands and feet to move the ball. The stretch band exercises were not as stimulating, resulting in his losing interest faster and falling asleep sooner.

His shoulder flexibility was initially measured at 54" for the right arm and 63" for the left arm; flexibility improved through the seventh week, and the last measurement was 64" on both arms (+10" and +1"). Grip strength was difficult to obtain as this subject was preoccupied with handling the tool and unable to comprehend its use. An initial measurement of 5 ft.lbs. on his right hand was obtained, but no other measurements could be collected until the seventh and eighth weeks. A grip strength measurement of 14 ft.lbs. on his right hand for both weeks (+9 ft.lbs.) was obtained. A sit and reach measurement was attempted, but the subject could not comprehend the use of the tool, resulting in his inability to leave the tool in
place to obtain a measurement. Thus, no valid measurements were obtained for the sit and reach assessment.

The life satisfaction interview was attempted, but this subject could not relay reliable answers and the interview was not continued.

Subject #12 was a 92-year-old non-ambulatory female with an eighth grade education. Diagnosis was dementia, CAD with stable angina, arthritis, and insomnia. Medications in use during the study were Ecotrin, elavil, Cerumenez, and Benadryl.

This subject was wheelchair bound but could wheel her chair a short distance independently. She was very outgoing, generally smiling and very willing to speak to anyone. The content of her conversation very seldom related to the present situation and even involved use of sounds in place of words to keep the conversation going. She was very active in the exercise sessions, using both her arms and legs in the beach ball activity. She conversed freely when it was her turn to move the ball and would comment on others' attempts as well. She was always courteous and positive when participating in 17 of the exercise sessions.

Her initial shoulder flexibility measurement was 60" for the right arm and 62" for the left arm. During the next six weeks her measurements were below the initial assessment by nearly 2" on both arms. However, in the eighth and final week, she measured 64" on both arms (+4" and +2"). Grip strength was difficult to obtain because this subject would continue to talk and not pay attention to
the instructions long enough to understand them. In the second week, measurements of 18 ft.lbs. on the right hand and 12 ft.lbs. on the left hand were obtained, but this performance was unusual. In the sixth week, measurements of 10 ft.lbs. for the right hand and 0 ft.lbs. for the left hand were obtained, but no other readable measurements were obtained. Sit and reach measurements were likewise difficult to measure because of the subject's lack of ability to concentrate on the task. Assessments of 11" in the second week and 8" in the sixth week were obtained.

A life satisfaction assessment was not attempted.

Subject #13 was a 92-year-old non-ambulatory female with a third grade education in Europe. Diagnosis was Alzheimer's and mild flexor contractors of the knees. The one medication in use during the study was Peri-Colace.

This subject was dependent on staff to wheel her in her wheelchair, and she had difficulty getting oriented to time and place. She would constantly move her hands around her lap board, continuously talking and humming. She attended only four of the exercise sessions. During the beach ball activity, she would occasionally respond and acknowledge the ball by striking it with her hands, but generally care was taken not to throw the ball too hard because she would not catch or respond to the ball even though she appeared to be looking at the ball. It was difficult to interrupt her routine of moving her hands around the lap board long enough for her to grasp the exercise stretch band and perform the exercise.
Generally, she would ignore the stretch bands even though she was moving them out of her way as she continued to move her hands around the table.

Shoulder flexibility was the only measurement obtained with an initial measurement of 43" on both arms and a final measurement of 51" on her right arm and 48" on her left arm (±8" and ±5").

The life satisfaction assessment was not attempted with this subject.

Subject #14 was a 91-year-old ambulatory female who had been a school teacher. Diagnosis was Alzheimer's, hypertension, mild aortic stenosis, and a history of pneumonia. No medications were in use during the study.

This subject helped the researcher push wheelchairs to the exercise sessions and offered her assistance in any way that was needed. She was very proper, polite, and concerned about the welfare of others. She attended 22 of the 24 sessions. She was very active and showed leadership abilities in promoting the efforts of others and demonstrating movements for the group. She was a skillful exerciser, moving the beach ball in a controlled style by either kicking hard or in a specific direction, depending on the situation. She responded to exercise movements with purposeful, deliberate, voluntary motor reactions.

Her shoulder flexibility showed an improvement in the right arm but not in the left arm. Initial measurements were 61" for the right arm and 63" for the left arm, ending with measurements of 67"
for the right arm (+6") and 63" for the left arm (no change). Grip strength actually declined, starting at 35 ft.lbs. for the right hand and 18 ft.lbs. for the left hand, reaching a peak of 34 ft.lbs. for the right hand and 40 ft.lbs. for the left hand in week four. Final assessments were 20 ft.lbs. for the right hand (-15 ft.lbs.) and 15 ft.lbs. for the left hand (-3 ft.lbs.). Her initial sit and reach measurement was 22". This measurement improved until week four, when she recorded a low measurement of 17". Her best effort followed a week later with 30", and the final measurement in week eight was 29" (+7").

This subject completed the life satisfaction assessment with a pretest score of 21 and a posttest score of 21 (no change). This subject appeared well adjusted to the facility and appeared to enjoy the company of the staff and other residents. This may be why there was no change in her perceived life satisfaction score. The factors on the assessment related to previous experiences with children and family were the questions that reduced her score on both assessments.

Subject #15 was a 90-year-old non-ambulatory female with an eighth grade education. Diagnosis was dementia, arteriosclerotic obliterations, dry eyes, and a history of hypothyroidism and strangulated bowel. Medications in use during the study were Tagamet, imipramine, Synthroid, lacri-lube, artificial tears, sulfanilamide, and calcium carbonate.
This subject was wheelchair bound and depended on staff to wheel her. She demonstrated a pleasant and courteous personality, always patiently waiting and considerate of others' turns during the beach ball activity. She also displayed unreliable speech that, though very sincerely stated, was not always accurate. She also demonstrated (by lack of eye movement and facing the wrong direction when conversing) that she could not see over three feet in front of herself, resulting in poor reaction to fast balls and lack of ability to visualize demonstrations. To assist her, she was cued before the ball was thrown to allow her to strike the ball once she felt its contact.

She attended 22 of the 24 exercise sessions. She was very active and seemed to enjoy the beach ball activity and stretch band exercise, as demonstrated by her smiling and verbally commenting on how good it felt to exercise and how good she thought it was for people to exercise.

Her initial shoulder flexibility measurement was 49" for the right arm and 53" for the left arm. After this assessment, she regressed for three weeks, going down to 40" for the right arm and 43" for the left arm. The following week she showed an improvement of 51" for the right arm but not in the left arm (42"). She ended with 57" for the right arm (+8") and 50" (-3") for the left arm. Grip strength was initially measured at 25 ft.lbs. for the right hand and 10 ft.lbs. for the left hand. The next week showed a drop to 2 ft.lbs. for the right hand and 0 ft.lbs. for the left hand. The measurements in the following two weeks were slightly better than
the initial measurement, with the best performance coming in week six with a measurement of 37 ft.lbs. for the right hand and 17 ft.lbs. for the left hand. The final measurement was 40 ft.lbs. for the right hand (+15) and 10 ft.lbs. for the left hand (no change).

An attempt was made to administer the life satisfaction pretest to this subject, but she could not understand the questions and preferred to talk about other topics.

Subject #18 was a 96-year-old non-ambulatory female with an eighth grade education. Diagnosis was dementia, diabetes, hiatal hernia, hyper uricemia, thoracolumbar osteoarthritis, and edema. Medications in use during the study were allopurinol, Tagamet, neodecadron, and naprosyn.

This subject was wheelchair bound and was dependent on staff to wheel her. Her verbal abilities were good but labored, with most of her conversation self-centered and pessimistic. Her inappropriate behavior (yelling and exaggerating reactions about painful movements) visibly upset the other subjects. Her attendance was attempted on four separate occasions, all but one of which proved to be in vain. She was allowed to watch (from within the activity room) on three occasions when she sat quietly and watched. During the one other session she became verbally abusive and had to be removed from the room.

Only two shoulder flexibility measurements were obtained: 42" on her right arm in week three, and two weeks later a measurement
of 42" on her right arm and 34" on her left arm where obtained. No other physical measurements were obtained.

She was given the life satisfaction assessment scale, scoring two on the pretest and five on the posttest. As stated earlier, this subject voiced her disapproval of many aspects of her life; her only positive responses on the assessment were in relation to religious activities in the facility.

Subject #17 was a 90-year-old non-ambulatory male, with an eighth grade education. Diagnosis was Alzheimer's, osteoarthritis, hiatal hernia, and stomach problems. Medications in use during the study were Peri-Colace, Tagamet, and Mellaril.

This subject was able to wheel himself short distances in his wheelchair but would become lost within the facility and unable to find his way to his home unit. He was hard of hearing, which required the researcher to speak slowly and clearly as well as to use visual communication gestures to instruct during exercises. He displayed poor posture, a slumping forward position which limited his ability to move freely. His participation in the beach ball activity was active; he would sit up straight in his chair and catch the 4' ball in the air, throwing it to another subject or the researcher. During the beach ball activity, he would smile and appear to tease the researcher by holding the ball and waiting to be coaxed into throwing the ball. He attended 19 of the 24 exercise sessions.
His shoulder flexibility was measured initially at 43" for the right arm and 60" for the left arm. The second week it measured 64" for both arms, then declined slightly for three weeks (-4" both arms), and finished with 63" for the right arm (+20") and 60" for the left arm (no change). Grip strength was initially measured at 20 ft.lbs. for the right hand and 0 ft.lbs. for the left hand. In the sixth week, a measurement of 30 ft.lbs. for the right hand and 21 ft.lbs. for the left hand was obtained, suggesting that he had difficulty coordinating a motor response to squeeze the dynamometer with his left hand. He ended with 30 ft.lbs. for the right hand (+10 ft.lbs.) and 0 ft.lbs. for the left hand. The sit and reach assessment yielded two measurements: in week two a 12" and in week seven a 14" reach measurement (+6") was obtained.

The life satisfaction assessment was attempted, but he could not stay on task long enough to answer the questions. He also appeared to have difficulty interpreting the questions, possibly because of his auditory deficit. He preferred to talk about topics unrelated to the present situation.

Subject #18 was a 94-year-old non-ambulatory female with an eighth grade education. Diagnosis was chronic brain syndrome, congestive heart failure (CHF) controlled, osteoarthritis, kyphosis, varicose veins, endoprosthesis, glaucoma hypertension, pedal edema, a history of cellulitis, and phlebitis right and left legs. Medications in use during the study were timoptic, haldol, Lasix, Bactrim, K-Lor, and artificial tears.
This subject was wheelchair bound and depended on staff to wheel her. Her verbal skills were limited to short phrases that had to be coaxed from her. She was active in the exercise sessions, attending 15 sessions. She displayed patient and oolite behavior, always waiting her turn (after which she would make eye contact with the researcher as if to ask if the movement had been correct and then, after contact was made, she would return the researcher's smile).

Her initial shoulder flexibility measurements were 67" for the right arm and 66" for the left arm. She continued with no improvement until week five when she improved 1" with both arms. She ended with a final measurement of 69" for the right arm (+2") and 68" for the left arm (+2"). Grip strength fluctuated very little, starting at 20 ft.lbs. for both hands and going up to 25 ft.lbs. on the right hand in the fourth week. Then both hands returned to the initial measurement in the eighth week (20 ft. lbs.). Sit and reach was measured initially at 13" and then improved to 16" (the highest) in week four, dropping to 10" two weeks later, and ending with a measurement of 14" (+1").

Due to this subject's unwillingness to speak, the life satisfaction assessment was not attempted. She was not able to use any alternative means of communication to answer the interview questions.

Subject #19 was an 80-year-old ambulatory male with a 12th grade education. Diagnosis was Alzheimer's, arteriosclerotic heart
disease, tachycardia, and a history of sinus arrest and coupled rhythm. Medications in use during the study were ASA, Lasix, Tagamet, and Gaviscon.

This subject had slow ambulatory skills and displayed an unbalanced gait. When the time came to assemble for the exercise group, he would always agree to attend. However, if he were napping in the day room on his living unit, he could not be stimulated enough to wake up. He attended 19 of the exercise sessions, however. He was required to sit in a chair with arms because he would easily fall asleep and fall from the chair if not protected by the arm rests. Sometimes while waiting for the other subjects to assemble in the activity room, there was little stimulation and he would fall asleep. However, once the session started, he would wake up and be a very active participant, never having a problem of falling asleep once the sessions started. He displayed good physical strength in his arms, striking the beach ball several times each session over the heads of the other subjects. He would smile and laugh each time he had a strong hit, but he had problems controlling himself and waiting his turn. He would strike the ball any time it was within range of his hands or feet even if it were the adjacent subject’s turn. Toward the end of the study, he did show some restraint and allowed those sitting around him to have their own turn without his assistance.

His shoulder flexibility was initially measured at 66" for the right arm and 67" for the left arm. He continued to improve and had his best performance in weeks six and eight at 72" for the right arm (+6") and 73" for the left arm (+6"). Grip strength showed continual
improvement starting at 60 ft.lbs. for the right hand and 65 ft.lbs. for the left hand in his second week and going up to 80 ft.lbs. for the right hand and 68 ft.lbs. for the left hand in the seventh week. In week eight the final measurement was slightly lower, ending with 68 ft.lbs. for the right hand (+8 ft.lbs.) and 70 ft.lbs. for the left hand (+5 ft.lbs.).

This subject did not understand the instructions on the sit and reach assessment until the end of the study. In week six an accurate measurement of 21" was obtained, followed by 24" the next week, and ending with 19" (-2"). Even though these measurements were obtained according to protocol, it should be noted that this subject probably could have performed better if he had not been confused about the instructions. His confusion caused him to become slightly rigid which, in turn, caused irregular readings.

The life satisfaction assessment was initially attempted. However, he became bored and fell asleep and could not be awakened to finish the interview.

Subject #20 was a 94-year-old non-ambulatory female with a seventh grade education. Diagnosis was dementia, Parkinson's disease, and a history of hypothyroidism, atrial fibrillation, and chronic asthma. Medications in use during the study were digoxin, halcion, thyroid strong tablets, Ther-Dur, Peri-Colace, Cogentin, multi-vitamin, and Ventolin inhaler.

This subject was wheelchair bound and required staff to wheel her. She appeared fragile; she was structurally small, and she
displayed slow, awkward arm movements as well as strained verbalization skills. She had difficulty maintaining an upright seated position and could frequently be found dozing in her wheelchair before the exercise sessions. When awakened and asked if she would like to attend the exercise group, she would always smile and agree to come. She attended 18 of the 24 exercise sessions and actively participated for nearly the entire session, usually falling asleep just before the session was finished. She showed limited physical abilities, including a short range of motion in her arms as well as low arm strength when using the stretch bands or striking the beach ball.

Her initial measurements for shoulder flexibility were 48" for both arms. She improved the following week to 51" for the right arm and 52" for the left arm, but measurements during the next four weeks were below her initial measurement. In week seven she recorded a measurement of 53" on the right arm and 54" on the left arm and in week eight she had her highest measurement of 63" for both arms (+15"). Grip strength was measured initially in week one at 5 ft.lbs. for the right hand and 10 ft.lbs. for the left hand. The second week measurements of 2 ft.lbs. for the right hand and 0 ft.lbs. for the left hand were obtained; she did not have any other recordable efforts. Sit and reach assessment was initially measured in week six at 7" and again in week eight at 18" (+11"). Because she could not comprehend the instructions, only two measurements were taken.
The life satisfaction assessment was given with a pretest score of 6 and a posttest score of 20 (+14). She put a lot of effort into answering the questions; it was visibly difficult for her to speak. (She would take a deep breath and labor over pronouncing the answers.) She was very definite about her answers, sometimes taking 10 or 15 seconds to answer and then following her response with a smile and a nod of her head.

Subject #21 was an 83-year-old non-ambulatory female who had been a Registered Nurse. Diagnosis was Alzheimer’s, atherosclerotic cardiovascular disease, and a history of angina, myocardial infarction, and insomnia. Medications in use during the study were Inderal, Lanoxicap, elavil, and multi-vitamin.

This subject was wheelchair bound but could wheel herself short distances. She was always alert, responding to slight stimuli such as a smile or wave from across the room. Her behavior was always polite but she was distrustful of the researcher, initially requiring other staff to ask her to attend the exercise sessions. The researcher did develop rapport with her after about two weeks, which seemed to stimulate her to become more active in the exercise sessions. She would laugh and comment about her performances during the stretch band exercises and the beach ball activity. She attended 19 of the 24 exercise sessions.

Her initial shoulder flexibility measurement was in the second week at 81" for the right arm and 62" for the left arm. She continued to improve slightly to week seven when she reached 64"
with both arms. During the next and final week she recorded her lowest measurement of 59" for the right arm (-2") and 58" for the left arm (-4"). Grip strength fluctuated, starting with 5 ft.lbs. for both hands, followed the next week (week 3) with 12 ft.lbs. for the right hand and 8 ft.lbs. for the left hand, then down to 7 ft.lbs. for the right hand and 5 ft.lbs. for the left hand the following week. She improved slightly into week eight with a final measurement of 8 ft.lbs. for the right hand (+3 ft.lbs.) and 7 ft.lbs. for the left hand (+2 ft.lbs.). Sit and reach was assessed initially at 13" and showed continuing improvement to week eight with a final measurement of 18" (+5").

The life satisfaction assessment was given with a pretest score of 19 and a posttest score of 25 (+6). This subject became visibly more at ease and involved in the exercise routine as the study progressed. At the beginning of the study, when she was asked if she wanted to participate in the exercise session that day, she would take a while to make up her mind and, as stated earlier, she would not agree to attend if the researcher asked her. However, by the end of the study, she would respond immediately with an affirmative answer the first time the researcher would ask her if she wanted to attend exercises that day.

Subject #22 was a 95-year-old non-ambulatory female with a fifth grade education. Diagnosis was chronic organic brain syndrome, Parkinson's, hard of hearing, grade II/VI early to mid-
systolic murmur, and chronic constipation. Medications in use during the study were Cogentin, halidol, and bisacodyl suppository.

This subject was wheelchair bound and depended on staff to wheel her. She actively participated in 13 of the 24 exercise sessions. She used only her arms in the exercise sessions and had limited range of motion and strength. This subject did not speak, but she did display facial expressions of happiness by smiling and nodding her head vertically and sadness by turning down her mouth and whimpering. She agreed to attend the exercise sessions by nodding her head and smiling. She tried many times to talk by moving her lips but could never enunciate a word. She appeared upset when this happened so requests for her to verbalize her communication were not pursued.

Her initial shoulder flexibility measurements were 51" for the right arm and 54" for the left arm. The following week was her best performance of 59" for the right arm and 51" for the left arm. She continued to fluctuate up and down to week five, which was her final measurement of 56" for the right arm (+5") and 55" for the left arm (+1"). She would not agree to any shoulder flexibility measurements after week five. The reason was not determined. The researcher tried a number of different approaches to gain consent, but the subject would become nervous and upset, resulting in no measurements for the last three weeks. She did attempt to register a reading on the grip dynamometer but could never succeed in moving the dial even though she appeared to be putting a great deal of effort into trying. She did try this measurement the last three weeks of
the study even though she would not try the flexibility assessment. A sit and reach assessment was never obtained, as the researcher could not relay the instructions of the procedure so she could understand them. She would nod her head for approval to try but would never move to touch the measuring stick.

The life satisfaction assessment was not attempted because of communication problems.

Subject #23 was an 95-year-old non-ambulatory male with a 12th grade education. Diagnosis was Alzheimer's, peripheral vascular disease, degenerative disease, and osteoporosis. The one medication in use during the study was dulcolax suppository.

This subject was wheelchair bound and depended on staff for all cares. He did not display any verbal abilities during the study. He had very few movement abilities, using only his left arm and occasionally flexing his feet, especially during the beach ball activity. At the beginning of this activity, one could observe his eyes following the ball. When it was his turn to move the ball, it was placed on his lap. He would make a small movement with his hand to roll the ball off of his lap, and he would often smile. The next time it was his turn, he would make a stronger movement and push the ball farther. His best effort would be when he would roll the ball off of his lap, also moving both of his feet in an effort to roll the ball to the center of the room. Once he had achieved what could be called his maximum effort, he would gradually regress to using shorter and shorter movements until he lost interest and fell
asleep, generally before the session was over. He attended 12 of the 24 exercise sessions.

His shoulder flexibility was measured initially at 50" for the left arm only, dropping down to 48" the next week, down to 46" in week six, and finishing with a measurement the same as the initial measure (50"). It was difficult to measure his flexibility due to joint contractures. However, if he were assisted to start the arm movement by proprioceptive cuing, he could continue on his own and hold his arm until the measurement could be read. He put a great deal of effort into squeezing the grip dynamometer as evidenced by his facial grimaces, but he could only manage a reading of 2 ft.lbs. throughout the study. Sit and reach measurements were not attempted due to his inability to sit in an upright position. (His wheelchair was always reclined.)

The life satisfaction assessment was not attempted due to his lack of ability to communicate verbally or consistently with gestures.

Subject #24 was 75-year-old ambulatory female who had been a Registered Nurse. Diagnosis was Alzheimer's, psychotic depression, and a history of hypothyroidism. Medications in use during the study were Synthroid, Mellaril, and artificial tears.

This subject was able to walk without limitations. She constantly paced, sometimes leaving her living unit on her own, but generally was assisted off her unit by holding a staff person's arm or hand and then following him or her to different activities. Her
physical abilities were good, as evidenced by her ambulation skills, ability to reach, and her grip strength. Her behavior was inappropriate at many of the exercise sessions, evidenced by paranoid reactions toward the beach ball, which she verbally abused. This behavior upset the other subjects, causing her removal from the immediate exercise area. Several approaches were tried to show her that the beach ball activity was harmless and the ball was not an object that was trying to harm her, but no method was found to alleviate these paranoid responses. Sometimes she would sit and play the game for several turns before she would suddenly explode, jump up, and call the ball derogatory names. The stretch band exercises were more successful; however, orienting her to present time and place as well as explaining the exercise movements was difficult. She would generally follow along with the researcher's visual cues and would complete the exercise with one-to-one assistance and verbal reinforcements.

Her initial shoulder flexibility measurement was 61" for the right arm and 60" for the left arm. Her assessments fluctuated 1" to 2" throughout the study, ending with a final measurement of 61" for the right arm (no change) and an improvement to 61" for the left arm (+1"). Grip strength was initially measured at 22 ft.lbs. for right hand and 12 ft.lbs. for the left hand. Three weeks later grip strength had dropped to 20 ft.lbs. for the right hand and 10 ft.lbs. for the left hand but the following week her left hand improved to 15 ft.lbs. She finished with a final measurement of 35 ft.lbs. for the right hand (+13 ft.lbs.) and 22 ft.lbs. for the left hand (+10 ft.lbs.). Obtaining
s't and reach measurements was difficult because she would not leave the measuring stick in place long enough to stretch forward and be measured. Three measurements were obtained, initially 19" in week two, 15" in week six, and 19" in the eighth and final week (+1").

The life satisfaction assessment was not attempted due to her inability to understand the context of the questions. She would not listen long enough for the questions to be read before interrupting with a comment that was out of context.
CHAPTER V
DISCUSSION

Summary

The purpose of this study was to provide a demonstration of an exercise program for mentally impaired older adults. The benefits of physical exercise programming for older adults are well documented. Improvement of physical functions that would promote independence of daily living was one of the objectives of this exercise programming because regaining these skills could progressively improve life satisfaction. However, few studies have been conducted to ascertain the exercise needs and provide for the limitations of the mentally impaired older adult and, in particular, the increasing number of individuals with dementia specifically of Alzheimer's type.

This study has provided evidence that physical exercise can be of value to mentally impaired older adults. Results of this eight-week study show some improvements and retention of flexibility and strength abilities as well as improvement in life satisfaction.

The exercise program was adapted from contemporary programs for healthy older adults. During the development of the design of this program, special considerations were given for symptoms and behaviors that accompany individuals with
Alzheimer's disease, dementia, and other cognitive impairments. These symptoms and behaviors include short attention spans, cognitive processing deficits, and agnosic reactions (loss of auditory, visual, or other sensations although the sensory sphere is intact). Other considerations such as poor eyesight, hearing deficits, slowed movements, and decreased exercise capacity are commonly found in all populations of older adults but were also considered because of the confounding effect they have on individuals with cognitive impairments.

Due to the various ages and physical functioning levels of the subjects in this study, a low intensity mode of exercise was chosen. The subjects in this study were not capable of performing exercises at the ACSM's recommended levels of intensity (19 subjects used wheelchairs). Thus, it seemed practical to start at the highest physical functioning level of each subject and attempt to improve physical fitness progressively. Improvising a program that allows for successful personal levels of participation is not uncommon in institutional settings. To provide for individual success, the program must have goals that are attainable by all participants. In this study those higher functioning individuals achieved the same goals as the lower functioning individuals; however, those with higher functioning levels achieved the goals more frequently by using superior skills. Several trained staff were available to provide the one-to-one facilitation needed by some participants to stimulate alternative motor pathways for the subjects to adapt movements enabling them to reach their goal.
This study included results of limited improvements in shoulder flexibility, grip strength, sit and reach flexibility, and perceived life satisfaction. Other studies have found improvements in neuropsychological and physical fitness following physical exercise in non-mentally impaired older adults (Blumenthal et al., 1989; Dustman et al., 1984; Rikli & Edwards, 1991; Spirduso, 1975; Stones & Kozma, 1989). Additionally, several studies have reported improvements in cognitive functioning after physical exercise (Clarkson-Smith & Hartley, 1989; Molloy et al., 1988; Rikli & Busch, 1989; Rikli & Edwards, 1991; Spirduso, 1983). This study did not test for differences in cognitive functioning; however, a recent study by Rikli and Edwards (1991) suggested that physical activity is an effective intervention to reversing or slowing certain age-related declines in both cognitive and motor performance. Spirduso (1983) reported that a single exercise bout could produce acute changes in neurotransmitter levels that take several hours to dissipate. These findings suggest questions of great practical significance: Can exercise alleviate the symptoms and progression of mental impairments? Does a history of physical fitness contribute to prevention of mental impairments in older adults? Alzheimer's disease and other dementias are characterized by a progressive decline in cognitive and functional abilities. In a study by Diesfeldt and Diesfeldt-Groenendijk (1977), psychogeriatric patients with organic brain syndrome showed improvement in retrieval activity and cognitive performance after physical exercise. Similar results by Folkins and Sime (1981) suggested that cognitive
functioning of geriatric mental patients was improved with physical exercise.

Several investigators have conducted research on flexibility in older adults (Cunningham et al., 1987; Morey et al., 1989; Rikli & Busch, 1986; Rikli & Edwards, 1991; Shephard et al., 1990; Tichy & Tichy, 1982). The most common test of flexibility is the sit and reach assessment, which has also been shown to be the most reliable (Shepherd et al., 1990). This reliability may be due to the fact that generally only two methods are used to assess this function, a flexibility bench (commonly found in physical education and fitness catalogs) and the newly adopted protocol endorsed by AAHPERD which uses regular measurement instruments (e.g., yard stick, tape measure). In this study no significant improvement was found in the modified sit and reach assessment. Other studies that used guidelines similar to AAHPERD’s have shown improvements in sit and reach flexibility in non-institutionalized older adults (Cunningham et al., 1987; Morey et al., 1989; Rikli & Busch, 1991; Rikli & Edwards, 1986).

Shoulder flexibility is a common assessment that has been studied in older adults. Paired pre- and posttest results of right shoulder flexibility showed a significant improvement in this study; similar results have been found for both shoulders in other studies (Rikli & Busch, 1986; Rikli & Edwards, 1991).

Grip strength was the other physical variable that was assessed. This study used a Quinton Dynamometer, which the majority of the subjects had difficulty operating. This study did not
show a significant improvement in grip strength. Other studies have shown similar results of no significant gain or decreased strength (Blumenthal et al., 1989; Cunningham et al., 1987; Rikli & Busch, 1986; Rikli & Edwards, 1991). In contrast, significant improvements in grip strength were shown in a study by Morey et al., 1989.

**Conclusions**

This study was designed to demonstrate the effects of an exercise program on older adults with mental impairments. Although the majority of studies with older adults have been done with the healthy noninstitutionalized population, this study demonstrated that some improvements in strength, flexibility, and life satisfaction can be realized by individuals with mental impairments.

Uncommon subject behaviors such as visual tracking from individuals with optic agnosia, less paranoid responses from those who are afraid to leave familiar living units, verbal responses from individuals who seldom speak, and uninhibited freedom of movement by those who display restricted movements were all found in this study.

This study is presented as a demonstration of an exercise program that can expand the knowledge base necessary for establishing effective exercise programs for the mentally impaired older adults. To draw statistically conclusive results, a larger
population would need to be in an exercise program for a much longer period of time.

Participation in a regular exercise program such as the one defined in this study appears to have a positive effect on maintenance of physical abilities of strength, flexibility, and life satisfaction in older adults with mental impairments. Although moderate improvements were shown in strength and flexibility, the subjects who were in their eighties and nineties did not decline or worsen in the variables tested during the eight weeks of the study.

It is suggested that a portion of perceived life satisfaction may be dependent upon an individual's physical abilities. However, the relationship of ability to be agile and maintain muscle tone to improved life satisfaction is not shown in this short study.

The techniques and equipment used for assessing shoulder flexibility and modified sit and reach can easily and inexpensively be replicated by other researchers. These assessment techniques have the capacity to be reliable and valid and can be performed by semiskilled professionals.

As previously mentioned, assessing grip strength in this study was difficult and questionable as far as accurately measuring maximum grip strength. Some of the subjects, as demonstrated by their handshake, clearly had 2 ft.lbs. of grip strength (minimum force to register on the dynamometer) but, due to cognitive disabilities, were not able to voluntarily coordinate a motor response to activate the dynamometer. Perhaps in the assessment of mentally impaired older adults, use of a grip strength assessment
tool that was more familiar to the subjects would produce more comprehensive results.

Misconceptions about aging and being old are pervasive in our culture. Stereotypes of the older adult as fragile and mentally inept are perpetuated in our society. The benefits of exercise are too important to allow these concepts to be perpetuated. As the ability to move is lost, quality of life decreases. The result is dependence on others and lack of control of one's own life. Every older adult, regardless of capabilities, should have access to exercise programming.

Recommendations

Clinicians and scientists generally recognize that people of all ages receive physical and emotional benefit from appropriate exercise programs (Van Camp & Boyer, 1989). The use of these basic concepts can be used to form objectives and goals for all older adults:

1. Maintain or improve flexibility.
2. Maintain or improve physical condition and function.
3. Promote psychological well being (relieve anxiety, reduce depression).
4. Provide social opportunities (promote group interaction).
5. Promote life satisfaction.
6. Maintain or raise self concept, self esteem.
7. Promote communication.
8. Maintain or improve cognitive skills.
10. Provide opportunities for emotional outlets.
11. Provide opportunities to achieve a source of joy and pleasure.

These basic concepts can be used to promote the sense of movement that is inherent in human activity, to encourage the ability to respond, and to support or improve quality of life. Possibly older adults have not been encouraged strongly or convincingly enough to motivate them to enjoy the benefits of exercise. To be free to enjoy movement and its sense of well being is clearly related to physical condition, social expectations, exercise knowledge, and personal goals. Exercise programming based on facts and individual needs and abilities should be available for all older adults, including the mentally impaired, diseased, and disabled older adults.

Additional recommendations are in the context of preparation for exercise programming. It must be emphasized that great care and research of each exercise participant's medical history and life experiences be performed before a program is developed for that individual. Simple considerations such as learning life histories of Alzheimer's diseased individuals can make the difference in facilitator-participant communication success by using familiar modes of object associations. These earlier life associations to movement are helpful to all older adults by creating an environment of understandable, previously experienced motor patterns.

Short attention spans must be considered in allowing extra time to reintroduce exercises or movements over and over again.
Methods of stimulating movement, using reflexive, proprioceptive, visual, or verbal cues should be considered as common procedures to be incorporated into a comprehensive exercise program, as well as precautions in dealing with maladaptive behaviors.

The facilitation of the program may require spontaneity. The subjects in this study were of all levels of mental and physical function, requiring diversity of instruction and adaptation to learning exercise movements. It is imperative that the exercise leader be well versed in alternative methods of stimulating volunteer physical movement as well as realizing benefits of various levels of exercise participation. Success levels in exercise programs cannot always be gauged objectively. It should be understood that to some individuals the ability to voluntarily move one finger or support a smile may be a landmark accomplishment and may not be readily recognized by observation. Additionally, there may be other stimulating factors in an exercise setting that are unexplained and unobservable that may cause uncharacteristic behaviors and reactions by the exercise participants.

Limitations

Generalizability of the results of this study are limited by several factors:

1. The quality of consistent/stimulating instruction of exercise was difficult due to differences of subjects' mental and physical skill levels within any given group.
2. The emotional and physical state of the subjects changed radically and without warning due to environmental conditions of the exercise area.

3. The ability of the subjects to comprehend verbal instruction was dependent upon voice levels, local dialects, age appropriate relationships (e.g., vocabulary), and the lack of ability to remain on task long enough to process verbal communication.

4. The visual acuity of the participants during exercise demonstration and sessions was restricted by functional, organic, or effects of medications. These limitations may not be constant or permanent and may be behavior related.

5. This study was limited to seven measurements of grip strength due to test administration difficulties in week 5.

6. The subjects in the long-term care facility used in this study resided there due to any or a combination of factors including financial, care need, social implications, and a familial prerogative for choice of placement in the long term care facility.

7. Subject composition for weekly group measurements limited the statistical analysis that could be performed to test for areas of significance.

8. The attendance and test measurements were at times limited by refusal to participate; the reasons for these occurrences were difficult to determine in this population of subjects.

9. Many of the subjects were limited by the grip dynamometer in performing accurate measurements possibly due to their small hand size. The dynamometer's operation was confusing
for the subjects to understand which part moved to produce a measurement reading.

**Implications for Further Research**

Contemporary views of research tend to find value only in findings that reach significant levels of probability. These views may not be realistic when reviewing research about possible physical changes in older adults. This study found significant levels of improvement on two variables, one physical and the other psychological. The other four physical variables did not reach significant levels of improvement. It should be emphasized that, although four of the physical variables did not improve to significant levels, they also did not decline during the course of this study. This lack of decline or the maintenance of a current level of functioning could be viewed as an improvement in performance rather than lack of change because of the process of continued natural aging. Thus, no change in a physical variable in individuals in their eighth and ninth decade of life could have a positive relationship to reaching significant levels of improvement, which would increase the validity of research that deals with physical changes in older adults.

More research, specifically longitudinal research, is needed to evaluate the long-term effects of exercise on older adults who are mentally impaired, diseased, or physically handicapped. What are the long-term effects of exercise on these populations? Do individuals early in life have a tendency to develop maladies later in
life as a result of quality and level of physical fitness? If the predisposition for the development of a malady is present early in life, can physical exercise alter or alleviate the symptoms later in life? From an economical standpoint, can exercise ameliorate the need for medications and other health care costs? Many variables make easy answers to these questions difficult but, through careful research and cooperation of all disciplines, this task can be accomplished.
APPENDIX A

ILLUSTRATION OF INSTRUMENT USED FOR MEASURING MODIFIED SIT AND REACH FLEXIBILITY

measurement end for AAHPERD protocol (inverted)

plastic angle for heel placement used in AAHPERD protocol

plastic angle placed against knees

FIGURE 9
APPENDIX B
CONSENT FORM

I, ________________________, a resident of Valley Eldercare Center, or an agent for ________________________, a resident of Valley Eldercare Center, give my consent for the above named resident to take part in a study on exercise and the elderly. The study will be conducted at Valley Eldercare Center, under the supervision of the Activities Department, by Linda Frizzell, a student at the Center of Teaching and Learning, University of North Dakota.

I understand that the above named resident will be involved in pre- and post interviewing and in a regular program of exercise for eight weeks beginning February 6, 1991. I also understand the results of this study will be used in a dissertation written by Linda Frizzell. I also understand that I may withdraw from this program at any time.

The program is designed to provide time for enjoyment through exercise. All exercises are done from a seated position which makes them safe and fun. The sessions will take place on Tuesdays, Wednesdays and Thursdays during the regular exercise time. Family and visitors are welcome at any time.

______________________________
(signed)
agent for ______________________

Date: ___________________________

Project Coordinator

135
APPENDIX C

PROJECT APPROVAL FORM

UNIVERSITY OF NORTH DAKOTA'S
INSTITUTIONAL REVIEW BOARD

DATE: __________ February 8, 1991

NAME: Linda D. Frizzell

DEPARTMENT/COLLEGE: Secondary Education

PROJECT TITLE: Physical Activities for Mentally Impaired Older Adults: Alzheimer's and Dementia Patients in a Long-Term Care Facility

The above referenced project was reviewed by a designated member for the University's Institutional Review Board on __________ February 12, 1991 and the following action was taken:

☐ Project approved on EXPEDITED REVIEW NO. 37.

☐ Next scheduled review is on __________ February 12, 1992.

☐ Project approved. EXEMPT CATEGORY NO. __________. No periodic review scheduled unless so stated in REMARKS SECTION.

☐ Project approval deferred.

☐ Project denied. (See REMARKS SECTION for further information.)

☐ Project denied. (See REMARKS SECTION for further information.)

REMARKS: Any changes in protocol or adverse occurrences in the course of the research project must be reported immediately to the IRB Chairman or ORPO.

* "Healthy" adults in Expeditable Category 7 has here been taken to mean PHYSICALLY healthy in the context of the category. Given that all participants will be cleared by physician, this will be enough protection.

HOWEVER, please supply, from Valley Elementary, a letter or memorandum addressed to the investigator granting permission and access, or acknowledge receipt.

J. Williams, Advisor

ce: J. Williams, Advisor

Dean, Graduate School

Signature of University designated IRB Member

Date

UNIR's Institutional Review Board

if the proposed project (clinical medical) is to be part of a research activity funded by a Federal Agency, a special assurance statement or a completed 596 Form may be required. Contact ORPO to obtain the required documents. (9/87)
APPENDIX D

STATISTICAL RAW DATA OF MENTALLY IMPAIRED PERSONS AVAILABLE FOR TESTING

DATA LIST

RECORDS=2
/1 ID 1-3 BIRTHYR 4-7 GENDER 8 AGE 9-10 EDUCAT 17 SHOUL1 TO SHOUL6 18-48
/2 GRIP1 TO GRIP6 5-36 MODSIT1 TO MODSIT8 41-56 ATTEND 59-60

VARIABLE LABELS BIRTHY 'BIRTHYEAR' EDUCAT 'EDUCATION'

SHOULD1 'RIGHT SHOULDER TIME 1' SHOULD2 'LEFT SHOULDER TIME 1'
SHOULD3 'RIGHT SHOULDER TIME 2' SHOULD4 'LEFT SHOULDER TIME 2'
SHOULD5 'RIGHT SHOULDER TIME 3' SHOULD6 'LEFT SHOULDER TIME 3'
SHOULD7 'RIGHT SHOULDER TIME 4' SHOULD8 'LEFT SHOULDER TIME 4'
SHOULD9 'RIGHT SHOULDER TIME 5' SHOULD10 'LEFT SHOULDER TIME 5'
SHOULD11 'RIGHT SHOULDER TIME 6' SHOULD12 'LEFT SHOULDER TIME 6'
SHOULD13 'RIGHT SHOULDER TIME 7' SHOULD14 'LEFT SHOULDER TIME 7'
SHOULD15 'RIGHT SHOULDER TIME 8' SHOULD16 'LEFT SHOULDER TIME 8'

GRIP1 'GRIP STRENGTH RIGHT TIME 1'
GRIP2 'GRIP STRENGTH LEFT TIME 1'
GRIP3 'GRIP STRENGTH RIGHT TIME 2'
GRIP4 'GRIP STRENGTH LEFT TIME 2'
GRIP5 'GRIP STRENGTH RIGHT TIME 3'
GRIP6 'GRIP STRENGTH LEFT TIME 3'
GRIP7 'GRIP STRENGTH RIGHT TIME 4'
GRIP8 'GRIP STRENGTH LEFT TIME 4'
GRIP9 'GRIP STRENGTH RIGHT TIME 5'
GRIP10 'GRIP STRENGTH LEFT TIME 5'
GRIP11 'GRIP STRENGTH RIGHT TIME 6'
GRIP12 'GRIP STRENGTH LEFT TIME 6'
GRIP13 'GRIP STRENGTH RIGHT TIME 7'
GRIP14 'GRIP STRENGTH LEFT TIME 7'
GRIP15 'GRIP STRENGTH RIGHT TIME 8'
GRIP16 'GRIP STRENGTH LEFT TIME 8'

MODSIT1 'MODIFIED SIT AND REACH TIME1'
MODSIT2 'MODIFIED SIT AND REACH TIME2'
MODSIT3 'MODIFIED SIT AND REACH TIME3'
MODSIT4 'MODIFIED SIT AND REACH TIME4'
MODSIT5 'MODIFIED SIT AND REACH TIME5'
MODSIT6 'MODIFIED SIT AND REACH TIME6'
MODSIT7 'MODIFIED SIT AND REACH TIME7'
MODSIT8 'MODIFIED SIT AND REACH TIME8'

ATTEND 'ATTENDANCE'

VALUE LABELS EDUCAT 1 '5 YRS' 2 '7 YRS' 3 '8 YRS' 4 '12 YRS' 5 'COLLEGE'
MISSING VALUES ALL(98,99,SYSMISS)

137
APPENDIX D
STATISTICAL RAW DATA OF MENTALLY IMPAIRED PERSONS AVAILABLE FOR TESTING

DATA LIST RECORDS=2
/1 ID 1-3 BIRTHYR 4-7 GENDER 8 AGE 9-10 EDUCAT 1' SHOULD1 TO SHOULD16 18-49
/2 GRIP1 TO GRIP16 5-36 MODSIT1 TO MODSIT8 41-56 ATTEND 59-60

VARIABLE LABELS BIRTHYR 'BIRTHYEAR' EDUCAT 'EDUCATION'
SHOULD1 'RIGHT SHOULDER TIME 1' SHOULD2 'LEFT SHOULDER TIME 1'
SHOULD3 'RIGHT SHOULDER TIME 2' SHOULD4 'LEFT SHOULDER TIME 2'
SHOULD5 'RIGHT SHOULDER TIME 3' SHOULD6 'LEFT SHOULDER TIME 3'
SHOULD7 'RIGHT SHOULDER TIME 4' SHOULD8 'LEFT SHOULDER TIME 4'
SHOULD9 'RIGHT SHOULDER TIME 5' SHOULD10 'LEFT SHOULDER TIME 5'
SHOULD11 'RIGHT SHOULDER TIME 6' SHOULD12 'LEFT SHOULDER TIME 6'
SHOULD13 'RIGHT SHOULDER TIME 7' SHOULD14 'LEFT SHOULDER TIME 7'
SHOULD15 'RIGHT SHOULDER TIME 8' SHOULD16 'LEFT SHOULDER TIME 8'

GRIP1 'GRIP STRENGTH RIGHT TIME 1'
GRIP2 'GRIP STRENGTH LEFT TIME 1'
GRIP3 'GRIP STRENGTH RIGHT TIME 2'
GRIP4 'GRIP STRENGTH LEFT TIME 2'
GRIP5 'GRIP STRENGTH RIGHT TIME 3'
GRIP6 'GRIP STRENGTH LEFT TIME 3'
GRIP7 'GRIP STRENGTH RIGHT TIME 4'
GRIP8 'GRIP STRENGTH LEFT TIME 4'
GRIP9 'GRIP STRENGTH RIGHT TIME 5'
GRIP10 'GRIP STRENGTH LEFT TIME 5'
GRIP11 'GRIP STRENGTH RIGHT TIME 6'
GRIP12 'GRIP STRENGTH LEFT TIME 6'
GRIP13 'GRIP STRENGTH RIGHT TIME 7'
GRIP14 'GRIP STRENGTH LEFT TIME 7'
GRIP15 'GRIP STRENGTH RIGHT TIME 8'
GRIP16 'GRIP STRENGTH LEFT TIME 8'
MODSIT1 'MODIFIED SIT AND REACH TIME1'
MODSIT2 'MODIFIED SIT AND REACH TIME2'
MODSIT3 'MODIFIED SIT AND REACH TIME3'
MODSIT4 'MODIFIED SIT AND REACH TIME4'
MODSIT5 'MODIFIED SIT AND REACH TIME5'
MODSIT6 'MODIFIED SIT AND REACH TIME6'
MODSIT7 'MODIFIED SIT AND REACH TIME7'
MODSIT8 'MODIFIED SIT AND REACH TIME8'

VALUE LABELS EDUCAT 1 '5 YRS' 2 '7 YRS' 3 '8 YRS' 4 '12 YRS' 5 'COLLEGE'/
MISSING VALUES ALL(98,99,SYSMISS)

137
```
BEGIN DATA
365 191713CVA 6499 6199 1
368 1899 1
230 89902CBS 2
236 1
262 898118989862999669965999639984 1
262 9910992299029922 0009915 20
246 9910081CVA 1 2
246 1
268 8980803989898 5153 5456 6160 13
268 99880000000 0000000000 1 2
228 8985086CVA 6261 12 16 14
228 8980500 0102000 2
346 89813078DEM 091409 16
346 0000000000 000015001800 1
346 898195096DEM 575957596080 19
346 0200020000 18 9999999999999999 2
426 8990192DEM 9898989898 1 2
426 22 02 1 2
466 901090CVA 45900 506362636265646563646464 0
466 1210 1212020 141510101802 13 15 212520 23
424 1907184ALZ 546356565498 6464 1
424 05000000000 14001400 9999999999999999 17
469 890902DEM 360325557555755952 5859 6464 17
469 00000000000 1000 0000 0000 11 08 17
473 890902ALZ 1434 5148 1
473 0000 000000 04 2
462 890091ALZ 46183663646364636626683673 1
462 35182023440 173020202015 222727 173029 22
426 891090DEM 34953241464540435125151 15750 1
426 2510020030082808 371700004010 15121009 13 16 22
475 890902DEM 3988 4298 0 4234 1
475 0000 0000 4 2
468 191190ALZ 343066466556 60656360 1
468 20001800 30213000 12 14 19
421 897094CBS 3998866686666676867686768676868 66666688 1
421 202020162520 20202020 131118 1014 15 2
426 911180ALZ 4989898667717173370727370717372
```
DATA

T-TEST Pairs=SHOULD1 SHOULD15
T-TEST Pairs=SHOULD2 SHOULD16
T-TEST Pairs=GRIPO GRIPI5
T-TEST Pairs=GRIPO2 GRIPI6
T-TEST Pairs=MODS11 MODS18

CONDESCRIPTIVE VAR=ALL

STATISTICS ALL

FREQUENCIES VARIABLES=BIRTHYR(1895,1917) GENDER(0,1) AGE(73,96)

EDUCAT(1.5) SHOULD1 TO SHOULD16(34,75) GRIP1 TO GRIP8(0,80)

MODS11 TO MODS18(7.35) ATTEND(2.23)

BARCHART/

PEARSON CORR VAR=BIRTHYR TO ATTEND

STATISTICS ALL

FINISH
BIBLIOGRAPHY
BIBLIOGRAPHY


Development of AAHPERD. Available from: Department of Movement Science and Leisure Studies, the William Paterson College of New Jersey, Wayne, NJ 07470.


