

RESISTANCE TRAINING FOR ADULTS WITH ALZHEIMER'S DISEASE AND RELATED  
DEMENTIAS: FEASIBILITY OF PROGRAM IMPLEMENTATION, APPROPRIATENESS  
OF PARTICIPANT ENGAGEMENT, AND EFFECTS ON PHYSICAL PERFORMANCE AND  
QUALITY OF LIFE

By

Sharon D. Rogers

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APPROVED:

Rosemary Blieszner, Ph.D. Co-Chair

Shannon E. Jarrott, Ph.D. Co-Chair

Jay A. Mancini, Ph.D.

Michelle Stevenson, Ph.D.

Janet Wojcik, Ph.D.

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Resistance Training for Adults with Alzheimer's Disease and Related Dementias: Feasibility of Program Implementation, Appropriateness of Participant Engagement, and Effects on Physical Performance and Quality of Life

Sharon D. Rogers

Abstract

Coupled with normal age-related regression in muscle mass, adults with cognitive impairment are at high risk for exacerbated declines in muscle strength, associated psychological well-being, and overall independence. Working from the environmental press model, a 12-week strength training intervention was designed to both support participants' continuing abilities and meet varied needs. Tailoring the environment helps optimize participation, which is essential if participants are to experience the greatest possible gains from a group-based exercise program.

The intervention was a group-based, progressive strength training program designed specifically for adults with dementia at two dementia care centers. The exercises were performed three times each week and the sessions were led by the centers' activities leaders. Participants used hand-held barbells when performing the upper-body exercises.

Findings indicated that individuals retain the capability to enhance their own quality of life through active participation in a therapeutic intervention. This is illustrated by the consistent effort of exercising participants to perform appropriately during the exercise intervention. Not only were adults able to demonstrate effort to appropriately participate, but the intervention supported high levels of *correct* performance of the exercise repetitions which is important for achieving physical gains. Exercisers did not experience improvement in physical abilities nor did they significantly differ at posttest from non-exercising participants in measures of physical

ability and function or quality of life. The program was deemed to be a feasible intervention for adults with dementia as indicated by both regular participant attendance at the program sessions and high levels of effort to engage appropriately in the exercises.

Due to the lack of opportunities for adults with dementia to participate in stimulating or meaningful activities, and the individuals' susceptibility to excess disability, the strength training program is a viable intervention to incorporate into the regular activities programming at dementia care centers. Future research should utilize the progress made by this study to continue exploring the environmental variables that most greatly affect the participation of adults with dementia, as well as outcome measurements that best capture important effects of participation in exercise for these individuals.

## Dedication

To my parents, This was only possible because of your unwavering faith in me. I am forever grateful for your guidance, patience, and support.

To Mimi, my inspiration and best friend.

I love you all.

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## I. Introduction

Coupled with normal age-related regression in muscle mass, adults with cognitive impairment are at high risk for exacerbated declines in muscle strength which can be associated with psychological well-being, and overall independence. The Nagi Model of Disability (1969) depicts this downward cascade in functional ability to which adults with Alzheimer's disease or related dementias (ARD) are especially vulnerable. In part, this vulnerability results from a phenomenon of "excess disability," or the negative effects of a disease that are greater than from the disease alone. For example, caregivers often over assist persons with ARD in lieu of aiding them in the completion of tasks by supporting intact abilities. As a result, this excess disability contributes to an expedited progression towards disability. However, strength training has the potential to offer a plethora of benefits that mitigate the functional declines that lead to physical disability. The opportunity to participate in a planned strength training program offers considerable potential benefit to individuals with cognitive impairment, yet the intervention must be supportive of individuals' abilities in order for individuals to participate.

Only a few research studies have examined outcomes related to strength training of adults with ARD. Though conclusions from extant literature are limited by numerous methodological considerations, such preliminary work informed the design of the current study. Working from the environmental press model, I structured the exercise training environment to both support participants' continuing abilities and meet varied needs. Tailoring the environment helps optimize participation, which is essential if participants are to experience the greatest possible gains from a group-based exercise program. These environmental considerations (i.e., ideal space, training a motivated facilitator) are realistically replicated whereby implementation at other sites is feasible.

The research is based on a 12-week, group-based, progressive strength training program designed specifically for adults with ADRD at two dementia care centers. The exercises included a deliberately planned programmatic structure with integrated elements of the environment thought to optimize participant engagement in the activity. The centers' activities leaders led the exercise program for 30 minutes three times each week. This was a quasi-experimental design with repeated measures of outcome variables. Sample participants were divided into an exercising ( $n = 17$ ) and a non-exercising comparison group ( $n = 8$ ).

Due to the planned environmental supports, I expected participants in the exercising group consistently to exhibit the *effort* to engage appropriately in the target activity. I also anticipated that participants would consistently *correctly* perform the exercise repetitions. Finally, I hypothesized that exercisers' physical abilities and functioning, as well as quality of life, would improve over 12-weeks, and that exercisers would possess superior outcomes as compared with the non-exercising group at the end of 12 weeks.

Findings indicate that individuals retain the capability to enhance their own quality of life through active participation in a therapeutic intervention, namely exercise. This is illustrated by the consistent effort of exercising participants to perform appropriately during the exercise intervention.

Not only were adults able to demonstrate effort to appropriately participate, but the intervention supported high levels of correct performance of the exercise repetitions which is important for achieving physical gains. Exercisers did not experience improvement in physical abilities nor did they significantly differ at 12 weeks from non-exercising participants in measures of physical ability and function. Quality of life scores did not significantly change for exercisers or non-exercisers during the 12 weeks.

Program feasibility is indicated by (a) regular participant attendance at the program sessions and (b) high levels of effort to engage appropriately in the exercises.

The current study made several improvements upon past research including advancement of the research design to include a comparison group. The findings established the reliability of particular physical and functional outcome measurements need to assess persons with ADRD. I provided suggestions to assess physical, functional, and quality of life outcomes from participation in strength training of adults with ADRD more effectively. Due to the lack of opportunities for adults with ADRD to participate in stimulating or meaningful activities, and the individuals' susceptibility to excess disability, the current strength training program is a viable intervention to incorporate into the regular activities programming at dementia care centers.

II. Feasibility of a Resistance Training Program for Adults with Alzheimer's Disease or Related  
Dementias and the Effects on Quality of Life

## Abstract

Individuals with dementia can sustain appropriate engagement and consequential improvements in quality of life, which are influenced by both the severity of cognitively impairing conditions and the nature of interventions. We implemented an individually-adaptive strengthening exercise program for residents of two dementia care facilities. We evaluated participants' overall engagement in the prescribed exercise routine and the effects of participation on quality of life. Results indicated that (a) the majority of adults with dementia of varying severity were constructively engaged through the entirety of each session of a 12-week exercise program and (b) neither exercisers' nor non-exercisers' quality of life significantly changed over 12 weeks. Demonstrated by high levels of participant engagement in the prescribed activity, these individuals retain the capability to enhance their own quality of life through planned exercise intervention.

Persons with Alzheimer's disease or a related dementia (ADRD) experience progressive declines in cognition, behavior, and functional ability which are associated with the regression of physical faculties (Barberger-Gateau et al., 2004). The Nagi Model of Disability (Nagi, 1965) posits that over time, the effects of diseases progress along a continuum, ultimately leading to disability for example, in performance of instrumental and basic activities of daily living. Disability, defined by compromised independence in specified activity, is a key detractor from quality of life (Kurz, Scuvee-Moreau, Rive, & Dresse, 2003).

Though progressive declines occur, all abilities are not lost at once. Too often an immediate full loss of abilities of an individual with ADRD is assumed; overcautious, well-intending care providers perpetuate the cycle of functional decline in that they often fail to support continued abilities and contribute to learned helplessness of the individual. This benevolent overprotection illustrates a lack of respect for intact skills and abilities of the person with ADRD, and a general lack of recognition for an individual's personhood, or status as an individual (Kitwood, 1997). Though severe memory loss is associated with a progressive cognitive disease, the procedural memory component remains largely intact. Activities that utilize this memory system support maintenance of "over-learned" abilities. Such an activity program takes a strengths-based approach (Bowlby-Sifton, 2000) as activity planners couple existing abilities with environmental adaptations (Lawton & Nahemow, 1973) to support the success of adults with ADRD in almost any activity. When the environmental "press" of a situation is modified in an effort to increase engagement and success in the activity, there are enhancements in the overall quality of life (Orsulic-Jeras, Judge, & Camp, 2000; Zygora, 1999).

At a time when there are fewer opportunities to engage in positive and meaningful experiences that may elicit feelings of success, exercise is one area where adults with ADRD can

achieve significant biological, psychological, and social gains for themselves and those around them. Strength training exercises target the syndromes of disuse and may significantly delay disability and the occurrence of disease (Miller, Rejeski, Reboussin, Ten Have, & Ettinger, 2000). Given the importance of strength for basic activities, including walking, transferring from a seated to standing position, and balance, any interventions that can yield improvements in function could lead to reductions in the burden of providing care and improvements in overall quality of life for both patients and caregivers.

*Feasibility of Implementing a Resistance Training Program*

Feasibility relates to the likelihood that the strength training program can be replicated in other dementia care centers and is defined by variables including environmental logistics (e.g., adequate space with few distractions, a motivated facilitator), regular participant attendance, and ability of participants to demonstrate effort to participate appropriately. We expect that the program, designed to optimize abilities of engagers, would support high levels of participant effort to perform appropriately. Also, we expected that the activity would be well received by participants as a part of regular activity programming, indicated by regular participant attendance to the program.

Only a few documented strength training interventions for adults with dementia exist; (Arkin, 1999, 2003; Brill, Drimmer, Morgan & Gordon, 1995; Francese, Sorrell, & Butler, 1997; Hageman & Thomas, 2002; Thomas & Hageman, 2003) therefore, descriptions of specific considerations related to implementing an exercise program for adults with dementia are limited, as are delineations of successful strategies that maximize the engagement of these adults in strength training. Using the Menorah Park Engagement Scale to determine adults' with dementia participation in an exercise program, Heyn (2003) noted that 69% of participants were

constructively engaged in an exercise program half or more of the observed time and another 30% of participants were constructively engaged in the exercises up to half of the observed time. Because constructive engagement represents individuals' efforts to perform appropriately in the activity, these findings support the notion that adults with dementia have the potential to engage in and sustain levels of attention in activities for extended periods of time.

Lawton and Nahemow (1973) proposed that the complexity of environments has a significant effect on the level of persons' functioning in them. Therefore, it can be hypothesized that structuring the environment to meet the needs of the individuals promotes competent engagement. Environments that minimize stress and optimize competence best facilitate success in performance of everyday activities. The environmental press model presents behavior as the function of the person, the environment, and the interaction between the person and demands of the environment. Competence resides in individuals and represents a fit between an individual's abilities and the environment. Competent behavior occurs when capabilities of the individual are congruent with environmental complexity, and, conversely, dysfunction occurs when environmental press is too weak or too strong relative to the individual's level of competence. Without environmental adaptations (Lawton & Nahemow, 1973), adults with dementia may have difficulty engaging sufficiently to receive health benefits associated with exercise. Thus, using the environmental press model to inform program design helps ensure program feasibility as indicated by participants' effort to appropriately engage in the program.

The purpose of this intervention was to investigate the feasibility of a group-based, individually adaptive, strength training intervention for adults with ADRD by examining participant engagement in the program and the effects of exercise on participant quality of life. We expected that participants would spend the majority of their time during the exercise sessions

demonstrating constructive engagement. Further, we expected that participation would yield positive changes in exercising participants' quality of life and that these changes would exceed any change that occurred in the comparison group.

## Method

### *Participants*

Subjects were recruited from two assisted living dementia care centers. The sample consisted of 25 participants who were sorted into either an exercising ( $n = 17$ ) or non-exercising ( $n = 8$ ) group by the activity directors who were familiar with the residents' interest in participating in center activities or exercise. This is the usual method of participant selection in planned center activities. Though this method of sample selection potentially imposes bias, it was accepted as a compromise necessary to secure agreement from the service providers to participate in the study. Eight of the original 31 participants were not included in the final analyses due to a variety of reasons which are described elsewhere (see Rogers & Jarrott, 2005 for a detailed discussion).

Subjects were selected to participate in the exercise group if they met all inclusion criteria, including (a) diagnosis of AD/DRD, (b) willingness to participate, (c) ability to follow simple instructions, (d) ability to tolerate environmental stimuli and group interaction, and (e) were not actively participating in other forms of strength training exercise. Participants became ineligible if they no longer met any of the specified inclusion criteria or received a physician's order to stop participating. The only expectation of the comparison subjects was to provide consent to be evaluated at each occasion of measurement. Written consent was required for all study participants by each participant's family caregiver and primary physician. However, participants' assent was recognized by their voluntary participation in performing the exercises.

Prior to beginning the intervention, demographic information was collected on all study subjects and included physician's diagnosis of cognitive impairment, cognitive status determined by score on the Mini-Mental Status Exam (MMSE; Folstein, Folstein, & McCue, 1975) which was assessed by the facility's social worker within six months of the start of the intervention, sex, date of birth, and extent of recent participation in physical activity.

#### *Program Description*

The program was an established 30-minute strength training activity program (Rogers, Gigliotti, Jarrott, & Weaver, 2004) implemented three times each week by the activities leader. The program was group-based, progressive and easily adapted to varying physical abilities. The entire program could be performed seated, seated with three transitions to standing, or in a standing position. Change in position (standing versus seated) and weighted hand-held barbells were used to escalate intensity of the program over the course of 12 weeks of the intervention.

Working from Lawton and Nahemow's model of environmental press (1973), special environmental design considerations were utilized in order to optimize participant engagement. The size of the exercising group was limited to no more than 15 participants in order both to manage safety concerns and to minimize excessive distractions. Aside from the facilitator, staff members were expected to be present to assist with safety issues, as well as to provide appropriate cues and prompts to individual exercisers who needed more assistance to perform competently. Recognizing both continued and limited abilities of participants, the activities leader organized a seating arrangement for exercisers in order to arrange individuals within the group most appropriately. For example, persons with behaviors such as restlessness or wandering were asked to sit near the back of the group such that they would not disrupt others when they stopped exercising or exited the group.

### *Instruments*

#### *Engagement in the Activity*

The Menorah Park Engagement Scale© (MPES) was used to evaluate type and level of engagement, or the *effort* to participate in the resistance training program appropriately.

Engagement was determined by observing and coding videotaped exercise performances of participants in the program. Three sessions were videotaped, one session during the first week, one during the sixth week (half-way point), and one during the twelfth (final) week.

The MPES was developed to capture type and level of engagement by distinguishing five types of participant engagement in Montessori-based activities (Camp & Skrajner, 2004). The types of engagement included competent engagement, passive engagement, self-engagement, other engagement, and non-targeted engagement (see Table 2.1). Researchers coded participants' levels of participation during an observational time frame as 2 (*equal to or more than half of the 1 minute observation*), 1 (*less than half of the observation*), or 0 (*not at all during the observation*). In addition to use in Montessori research (Gozali, 2002; Camp & Skrajner, 2004), the MPES has been used to assess engagement of adults with ADRD in horticultural activities (Gigliotti, Jarrott, & Love-Norris, 2005) and during exercise (Heyn, 2003).

Observational research on adults with ADRD or on prescribed times, including time of day or length or frequency of times to observe behaviors is limited. The original MPES scale coded participation during a single 5-minute observation period. Heyn (2003) used the MPES to determine engagement in an exercise program but the method and length of time used to observe each participant is not stated. Using another form of observational assessment, Engleman, Altus, and Mathews (1999) coded participants' engagement in certain daily activities as appropriate,

inappropriate, or not-engaged. They observed each participant sequentially in turn, 15 times for 3 seconds, in observational blocks lasting as long as 50 minutes.

Table 2.1

*Types of Engagement within the Menorah Park Engagement Scale*

Type of Engagement	Description	Example
Constructive Engagement	Participating or commenting on an activity	Performing exercises during an exercise program
Passive Engagement	Listening or watching when performing is expected	Listening to instructor during exercise program but not physically participating
Self-Engagement	Self-stimulating behaviors	Tapping fingers or toes, picking at clothing
Other Engagement	Participating in an uninvolved activity	Dancing during exercise program, reading newspaper during instructions
Non-Engagement	No activity	Sleeping, closing eyes, staring into space

*Note.* From “Resident-Assisted Montessori Programming (RAMP): Training Persons with Dementia to Serve as Group Activity Leaders,” by C. J. Camp and M. J. Skrajner, 2004, *The Gerontologist*, 44, p. 428-429.

Though Lawton, Van Haitsma, Perkinson, and Ruckdeschel (1999) and Camp and Skrajner (2004) originally used a single observation period of five minutes, both later modified their protocols by adjusting the periods of observation. Gozali (2002) used observational research to determine participants’ engagement in Montessori activities and found that one 5-minute observational period observed during the beginning or end of the intervention did not adequately describe overall engagement of individuals.

With these considerations from past research in mind, in the present study the amount of time participants demonstrated each type of engagement was recorded over three one-minute observation periods and coded categorically. We modified the original protocol of the MPES (Camp & Skrajner, 2004) by shortening the observation time from five minutes to one minute. Each participant was observed for one minute at the beginning, middle, and end of the exercise session in order to have observations over multiple intervals during the exercise session. It was anticipated that this would better assess true engagement, rather than observing individuals for a single and longer period of time that could result in an inaccurate representation of a person's involvement over the course of an activity (which would be the case if someone who actively joined 20 minutes of a 30 minute activity were observed only during the final 10 minutes of the activity when he or she was not participating).

Researchers used videotaped images of exercisers to evaluate participant engagement in exercise. Each participant was observed individually for a one-minute interval until every participant was observed. Upon completing this first one-minute observation for each person on the list, the cycle was repeated, gathering a second, and then third, one-minute observation for each person. This procedure provided observations of participants during various stages of the session.

Before evaluating engagement, inter-rater reliability was established with another researcher skilled in the use of the MPES to help ensure that levels of engagement were assessed appropriately. A minimum inter-rater reliability was established at 90% agreement. This percentage of agreement is standard across observational research and research using the MPES, (Fleiss, 1981; Landis & Koch, 1977; Orsulic-Jeras, Judge, & Camp, 2000). An inter-rater reliability check was repeated prior to coding the video at each of the three waves of

measurement, which helped to reduce observer drift, or the re-characterization of what qualifies as a type of engagement which compromises the validity of an assessment (Smith & Glass, 1987).

### *Quality of Life*

The Quality of Life- Alzheimer's Disease instrument (QOL-AD; Logsdon, Gibbons, McCurry & Teri, 1999) is a 13-item dementia-specific scale that assesses quality of life of older adults from a multidimensional approach. The reliability and validity of the scale have been established (Logsdon, Gibbons, McCurry & Teri, 1999; Merchant & Hope, 2004; Thorgrimsen et al., 2003). It was administered to subjects in an interview format, which, consistent with Kitwood's (1997) person-centered approach, gives persons with dementia the opportunity to express their own feelings. Subjects were asked to rate each of 13 items, which were scored on a four-point ordinal scale with 1 (*poor*) and 4 (*excellent*). Sample items in the questionnaire include feelings about physical health, mood, and relationships with family and friends. Pre-determined prompts included with the original scale (Logsdon et al., 1999) were used as cues when necessary to help describe a questionnaire item better. The interviews took place in either the common area at the center or the residents' rooms. Interviews were conducted with all study participants at the three occasions of measurement which occurred at weeks 1, 6, and 12.

### *Analysis*

We recorded preliminary, descriptive data for all study participants including sex, age, and MMSE score. For the dependent variables, we recorded type and level of engagement at each occasion of measurement during the exercise program for members of the exercise group, and we assessed quality of life of exercise and non-exercise group subjects.

We expected subjects in the exercise group to express high levels of consistent engagement across all occasions of measurement. Therefore, we repeated procedures used in similar studies and present here descriptive results of the percent of participants' engagement by type and level (Heyn, 2003; Matthews, Clair, & Kosloski, 2001). This presentation is in accordance with advisement provided by the instrument's developer (C. J. Camp, personal communication, March 02, 2005). Participants' engagement in the exercise sessions was coded categorically, adhering to the prescribed procedure of the MPES. I charted (a) the percentages of participants exhibiting each type and level of engagement (e.g., constructive engagement for one-half or more of the observation) during each of the three 1-minute observations at weeks 1, 6, and 12 and (b) the overall percentage (the combined percentage from the three 1-minute observations) at each occasion of measurement for each type and level of engagement.

I expected exercisers' (a) quality of life to improve over time, (b) quality of life to be higher than that of the comparison group by the end of the intervention, and (c) changes in quality of life to exceed changes experienced by the comparison group. Responses to questions on the QOL-AD were scored with recommended scoring procedures to indicate level of quality of life. A mean response score on the QOL-AD was determined for each participant at each time of measurement. I used a repeated measures analysis of variance to test for significant changes in quality of life over time for each treatment group, and for significant differences in quality of life between the two groups.

Change scores were computed as the difference between mean scores of weeks 1 and 12 of the QOL-AD. I tested for significant differences between groups' change in quality of life over 12 weeks using an independent samples analysis of variance.

Pearson's coefficient correlation was used to express the relationship between quality of life and demographic characteristics of the sample in order to examine any demographics that are related to the level of quality of life. We expected that more exercise would have a relationship with higher quality of life so Pearson correlations were also used to examine the relationships between the percentage of exercise sessions attended and quality of life assessed by the score on QOL-AD.

All data were analyzed using the SPSS (version 11.0) PC program and significance was set to a level of .05.

### Results

The overall sample was 72% female, old-old, and moderately cognitively impaired as assessed by scores on the MMSE (see Table 2.2). No significant group differences in sex, age, or cognitive ability existed between groups at baseline.

Table 2.2

#### *Characteristics of Participants by Exercise Group*

Characteristic	Exercisers ( <i>n</i> = 17)				Non-Exercisers( <i>n</i> = 8)			
	<i>n</i>	<i>R</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>R</i>	<i>M</i>	<i>SD</i>
Sex (female)	12				6			
Age (years)		75-95	94.0	5.88		73-90	83.13	5.33
MMSE Score <sup>a</sup>		0-30	15.69	9.01		11-25	19.13	4.29
Percentage of Attended Sessions		85-100	91.35	4.57		--	--	

<sup>a</sup> MMSE = Mini-Mental Status Examination (Maximum score = 30).

### *Engagement*

Because exercisers were the only study participants observed during activity, descriptions of engagement are specific to this group and therefore reflect no information about the comparison group.

The percentage of participants exhibiting each type and level of engagement was determined at each observation period. More than 90% of participants remained constructively engaged for at least half of the observation time frame in the intervention at each occasion of measurement. Moreover, neither participation in passive engagement nor any other forms of engagement exceeded 10% at any of the three occasions (see Table 2.3). The figures demonstrate that the majority of observation frames gathered during the exercise sessions were characterized by constructive engagement.

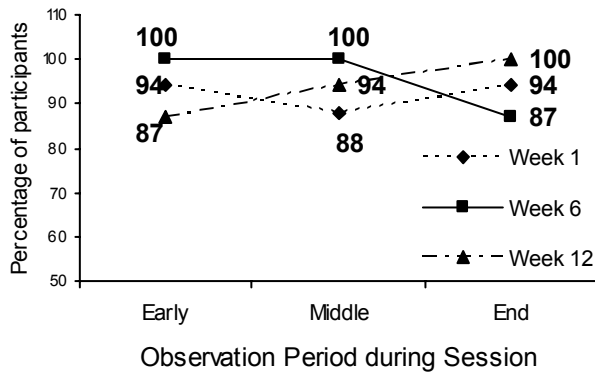
Over the course of the 12 weeks of the intervention, constructive engagement during half or more of the observation period remained high, with participation reaching 100% during several observations (see Figure 2.1). Every participant consistently exhibited constructive engagement during the exercise sessions and over the course of the program. Passive engagement was exhibited in the form of participants listening and watching the instructor. *Other* engagement, though exhibited in only a few instances, was in the form of adjusting shirt sleeves or moving a chair to better position oneself within the group.

Table 2.3

*Types and Levels of Engagement over Time*

		Occasion of Measurement		
		Week 1	Week 6	Week 12
Constructive Engagement	$\geq 1/2$ time	94	100	94
	$< 1/2$ time	6	0	4
Passive Engagement	$\geq 1/2$ time	4	10	2
	$< 1/2$ time	9	7	4
Self Engagement	$< / \geq 1/2$ time	0	0	0
Other Engagement	$\geq 1/2$ time	2	0	4
	$< 1/2$ time	7	7	0
Non Engagement	$< / \geq 1/2$ time	0	0	0

*Note.* Cell entries = percent of participants.



*Figure 2.1.* Percentage of participants constructively engaged during at least half of the observation period.

*Quality of Life*

Using the data from both exercisers and non-exercisers, I calculated internal consistency of the scale's original 13 items (pretest  $\alpha = .88$ , 6 weeks  $\alpha = .67$ , 12 weeks  $\alpha = .80$ ). However, for the sake of greater validity, we also selected items based on empirical support that exercise would most likely influence. These items included physical health, energy, mood, memory, relationships with family, relationships with friends, feelings about self as a whole, and perception of ability to do everyday tasks. The internal consistency of this subset of items at week 1, 6 weeks, and 12 weeks was  $\alpha = .78$ ,  $\alpha = .82$ , and  $\alpha = .84$ , respectively.

Table 2.4

## Analysis of Variance for Quality of Life

Source	<i>df</i>	<i>F</i>	$\eta$	<i>p</i>
Between Subjects				
Group (G)	1	.09	.00	.77
G within-group error	17	(.29)		
Within Subjects				
Time (T)	1	.27	.00	.61
T $\times$ G	1	.25	.01	.63
T $\times$ G within-group error	17	(.03)		

*Note.* Values enclosed in parentheses represent mean square errors.

Mean scores of quality of life from the 13-item scale administered week 1 suggested that participants in both the exercising and comparison groups rated their lives as *good*, and this positive perspective was reflected at each time of data collection. There were no differences between groups at baseline ( $F(1,23) = .386$ ; n.s.). Neither of the groups' scores on quality of life significantly changed over time nor were there any significant differences between the two groups (see Table 2.4). There was no difference between groups in amount of change over 12 weeks in quality of life [ $t(18) = .151$ , n.s.].

For the exercising group, being male was associated with a lower reported quality of life at week 1 ( $r = -.501$ ,  $p < .05$ ). We expected that higher attendance at exercise sessions, among subjects in the exercise group, would be associated with higher quality of life at the 12-week follow-up; however, evidence did not support this relationship ( $r = -.021$ , n.s.).

### Discussion

This study supports the feasibility of a resistance training program for adults with ADRD with indicators including (a) participant attendance at more than 85% of the exercise sessions and (b) greater than 90% of participants exhibiting effort to perform the exercises appropriately over the course of the intervention. Further, the environmental accommodations needed to support participant engagement can be readily incorporated at most dementia care centers, enabling this intervention to be easily replicated.

The high levels of engagement demonstrated by members of the exercise group during the strength training sessions, which were maintained throughout the program, reflect the intervention's capacity to support the intact abilities of individuals. In addition to tailoring the environment to the individuals, we designed this exercise program to sustain attention over the length of the session by including physical movements such as rowing a boat and climbing a

ladder which are likely to be familiar to participants near the end of the 30 minute program when participants' attention levels are likely to be waning. The characteristics of the facilitator are also important in maintaining the attention of the participants and supporting and encouraging intact abilities. The skill in communicating with persons with ADRD, personality and expressiveness, and adeptness instructing the exercise routine are examples of the kinds of facilitator characteristics that likely affect the level of participant engagement. Moreover, the activity should be meaningful and stimulating to participants in order to increase engagement (Gori et al., 2001), which lends support to the technique of sample selection used in this study.

#### *Detecting Change in Quality of Life*

At week 1, scores on the QOL-AD were not variable since both exercisers and non-exercisers reported a positive quality of life, perhaps as the result of non-random sampling. These scores approached a ceiling effect whereby limiting the extent to which scores of quality of life could improve. It is not reasonable to expect everyone to report excellent scores on quality of life, especially persons with compromised abilities who have been moved from their homes or families. This is not an element of psychological well-being that exercise is likely to affect; however, meaningful group activity and interaction, which the exercise program offers, would elicit feelings that positively influence overall quality of life.

Though engagement in the program remained high throughout the 12 weeks, interest in the activity may have waned or there may have been effects of "getting comfortable with" the activity. We expected that physical improvements associated with participation in exercise would positively affect quality of life. It is likely that the positive effects of exercise on everyday physical functioning may take longer than 12 weeks for an individual to detect. This is also limited to the strength, or dosage, of the exercise.

Elements of program implementation likely contributed to the lack of treatment effect of the intervention. For example, repeated instances of poor feedback and lack of providing cues to participants by the facilitator would have been detrimental for participants' motivation and effort. Also, inadequate escalation of hand-held weights limits possible strength gains. It is also important to recognize that motivation affects the intensity and level of effort of an individual applies during an activity. Even though adults demonstrate the effort to perform appropriately during an activity, they have preferences and may not feel inclined to participate to their greatest ability and therefore limit the gains that result from participation.

Further, the use of the QOL-AD posed some challenges to interviewers, although the scale has strong psychometric properties. Because the current study was the first to use the QOL-AD as an outcome of exercise, we decided to use the full 13-item scale to assess quality of life. Certain items repeatedly elicited in participants a negative emotional reaction and in particular, the item inquiring about the quality of the relationship with a significant other. Further, many participants chose not to respond to the item which assessed their level of comfort with financial status because they had transferred this responsibility to a relative. Interviewers observed that respondents often appeared to provide answers that they considered socially desirable, evidenced by asking the interviewer if they had answered correctly. However, the impact of exercise on quality of life might be best examined using specific subsets of items the QOL-AD most likely to be influenced by exercise, such as the subset mentioned previously.

The physical, psychological, and social gains associated with exercise have the potential to positively influence quality of life. For example, exercise induces immediate psychological gains in self-esteem or mood, for examples. Unfortunately, adults with ADRD who exercise may not experience these psychosocial gains augmented by participation in exercise because they

retain no memory of exercising. Enhanced physiological function due to exercise would improve health and perceived well-being, elements critical to quality of life. Perhaps precise physiological measures (e.g., hormone levels, body temperature, blood pressure) which can also be impacted from a sufficient dosage of exercise are more reliable outcome measures when assessing the effects of exercise.

Though this physical activity program did not result in improved quality of life over each occasion of measurement, the value of the exercise program is illustrated by anecdotal remarks of the staff familiar with the participants. These remarks are descriptive of functional improvements, fewer behavioral disturbances, and more positive group interactions of the participants. Even in consideration of the unproven efficacy of the intervention, active engagement in activities is important in that most adults in nursing homes are not stimulated with activities and sit solitary in their rooms most of the day (Harper-Ice, 2002).

#### *Evidence of Procedural Memory*

The current exercise program was an organized sequence of activities with the same music accompaniment during each session. The routine became familiar, and staff reported that participants demonstrated behaviors that were suggestive of their having memorized the exercise routine, characteristic of an acquired procedural memory. For example, these individuals performed movements within the sequence of exercises before the facilitator provided visual or verbal instructions, or they required fewer cues over time. For adults with cognitive impairment, procedural memory is most often attributed to regular performance of activities that occurred over long periods of time in the past; opportunities for adults with ADRD to demonstrate the ability to learn new procedures are virtually non-existent.

The amount of engagement an individual with ADRD can exhibit within each activity session, and cumulatively over the course of a full intervention program, is likely affected by numerous variables such as attention span, severity of impairment, and characteristics of the environment. This study did not employ repeated measures of these variables. However, it was not the intent of the researchers to determine the extent of each variable's effect on the outcomes of the exercise program; rather, we were interested in testing the feasibility of a specific program to be implemented in typical dementia care facilities. The current intervention was tailored to optimize participant engagement and in fact, supported high levels of participant engagement. Even with budget, staff, and time constraints that plague activities departments at many dementia care facilities, this intervention can be realistically replicated.

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### III. Resistance Training for Adults with Alzheimer's Disease and Related Dementias:

Appropriateness of Participation and Physical Performance Outcomes

### Abstract

Coupled with normal age-related regressions in muscle mass, adults with cognitive impairment are at high risk for exacerbated declines in muscle strength, associated declines in psychological well-being, and overall reduction of independence.

We implemented a 12-week strength-training intervention designed to enhance physical abilities of adults with dementia. Special design considerations were made such that the program was individually adaptable to maximize participants' appropriate engagement in the exercises. Repeated measures analysis of variance was used to test for differences between and within treatment groups' physical abilities over 12 weeks and changes in exercising participants' appropriate engagement in the exercises.

An individually-adaptive, group-based strength-training program can be successfully implemented with adults with dementia. No significant changes in physical abilities occurred during the 12 weeks. Nonetheless, the intervention was effective in properly engaging participants in sustained exercise which is necessary to ensure that they can achieve benefits from group-based exercise. Future research should assess other methodologies and outcomes of participation in group exercise in order to extend the understanding of effective exercise programs for individuals with cognitive impairment.

The decline in muscle mass associated with normal aging, referred to as sarcopenia, is a major factor for strength loss in old age. Strength declines in the lower extremity are slightly more pronounced than in the upper extremity (Hughes et al., 2001; Onder et al., 2002) suggesting the likelihood of functional declines (Janssen, Heymsfield, & Ross, 2002), notably in mobility. Diminished leg strength and lower body functioning appear to be strong predictors of disability and institutionalization following functional declines in nondisabled community-dwelling older persons (Guralnik, Ferrucci, Simonsick, Salive, & Wallace, 1995; Guralnik et al., 2000).

Lower cognitive skills and the presence of dementia place individuals at higher risk for functional declines and disability, though no specific explanations are reported (Agüero-Tores, Thomas, Winblad, & Fratiglioni, 2002; Barberger-Gateau et al., 2004; Fitz & Teri, 1994; Gill, Richardson, & Tinetti, 1995; Gill, Williams, Richardson & Tinetti, 1996). Adults with Alzheimer's disease or a related dementia (ADRD) are especially susceptible to "excess disability," which is "a discrepancy that exists when a person's functional incapacity is greater than that warranted by the actual impairment" (Brody, 1971, p. 125). This results from external factors such as individuals' unsupported interactions with the environment or from their personal awareness of cognitive deficits, which may contribute to negative self-concept and self-worth. Furthermore, caregivers often fail to encourage care receivers to perform physical activities, even basic activities of daily living, to the fullest extent of their capabilities. Physical inactivity ultimately leads to functional declines (Gill, Allore, & Guo, 2003; Keysor & Jette, 2001); consequently, well-intentioned but stressed caregivers may inadvertently contribute to functional decline and disability (Morris & Morris, 1997). Functional decline may be one of the most

problematic aspects of dementia in that it may lead to institutionalization (Miller, Longino, Anderson, James, & Worley, 1999).

The Nagi Model of Disability (Nagi, 1969) was developed to explain the continuum of processes that lead to disability. The original model consists of four elements along a continuum from disease to disability but a revised disablement model (Verbrugge & Jette, 1994) added two elements, *predisposing risk factors* and *psycho-social factors and internal resources* (see Figure 3.1), thought to influence the main pathway or continuum of the original model.

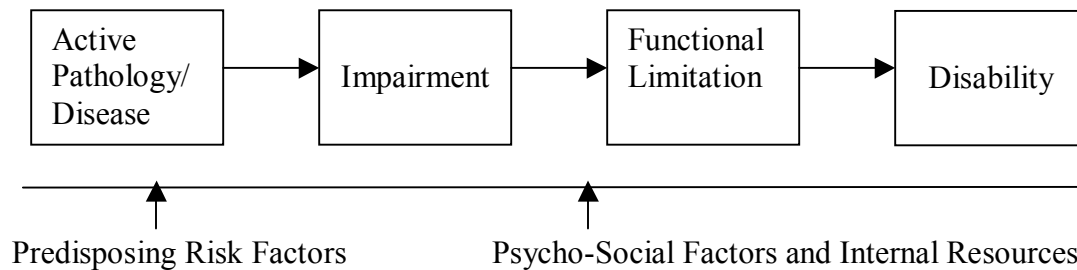


Figure 3.1. Conceptual model of the disablement process (Verbrugge & Jette, 1994). From *Social Science and Medicine*, 38, L. M. Verbrugge, & A. M. Jette, The disablement process, p. 1-4, Copyright 1994, reprinted with permission from Elsevier.

Barberger-Gateau et al. (2004) tested an adaptation of Verbrugge and Jette's (1994) model and found that dementia had a significant impact on the onset of disability in instrumental activities of daily living (IADL) and activities of daily living (ADL). *Predisposing risk factors* was added to indicate the influence of characteristics or behaviors that increase one's progression through the continuum. Examples of predisposing risk factors include sex, age, race, health status, or health behaviors, including prolonged inactivity or physical disuse. The second new element was the influence of *psycho-social factors and internal resources* that may contribute to

the progression of disability. These factors and resources allow individuals to respond and adapt to the demands of the environment as well as remain engaged in higher levels of functioning (Verbrugge & Jette, 1994). Therefore, lower levels of resources such as cognitive skills, peer support, or motivation put individuals at a higher risk for disability.

The addition of the two elements to the revised model strengthens its application to the disability process of adults with ADRD. These individuals are particularly susceptible to the disuse syndrome, which is perpetuated by the negative effects of physiological changes associated with predisposing risk factors, including increasing age, presence of cognitive impairment, and overcautious care providers. Disuse, a consequence of having unnecessary care provided for an individual, expedites the progression of functional limitations and subsequent declines in performance of ADL and IADL tasks (Hirvensalo, Rantanen, & Heikkinen, 2000; Miller, Rejeski, Reboussin, Ten Have, & Ettinger, 2000; Morris et al., 1999). Declines in psychosocial factors and internal resources such as locus of control, life satisfaction, and self-efficacy can exacerbate the disability process (Seeman, Berkman, Charpentier, Blazer, Albert, & Tinetti, 1995). Because cognitive impairment negatively affects each of these psychosocial variables, adults with ADRD are more susceptible to progression along the continuum of disability.

Individuals with ADRD progress through stages of decline in daily functioning and exhibit increases in inappropriate behaviors. Aside from monetary costs, management can be psychologically and physically burdensome on caregivers, spouses, and relatives. Therapeutic methods, including pharmacological treatment, for ADRD target a decrease in negative behaviors and optimize the display of intact abilities in an effort to maintain the highest level of functional capacity. Behavioral interventions are used to manage a variety of problem behaviors

or for treatment of other symptoms associated with dementia such as depression. Few of these interventions target the physical elements involved in maintaining gross motor functional ability. If opportunities to be physically mobile and active do not exist and participation in physical activity is unsupported, physical disuse will further exacerbate age-related muscle loss, hastening progression toward disability.

There are a variety of exercise intervention programs for adults with dementia, which incorporate a range of evaluated outcomes, including physical function measures such as gait or balance (Teri et al., 2003), cognitive functioning (Lindenmuth & Moose, 1990; Lindenmuth & Lindenmuth, 1994; Palleschi et al., 1996), affect (Teri et al., 2003), behavior (Alessi, Yoon Schnelle, Al-Samarrai, & Cruise, 1999; Holmberg, 1997; Rolland et al., 2000), and communication (Friedman & Tappen, 1991). Yet, only a few documented resistance training exercise interventions for adults with ADRD evaluated strength outcomes (Arkin, 1999, 2003; Brill, Drimmer, Morgan & Gordon, 1995; Francese, Sorrell, & Butler, 1997; Hageman & Thomas, 2002; Thomas & Hageman, 2003). Other interventions have been touted as strength training but do not meet the definition of strength training of the American College of Sports Medicine (1998), and are instead range of motion programs (Mathews, Clair, & Kosloski, 2001), leisure activities (Schneider, Drake, Simms, & Harren, 2001), or otherwise designed exercise programs with incorporated strength training elements (Toulette, Fabre, Dangremont, Leusel, & Thevenon, 2003; Heyn, 2002, 2003).

Strength training effectively improves older adults' muscular strength and neuromuscular competence and positively influences psychological well-being (American College of Sports Medicine, 1998; United States Department of Health and Human Services, 1996). Improvements in strength support ability to perform everyday functional activities and may postpone disability

and subsequent institutionalization (Miller et al., 1999). Extant research supports the extensive positive health effects of resistance training for older adults but has largely excluded adults with cognitive impairment from the studies. It is likely, however, that these individuals would similarly benefit.

A variety of prescribed exercise programs and measured outcomes is reflected across the few documented strength training interventions for adults with ADRD (Arkin, 1999, 2003; Brill, Drimmer, Morgan, & Gordon, 1995; Francese, Sorrell, & Butler, 1997; Hageman & Thomas, 2002; Thomas & Hageman, 2003). Consequently, there are not defined guidelines for mode and associated dose of strength training needed to produce positive health outcomes in older adults with ADRD, although it is plausible that recommended guidelines for unimpaired older adults are equally appropriate for adults with ADRD based on like physiological characteristics of systems such as the musculoskeletal system which supports older adults' ability to achieve strength gains with training into the tenth decade of life (Fiatarone, Marks, Ryan, Meredith, & Lipsitz, & Evans, 1990).

Individuals must be provided the opportunity to engage in physical exercise appropriately in order to achieve the full physical benefits of a resistance training intervention. We take our cues from caregiving theory and recent literature specific to ADRD which suggest that activity must be structured according to established principles of activities for adults with dementia targeting appropriate participation in the activity. It should be pleasurable and meaningful to participants and should support intact or continuing abilities (Bowlby-Sifton, 2000; Gori, Pientini, & Vespa, 2001; Kitwood, 1997). Based on the model of environmental press (Lawton & Nahemow, 1973), competent behavior occurs when capabilities of the individual are congruent with environmental complexity, wherein individual accommodations are made to support intact

abilities and attain the desired outcome of enhanced physical capacities. Depending on the type and severity of disease, adults with dementia experience progressive declines in cognitive and physical abilities. The declining levels of competence associated with physical and cognitive impairments can result in incongruence between individual capabilities and environmental demand. Therefore, the environment must be continually adapted in order to accommodate the changing abilities of the individual. For example, providing task instructions through visual, auditory, and physical cues may improve the appropriate participation of an individual with a cognitive impairment.

The benefits of exercise depend on duration and intensity of participation (Bouchard, 2001). Structuring the environment to meet the needs of the individuals will promote competent engagement such that without environmental adaptations (Lawton & Nahemow, 1973), adults with dementia may have difficulty engaging sufficiently to receive health benefits associated with exercise. Using the Menorah Park Engagement Scale<sup>©</sup> to determine engagement in exercise, Heyn (2003) concluded that adults with dementia can competently engage in an exercise program and sustain levels of attention in pleasurable activities for extended periods of time. However, none of the research evaluating resistance training interventions for adults with dementia (Arkin, 1999, 2003; Brill, Drimmer, Morgan, & Gordon, 1995; Francese, Sorrell, & Butler, 1997; Hageman & Thomas, 2002; Thomas & Hageman, 2003) investigated whether participants correctly performed the exercises.

The current study explored the effects of participation in a 12-week strength-training intervention of adults with ADRD on lower and upper body strength, gait performance, and physical functioning. Further, we evaluated participation in the exercise program to determine whether the adults with ADRD could competently perform the exercises to achieve intended

physical outcomes. We hypothesized that exercising participants could competently engage in the exercise program at levels sufficient to improve physical abilities and that these individuals would experience enhanced physical abilities or fewer declines than non-exercising persons with ADRD.

## Method

### *Participants*

A non-random sample of 31 participants was recruited from two assisted living dementia care centers. Subjects for the treatment and comparison groups were selected by each center's activities leader based on awareness of residents' interests and abilities. Both facilities' activity structure exists such that the activities leader selects participants for each activity; these participants are then escorted to the activity by staff. Though this means of identifying study participants posed high risk for sample bias, it was the most plausible means of obtaining a sufficient number of participants from these facilities. Because the exercise group participants were selected based on past involvement in exercise at the center or based on an expressed interest in such activities, it was likely that the activity would be pleasurable and meaningful to them. This corresponds to the practice implications of Kitwood's (1997) theory of personhood which specifies that individuals' preferences, based on social history, should be recognized. Even adults with cognitive impairment retain the ability to express human emotions though their cognition is impaired. Participants were selected for the comparison group based on past experience refusing to participate in group activities at the center or expressed disinterest in joining the exercise intervention.

No baseline differences were expected in physical abilities between these two groups. This was because residents at long-term care facilities are sedentary (Armstrong-Ether, Browne,

& McAfee, 1994) and are provided little or no opportunity to be physically active at levels needed to affect fitness or functional abilities.

Participants were eligible to participate in the exercise program if they had a diagnosis of ADRD, were willing to participate, were able to follow simple instructions, were able to tolerate environmental stimuli and group interaction, and were not actively participating in other forms of strength training exercise. Adults became ineligible if they no longer met any one of the participation criteria. Written consent from guardians and primary physicians was required for participation. Participation in both the treatment and comparison groups was voluntary and participants were free to withdraw from any session or from the entire intervention. Only 25 (18 females, seven males) of the original 31 participants were included in the analyses. Twenty-two original participants were assigned to the exercising group but five were removed because they had participated in fewer than 80% of the exercise sessions or had missed three or more consecutive exercise sessions. These criteria reflect exposure to appropriate dosage of activity defined as consistent participation in strength-training three days each week over 12 weeks, from which reasonable effects of participation can be expected (American College of Sports Medicine, 1998). Reasons for lack of attendance or prolonged absences included onset of illness or injury, physician or personal care appointments, refusal to attend, or a combination of these reasons. The comparison group consisted of eight participants because one of the original nine assigned group members moved from the facility during the course of the intervention. Sample demographic information is presented in Table 3.1.

Table 3.1

*Characteristics of Participants by Exercise Group*

Characteristic	Exercisers ( <i>n</i> = 17)				Non-Exercisers( <i>n</i> = 8)			
	<i>n</i>	<i>R</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>R</i>	<i>M</i>	<i>SD</i>
Sex (female)	12				6			
Age (years)		75-95	94.0	5.88		73-90	83.13	5.33
MMSE Score <sup>a</sup>		0-30	15.69	9.01		11-25	19.13	4.29
Percentage of Attended Sessions		85-100	91.35	4.57		--	--	--

<sup>a</sup>MMSE = Mini-Mental Status Examination (Maximum score = 30).

Prior to testing, participants were familiarized with the purpose of the study. Participants were tested at their respective center. The study was approved by the university ethics committee.

*Data Collection**Sample Descriptives*

A questionnaire of relevant descriptive personal information for each participant was completed jointly by the activities leader and the center administrator. Items included: physician's diagnosis of cognitive impairment, Mini-Mental Status Exam (MMSE) score (Folstein, Folstein, & McCue, 1975) assessed by the facility's social worker within the previous six months, sex, date of birth, and confirmation that participants had not recently engaged in an organized strength training or physical activity program.

*Participant Attendance*

The activities leader documented daily attendance at the resistance training program in an attendance log. Attendance was not a measure of time or type of engagement but was

determined by arrival to the site of the program. The activities leader also documented the amount of hand-held weight used by each participant during the session. One site held two more exercise sessions than the other over the 12 weeks due to a holiday and a fire drill, therefore the percentage of the total number of attended sessions (as opposed to the total number of sessions) for each participant was used to indicate participant attendance to the program.

### *Functional Performance*

Because task segmentation batteries take time to complete and assess a range of task abilities (Morris & Morris, 1997) that exercise has not been documented to affect, such as skills involved in grooming and eating, the 10-item Physical Functioning Inventory of the Short Form-36 Health Survey (SF-36; Ware & Sherborne, 1992) was used to assess functional performance. The 10 items assessed ability to perform everyday mobility-related tasks and were scored on a 3-point scale with 1 indicating great limitations in performing an activity and 3 meaning no limitations in ability to perform the activity. Examples of the items include: ability to lift or carry a dinner tray or laundry, ability to climb a flight of stairs, and ability to bathe or dress self. The PF-10 inventories for participants were completed jointly by the activities leader and a center administrator prior to the commencement of the program and immediately after its cessation.

### *Physical Performance Measures*

Physical performance measures for upper and lower body strength and agility were conducted prior to beginning the exercise program (pretest), after six weeks, and after 12 weeks (posttest) of program implementation. The physical assessment was performed by the first author, who is experienced in conducting these assessments, and took approximately 15 minutes/person to complete. Because these performance tests had not been determined to be

reliable for use with adults with ADRD, reliability was established by conducting testing approximately one week prior to the pretest assessment (Rogers, 2005). Because some participants were wheelchair bound or had other mobility limitations, all tests were not completed by all participants. If a participant had difficulty appropriately completing a test due to effects of cognitive impairment, the participant was given further visual, verbal, or physical cues until the test could be completed appropriately, and if the participant was still unable to perform appropriately, the test was skipped and an explanation was noted.

Grip strength has established validity as a predictor of upper body strength (Schwartz, Cohen, Herbison, & Shah, 1992). A Baseline® hydraulic hand dynamometer was used to assess all subjects' hand grip strength. Each subject performed the test from a seated position and the standard test protocol recommended by the instrument manufacturer was followed. The subject was given one practice trial before the first recorded trial. The test was administered three times in the dominant arm, with a 30-second rest between trials, and the best score of the three trials was recorded. The manufacturer recommends using the mean score of the three trials but because of episodic variations in cognitive ability, one trial may negatively affect the mean score and incorrectly indicate lower strength ability. Based on clinical experience, we expected the best score of the three trials to be a better indicator of the actual strength of adults with ADRD therefore that is the datum that was used. Scores were assessed in kilograms.

The repeated chair stands test is a valid measure of lower body strength (Guralnik et al., 1994). The test was conducted using a flat-seated chair with the seat approximately 45 cm from the floor. Participants were asked to repeatedly stand five times as quickly as possible. Timing began when the participant left the chair seat and time ended when the participant touched the chair's seat following the last stand. Time was recorded to the hundredth of a second.

Participants were discouraged from using their hands to push upwards when standing.

Participants performed the test once.

In order to assess agility, the 4-meter timed walk test (Guralnik et al., 1994) was conducted; the participant was asked to walk a straight four-meter distance at the fastest pace of safe ambulation. Participants were asked to stand at the starting line; timing commenced when the participant initiated movement and crossed the starting line and timing stopped when the participant had crossed the 4-meter marker with both feet. Time was recorded to the hundredth of a second. The best score of two performances was used as the datum. Participants were permitted to use usual walking devices in order to complete the test and any use was recorded.

#### *Appropriate Engagement in the Resistance Training Program*

Engagement was determined by observing and coding videotaped exercise performances of participants in the program. Three sessions at each center were videotaped, one session during the first, sixth, and twelfth weeks. The Menorah Park Engagement Scale© (MPES) was used to evaluate type and level of engagement. According to the MPES, five categories of engagement capture participant involvement in an activity. The categories are labeled as constructive, passive, self-, other, or non- engagement; the level of engagement is quantified by the proportion of time the participant spends exhibiting each type of engagement. These findings are reported elsewhere but indicate that during a group-based exercise program, nearly all participating adults with dementia expressed effort to perform the intended activity for the duration of the program (Rogers & Jarrott, 2005). Though the participants' effort to engage appropriately in the exercises was coded as constructive engagement on the MPES, this coding label does not capture whether the exercises were performed properly. Therefore, when observing the videotaped images we also observed for and recorded the number of *appropriately*

performed exercise repetitions. We then computed the percentage of appropriately performed repetitions during each videotaped session and the average percentage of appropriately performed repetitions over the course of the intervention. We anticipated that this information would provide us with insight about the overall feasibility of the program as well as specific programmatic elements, and would be useful to explain effects on strength outcomes by the end of the program.

### *Exercise Program*

The program was an established resistance training program consisting of exercises that targeted major muscle groups involved in performing everyday physical activities and was designed in accordance with recommended guidelines for older adults (American College of Sports Medicine, 2000). The program lasted approximately 25 minutes and was performed three times each week. Each center's activities leader was trained by the first author and served as the facilitator for the program. The program had been successfully implemented for more than one year within an adult day services center serving clients with ADRD and various physical conditions (Rogers, Gigliotti, Jarrott, & Weaver, 2004).

Each session consisted of the activities leader and no more than 12 participants. It was encouraged that at least one other staff member be present to assist participants who needed individual attention and to encourage engagement in the exercises, although this was not always possible. The activity leader recorded each participant's attendance to the program and the weight of the barbell used during the program.

### *Environmental Considerations*

Based on Lawton and Nahemow's model of environmental press (1973), special consideration was given to the environment and the means of facilitating appropriate engagement

for the participants. The exercise program used music as a part of a multi-sensory strategy intended to support engagement in intended activity (Kneafsey, 1997; Matthews, Clair, & Koslowski, 2001). Recognizing special needs of individuals within the group, each facilitator developed a seating arrangement that maximized opportunity for engagement and managed safety issues. For example, each individual was seated in clear view of the instructor and individuals who were more easily agitated or tended to be unfocused were situated in the front row in order to reduce distraction from other participants.

### *Progressive Nature of the Program*

An objective of the exercise program was to guide individuals through an increasingly challenging program in an effort to maintain, and perhaps enhance, their functional abilities. For example, a progressive exercise program increases the weight of the hand-held weights. The initial intensity of the program was one set of eight repetitions at a specific weight and the intensity was increased to ten, then twelve repetitions every 4 weeks. In addition, it was structured to transition the individual from a seated position to standing, thereby enhancing lower body strength and balance. Initial assignment of hand-held weights and the anticipated progression in weight was based on ease of ability in performing eight repetitions (American College of Sports Medicine, 1998). Some participants could communicate this information; however, the activities leader needed to make a judgment for others. Assessments for increasing the weight occurred approximately every two weeks. For any adults who experienced medical situations that caused a decline in physical ability, weights were decreased as needed. Furthermore, the program content did not change, thereby maintaining a familiar continuity for the participants, which is especially valuable to adults with ADRD.

*Analysis*

Data were analyzed using the SPSS (version 11.0) PC program. Analyses included frequency distributions for characteristics of the sample including sex, age, and cognitive ability, assessed by MMSE score. Pearson's correlation coefficient was used to express the relationship among measurements of interest and demographic variables in order to acknowledge any relationship that demographic variables and physical abilities. Outcome variables included: (a) measures of physical abilities including hand grip strength, time of five repeated chair stands, time of gait over four meters, and score on PF-10 inventory; (b) performance variables including percentage of exercises appropriately performed and percentage of exercise sessions attended; and (c) percentage of change during the intervention in selected physical ability and performance variables. Means and standard deviations were calculated for physical ability and performance variables at each occasion of measurement. Also, percentages of changes from baseline to 12 weeks were figured for these variables. Percentages were used instead of difference scores in order to indicate the magnitude of change.

Because empirical evidence indicates that sex affects strength and there is theoretical justification that cognitive status affects an individual's ability to follow instructions, sex and cognitive status were investigated for effects on baseline physical abilities and functioning. Significant effects of either of these demographic variables would justify use as a covariate in means tests.

I expected exercisers' physical abilities and functioning to be at least maintained over time. Maintenance of function is a meaningful outcome for adults at risk for declines. I did not expect non-exercisers to improve in measures of physical ability or functioning. A repeated measures analysis of variance was performed to test for significant change of each physical

performance variable over 12 weeks for the exercising and non-exercising groups. An analyses of variance (ANOVA) was used to test for differences between the two treatment groups in percentage of change from pretest to posttest for each measure of physical ability and functioning.

Each measurement was assumed to bear some dependence on other physical performance measurements; therefore, a Bonferroni correction was applied, resulting in the level of significance being set to  $p < .001$ .

Pearson's correlation was also used to examine the relationship between each 12-week assessment of physical ability and both the percentage of sessions attended and the percentage of repetitions appropriately performed.

## Results

The overall sample was predominately female, old-old, and moderate to severely cognitively impaired (see Table 3.1). No significant differences in personal characteristics or physical abilities existed at baseline between treatment and control groups.

### *Physical Abilities and Functioning*

A repeated measures analysis of variance was used to test for differences over time in physical abilities and performance variables. Sex was entered as a covariate because of its significant influence on grip strength at pretest ( $t(23) = 4.19, p = .00$ ). Cognitive ability was entered as a covariate for pretest assessments of the time of repeated chair stands and the 4-meter walk [ $t(20) = -2.13, p = .04$  and  $t(22) = -2.59, p = .02$ , respectively]. No significant changes were observed over time in physical abilities or functioning (see Tables 3.2 - 3.5).

Table 3.2

## Analysis of Covariance for Grip Strength

Factor	<i>df</i>	<i>F</i>	$\eta$	<i>p</i>
Between Subjects				
Group (G)	1	.50	.03	.49
Sex (S)	1	18.90	.51	.00*
Within-group error	18	(64.92)		
Within Subjects				
Time (T)	1	2.02	.10	.17
T × G	1	.36	.02	.56
T × S	1	2.14	.11	.16
T × G within- group error	18	(6.86)		

*Note.* Values enclosed in parentheses represent mean square errors. \*  $p < .05$ .

Table 3.3

## Analysis of Covariance for Walk Time

Source	<i>df</i>	<i>F</i>	$\eta$	<i>p</i>
Between Subjects				
Group (G)	1	.02	.89	.89
Cognitive Status (C)	1	5.89	.27	.03
Within-group error	16	(92.26)		
Within Subjects				
Time (T)	1	4.46	.21	.05
T × G	1	.12	.00	.74
T × C	1	3.43	.18	.08
T × G within- group error	16	(1.29)		

*Note.* Values enclosed in parentheses represent mean square errors.

Table 3.4  
 Analysis of Covariance for Time of Repeated Chair Stands

Source	<i>df</i>	<i>F</i>	$\eta$	<i>p</i>
Between Subjects				
Group (G)	1	.04	.00	.85
Cognitive Status (C)	1	16.38	.52	.00*
Within-group error	15	(68.80)		
Within Subjects				
Time (T)	1	.01	.00	.93
T × G	1	.22	.00	.65
T × C	1	.00	.01	.95
T × G within- group error	15	(99.72)		

*Note.* Values enclosed in parentheses represent mean square errors. \*  $p < .05$ .

Table 3.5

## Analysis of Variance for Scores on PF-10 Inventory

Source	<i>df</i>	<i>F</i>	$\eta$	<i>p</i>
Between Subjects				
Group (G)	1	1.75	.08	.20
Within-group error	22	(12.06)		
Within Subjects				
Time (T)	1	1.75	.07	.20
T × G	22	2.25	.09	.15
T × G within- group error	22	(58.98)		

*Note.* Values enclosed in parentheses represent mean square errors.

In the exercising group, the 4-meter walk time and scores of the PF-10 inventory were the only outcome measures of physical ability and function whose change occurred in the expected direction (see Table 3.6), that is walking time dropped and PF-10 scores increased. Because raw scores do not indicate relative change, the percentage of change between pretest and posttest was calculated for each physical performance variable in order to obtain an indicator of magnitude of change. An analysis of variance was used to test for differences in change over time between groups. Though it was expected that non-exercisers' physical abilities and functioning would decline or remain unchanged over 12 weeks, 4-meter walk time improved by 6%, and the physical functioning score improved by 31%. I expected these variables to change in the

opposite direction. Despite these changes, there was no significant effect of group, time, or group  $\times$  interaction on any physical performance variables (see Table 3.6).

### *Appropriate Engagement*

The datum for overall percentage of appropriate engagement among exercisers was constructed from the mean of appropriate engagement for the three occasions of measurement. Unexpectedly, there were no significant correlations between the percentage of appropriately performed repetitions and change in physical ability or functioning scores, nor were there significant relationships between the percentage of exercise sessions attended and change in scores of physical ability or functioning.

Appropriate participation appeared to improve during the course of the intervention (see Figure 3.2). Participants in the exercising group were able to perform the exercises correctly in the program such that 75% of participants appropriately performed at least half of the expected repetitions, and nearly 50% of the participants performed at least three-quarters of the expected repetitions. For the sake of determining the effect of appropriate performance of exercises, participants' data were divided into two groups, more appropriate performers ( $\geq 75\%$  overall repetitions performed appropriately) and less appropriate performers ( $< 75\%$  overall repetitions performed appropriately). Change percentages between pretest and posttest were used in an ANOVA to test for differences in percentage of change in physical abilities between individuals who were categorized as *more* or *less* appropriately performing the minimum amount of exercise to achieve gains. Though there were no significant differences between groups, participants who appropriately performed at least three-quarters of the repetitions experienced outcomes superior to the other participants for grip strength, 4-meter walk time, and chair rise time (see Table 3.7).

Table 3.6

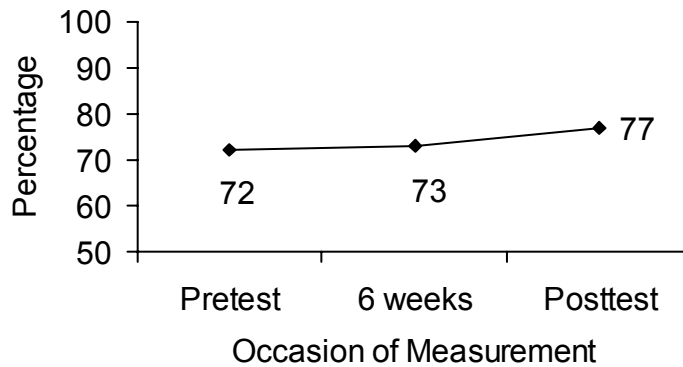
*Percentage of Change over 12 Weeks Between Groups in Tests of Physical Performance*

	Exercisers		Non-Exercisers		df	<i>t</i>	<i>p</i>
	Expected Change	Mean Change, in %	Expected Change	Mean Change, in %			
Grip Strength (kg)	+	-11.66	-	-2.26	21	.95	.35
Walk Time (s)	-	-1.16	+	-6.26	20	-.33	.75
Stands Time (s)	+	21.22	+	11.55	19	-1.31	.21
PF-10 Score	+	17.68	-	31.74	22	2.04	.05

Table 3.7

*Percentage of Change over 12 Weeks in Physical Abilities for Participants Grouped by Amount of Appropriate Repetitions Performed*

Physical Performance Test	Competence Group				df	<i>t</i>	<i>p</i>
	< 75% Appropriate Repetitions Performed ( <i>n</i> = 9)		≥ 75% Appropriate Repetitions Performed ( <i>n</i> = 8)				
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Grip Strength (kg)	13.41	32.4	9.69	22.84	15	-.877	.420
Walk Time (s)	4.75	37.85	-7.07	18.63	14	-1.01	.329
Stands Time (s)	36.05	78.18	8.24	33.2	13	-.102	.326
PF-10 Score	17.99	14.37	17.28	13.11	14	.051	.960



*Figure 3.2.* Percentage of exercisers appropriately performing repetitions at each occasion of measurement.

### Discussion

This study aimed to implement an effective strength training intervention for adults with dementia and improve upon research designs and methodologies used in past research. Most prior research on this topic did not use outcome variables that had been established as reliable for use for persons with dementia, whereas the measures used in this study were deemed reliable for use with these subjects.

Because the strength of the program is determined by the type of exercise, intensity of each session, duration of each session, and length of the program, each of these factors should be considered in program design. Cited explanations in previous research for the lack of statistically significant findings include the requirement for the intervention to last longer than six weeks (Hageman & Thomas, 2002; Thomas & Hageman, 2003) and for aggressive progression of external resistance (American College of Sports Medicine, 2000; Brill et al.,

1995). These conclusions and recommendations were incorporated when planning this intervention, though this intervention did not result in significant changes in participants' physical abilities or function. Though the effect of the intervention was small (see Table 2), all participants increased the amount of handheld weight used over the study and most finished standing for the entire duration of the program and were able to appropriately complete all of the sit-to-stand transitions. The increase in the weight and body positioning most likely reflects a change in confidence rather than significant change in strength abilities, or perhaps it indicates a change in neuromuscular ability based on capacity to perform the movements (Thomas & Hageman, 2003). Even if significant change in physical abilities did not occur, the smallest of gains in muscular ability likely translate into large gains in functioning, independence, and quality of life given an environment supportive of intact abilities and these gains. Perhaps because feasibility of strength training for adults with dementia has been repeatedly established (Arkin, 1999, 2003; Brill, Drimmer, Morgan, & Gordon, 1995; Francese, Sorrell, & Butler, 1997; Hageman & Thomas, 2002; Thomas & Hageman, 2003), the remaining challenge is to select outcomes and develop evaluation tools that best measure gains from participation that are relevant in the lives of these participants.

The evaluation of the appropriateness in performance of exercise repetitions indicated that participants understood the exercises and were able to perform these to sufficient levels to acquire change in physical abilities. This helps establish credibility for these individually-adaptive interventions designed to support intact abilities of adults with dementia. Given a supportive environment, these individuals can act appropriately as agents in activities that support their intact abilities whereby positively influencing their own quality of life.

In spite of an appropriately planned program, which adhered to recommended guidelines and was informed by conclusions from past research, and the majority of exercisers appropriately performing the repetitions, outcomes contradicted expectations. Limitations of the current study, notably a small treatment group, most likely contributed to many of the statistically insignificant outcomes.

Skilled facilitation of the exercise program is an essential element such that without adequate facilitation, which requires an attentive, intuitive, and energized instructor, the communication between the instructor and participants will be ineffective whereby poor participation or more likely, poor performance, will result and no improved outcomes can be reasonably expected. Perhaps a means of improving the likelihood of significant change over time might be to allow the activities leader several weeks to instruct the program to acquire confidence and familiarity with the program exercises prior to beginning data collection. In the present intervention, aside from a few rehearsals the facilitation began when the research began. Another option might be to have a particularly skilled staff person such as a physical therapist to lead the program, though this is not a realistic expectation for many facilities. Because the facilitator was learning to instruct the program for the early part of the intervention, exercises were sometimes poorly performed by the facilitator, elements of the program were left out, and the ability of the facilitator to provide feedback to participants was initially compromised because of the focus on presenting the unfamiliar activity.

Evidence-based practice develops from established efficacy of interventions and represents the “greatest proof” of effect on outcomes. A goal of social welfare workers is to take established scientific principles and deliver them, as part of evidence-based practice, into the community. Given here that (a) strength training is effective in older adults, (b) the current

intervention was based on established science, and, (c) adults with dementia did appropriately perform the exercises, the *effectiveness* of this intervention is promising. Researchers should explore what factors, besides the presentation of the exercise protocol, affect the efficacy of the program, such as sample selection, shortcomings in facilitation, or insensitive, invalid, or inappropriate outcome evaluation tools.

Anecdotally, staff observant of participants' abilities described exercisers' improved ability to anticipate upcoming movements during the regular sequence of exercises during the program, and suggested that participants took more initiative during daily activities, slept less in the afternoon, and less frequently exhibited certain problematic behaviors associated with the progression of cognitive impairment. It is anticipated that researchers will use conclusions from this study to further specify guidelines about the strength of the intervention (i.e., frequency of exercise sessions each week, intensity of each session relevant to participants' abilities and strength of facilitator, and duration/length of the intervention) necessary to enhance participants' physical or functional abilities. The opportunity to offer the exercise intervention in sufficient dosage as part of regular center activity programming faces realistic constraints such as limitations in time, space, and staffing. Nonetheless, valuable effects such as perceived improvements in physical function and psycho-social outcomes may still be reasonably expected from any appropriate participation in exercise.

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## Appendix A

### Resistance Training for Adults with Alzheimer's Disease and Related Dementias: Feasibility of Program Implementation, Appropriateness of Participant Engagement, and Effects on Physical Performance and Quality of Life

#### THEORETICAL BACKGROUND AND STUDY RATIONALE

Over the next 20 years the current population of 30 million adults over age 65 will double; moreover, the population of adults with Alzheimer's disease or a related dementia (ADRD) will swell if no cure is found. Currently, 6 to 8% of adults over age 65 are diagnosed with dementia and this estimated percentage grows to 30% after age 80 (Kane, Ouslander, & Abrass, 1999, p. 139). As older adults with ADRD are highly susceptible to physical disability, developing interventions to limit premature functional declines or disability will enhance their quality of life and the lives of those around them.

Dementia refers to a syndrome characterized by a progressive decline in cognitive abilities and subsequent changes in physical abilities, behaviors, and emotions. This syndrome is a pattern of symptoms that can be caused by many different illnesses (Zarit & Zarit, 1998, p. 33).

Depending on the disease source, the progression and characteristics of the dementia vary.

Accounting for approximately two-thirds of all dementia cases, Alzheimer's disease (AD) is the most frequently occurring form of dementia. Alzheimer's disease is a progressive disease characterized by the production and accumulation of neurofibrillary tangles and amyloid plaques in the brain and a loss in brain mass. The exact cause of the AD is largely unknown, though research has made significant pathways into eliminating certain suspected causes such as the toxic effects of aluminum (Cohen, 1990) or an infectious virus (Jorm, 1987). Differential diagnosis is only confirmed by autopsy, consequently leading to variability in diagnosis and potential for

misdiagnosis. The onset is gradual, but in the early stages of AD, losses in memory become evident. Emotional responses are common, including increased anxiety or depression, both of which are likely targets for interventions. As the disease progresses, steady declines occur in cognitive and associated functional abilities, as well as fluctuations in a wide range of behaviors and emotions. Late stage AD is often characterized by a complete inability to care for oneself. Functional abilities are largely lost and ability to ambulate is compromised (Kane et al., 1999; Zarit & Zarit, 1998).

Vascular dementias, reportedly the second most common dementia, result from an infarct or an accumulation of mini-infarcts in the brain that disrupt normal processes, otherwise known as a stroke. There is an immediate manifestation of dementia symptoms occurs after the stroke. All strokes do not result in dementia, yet those that do progress in a stepwise pattern such that there are periods of no decline followed by a notable decline in cognitive functioning. The cognitive losses depend upon the location of the infarct, and consequently affect the symptoms of each stage of the progression. Emotional changes, notably in areas of self-esteem, competence, depression, and anxiety, may result in part from the awareness of the inability to perform physically or cognitively to prior levels of ability (Knight, 2004). The progression through the stages of dementia depends on the area of infarct and the frequency of subsequent micro-infarcts (Zarit & Zarit, 1998).

Lewy body dementia is a syndrome characterized by dementia and other symptoms, including tremors or hallucinations. The causes and prevalence of Lewy body disease are unknown and differential diagnosis is only confirmed upon autopsy, posing a challenge for accurate diagnosis and treatment. Knight (2004) explained that Lewy body dementia may be the second leading type of dementia, accounting for some cases of dementia misdiagnosed as AD and

contributing to the incidence of mixed dementias. Lewy body disease has clinical symptoms similar to Parkinson's disease, but there are no clear links in the disease pathologies. The progression of Lewy body disease and associated dementia is highly dependent on how early the features first appear, in that early appearance elicits faster progression, even faster than AD or vascular dementias (Knight, 2004).

Though there are a host of other causes and types of dementias, including dementias resulting from Parkinson's disease, alcohol, or AIDS, these exist in small numbers and are not expected to be represented in the study sample. Therefore, full descriptions of other types of dementia will not be presented.

Though progressive declines in cognition and changes in behavior occur over time as symptoms of dementia, all abilities are not lost at once. Too often an immediate full loss of ability is assumed, resulting in a lack of respect for intact skills and abilities of the person with ADRD and a general lack of recognition for the individual's personhood, or status as an individual. Consequently, excessive disability results and behavior problems occur beyond those caused by the disease itself.

Individuals with ADRD progress through stages of decline in daily functioning and exhibit increases in inappropriate behaviors. Aside from monetary costs, management can be psychologically and physically burdensome on caregivers, spouses, and relatives. Therapeutic methods for ADRD target a decrease in negative behaviors and optimize the display of intact abilities in an effort to maintain the highest level of functional capacity. Current pharmacological treatments either treat the primary, underlying disease or modify symptom progression by delaying or preventing the onset or severity of symptoms. These drugs often have side-effects that dampen individuals' personality (Alzheimer's Disease Education and Referral Center, 2004; Zarit

& Zarit, 1998). Cognitive stimulation and training strategies have yielded successful cognitive gains in adults with dementia but the impact these strategies have on performance in everyday situations remains uncertain (Zarit & Zarit, 1998).

Behavioral interventions are used to manage a variety of problem behaviors or for treatment of other symptoms associated with dementia such as depression. Few of these interventions target the physical elements involved in maintaining functional ability. If opportunities to be physically mobile and active do not exist and participation in physical activity is unsupported, physical disuse will further exacerbate age-related muscle loss, hastening progression toward disability. Together, the increased risk of physical illness, progressive functional and behavioral declines, and poor management strategies account for the need to orchestrate and facilitate better care for adults with ADRD. The progression of dementia symptoms will continue yet, interventions have the potential to improve individuals' quality of life and the lives of those around them.

Resistance training has the potential to help maintain or enhance performance of activities of daily living (ADLs). Extant research supports the extensive positive health effects of resistance training for older adults but has largely excluded adults with cognitive impairment from the studies. It is likely, however, that these individuals would similarly benefit. Many of the physiologic processes that respond to resistance training in older adults are unchanged due to dementia. Nevertheless, the ability of adults with ADRD to perform an exercise program should be considered. Individuals must be provided the opportunity to engage in physical exercise appropriately in order to achieve the full physical benefits of a resistance training intervention. The activity must be structured according to established principles of activities for adults with

dementia targeting appropriate participation in the activity, and it should be pleasurable and meaningful to participants.

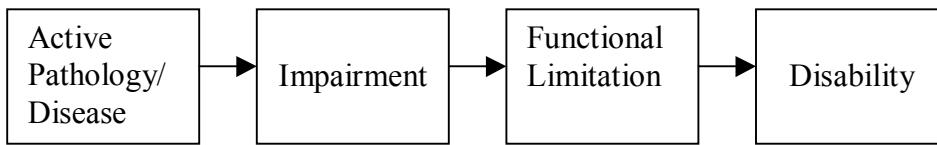
The goal of the intervention proposed for this study is to implement a strength training program that will support appropriate engagement. With appropriate engagement, adults with ADRD have the opportunity to experience gains in muscle strength and neuromuscular function which result in maintained or enhanced physical abilities. Maintaining the highest level of independence mediates the cascade of processes that led to disablement. Because disablement is a leading contributor to quality of life, we expect that intervening in the disablement process with participation in strength training will positively influence overall quality of life.

### Theory and Rationale

Two theoretical sources interconnect and inform the proposed investigation. These sources represent the relationships among the physical, psychological, and environmental influences of individual development. First, Nagi's model of disability (1969) describes the progression towards disability and serves a specific rationale for a strength training program for adults with ADRD. Second, Lawton and Nahemow's environmental press model (1973) posits that optimal functioning occurs when stimuli match capabilities, and provides the foundation for effective program design for adults with dementia. The environmental press model is extended to include Kitwood's concept of *personhood* (1997) which purports that individuals with cognitive impairment should be acknowledged as persons of value. Collectively, these theoretical sources lend support for promoting the quality of life of individuals with ADRD through therapeutic interventions which are specifically tailored to maximize participant engagement in an activity.

### *Nagi Model of Disability*

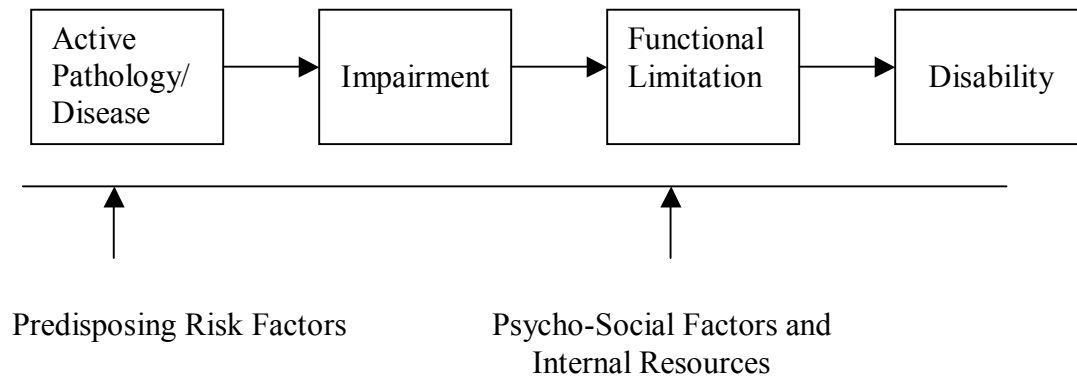
The Nagi model of disability (Nagi, 1965; see Figure A-1) was developed to explain the continuum of processes that lead to disability. The original model consists of four elements along a continuum from disease to disability. The first element identifies an *active pathology* or *disease* such as Alzheimer's disease or other source of dementia, or the degenerative process that results from aging. The next element on the continuum is *impairment* in which the pathology manifests itself at the system level. An example of an age-related loss is decline in agility or reduced strength resulting from sarcopenia. The third stage on the continuum is *functional limitation*, which is a restriction in the performance of components of activities of daily living (ADL) or instrumental activities of daily living (IADL). Examples include abnormalities in gait, difficulty climbing, or difficulty kneeling. These limitations can result from muscular or perceptual changes with age or the progression of a cognitive disease that affects processes involved in performing motor movements. The final element in the model is *disability*. This term describes any restriction in performing or inability to perform leisure activities, ADL or IADL tasks, or familial, social, or occupational roles normally expected of the individual. The level of disability experienced by an individual is largely dependent on factors such as physical or self-perceived ability, health, goals, motivation, social support, and physical environment such that two individuals with the same pathology or impairment may have very different levels of disability. Individuals with ADRD who have intact abilities that are unsupported by others may experience a more rapid onset of disability than individuals who inhabit a structured environment in which they can competently perform the intact abilities.



*Figure A-1.* Nagi model of disability (Nagi, 1965). From *Sociology and Rehabilitation* (p.100-113), by S. Z. Nagi, in M. B. Sussman (Ed.), 1965, Washington, DC: American Sociological Association. Copyright 1965 by ASA. Reprinted with permission.

In the case of adults who are physically capable but have difficulty performing ADLs and other tasks, other factors seem to exacerbate the disablement process (Femia, Zarit, & Johanson, 2001), one of which is cognitive impairment. A revised disablement model (Verbrugge & Jette, 1994) added two elements thought to influence the main pathway or continuum (see Figure A-2). These additional factors are unlike the core elements in that they are not causally ordered and can influence each of the main elements on the continuum. *Predisposing risk factors* was added to indicate the influence of characteristics or behaviors that increase one's progression through the continuum. Examples of predisposing risk factors include sex, age, race, health status, or health behaviors, including prolonged inactivity or physical disuse.

The second additional element was the influence of *psycho-social factors and internal resources* that may contribute to the progression of disability. These factors and resources allow individuals to respond and adapt to the demands of the environment as well as remain engaged in higher levels of functioning (Verbrugge & Jette, 1994). Therefore, lower levels of resources such as cognitive skills, peer support, or motivation put individuals at a higher risk for disability. The addition of these elements to Nagi's original model (1969) illustrates the interplay among the physical, psychological, and environmental influences on individuals.



*Figure A-2.* Conceptual model of the disablement process (Verbrugge & Jette, 1994). From *Social Science and Medicine*, 38, L. M. Verbrugge, & A. M. Jette, The disablement process, p. 1-4, Copyright 1994, reprinted with permission from Elsevier.

The revised disablement model (Verbrugge & Jette, 1994) has not been explicitly tested for adults with cognitive impairment. Because there is no evidence suggesting that cognitive disease alters the physiologic processes associated with ordinary aging, this model is plausible for examining the disability process among adults with ADRD. The addition of the two elements in the revised model particularly strengthens the model for this application. Disuse, a consequence of having unnecessary care provided for an individual, expedites the progression of functional limitations and subsequent declines in performance of ADL and IADL tasks (Hirvensalo, Rantanen, & Heikkinen, 2000; Miller, Rejeski, Reboussin, Ten Have, & Ettinger, 2000; Morris, Fiatarone, Kiely, Belleville-Taylor, Murphy, Littlehale, Ooi, O'Neill, & Doyle, 1999). The disuse syndrome is perpetuated by the negative effects of physiological changes associated with increasing age, cognitive impairment, and overcautious care providers. Declines in psychosocial factors and internal resources such as locus of control, life satisfaction, and self-efficacy can

exacerbate the disability process (Seeman, Berkman, Charpentier, Blazer, Albert, & Tinetti, 1995). Because cognitive impairment negatively affects each of these psychosocial variables, adults with ADRD are further exposed to the continuum of disability.

#### *Environmental Press Model*

Lawton and Nahemow (1973) proposed that the complexity of environments have a significant effect on the level of persons' functioning in them. Environments that minimize stress and maximize competence best facilitate success in performance of everyday activities. The environmental press model presents behavior as the function of the person, the environment, and the interaction between the person and demands of the environment. Competence resides in individuals and represents a fit between an individual's abilities and the environment. Competent behavior occurs when capabilities of the individual are congruent with environmental complexity and conversely, dysfunction occurs when environmental press is too weak or too strong relative to the individual's level of competence.

Because adults with dementia experience progressive declines in cognitive and physical abilities, depending on the type and severity of disease, declining levels of competence can result in incongruence between individual capabilities and environmental demand. Therefore, the environment must be adapted in order to accommodate the decreased abilities of the individual.

Kitwood (1997) purported that the humanity of adults with ADRD is often diminished based on reactions of people to those with cognitive limitations. Kitwood argued that that it is important to recognize all individuals in their full humanity because they retain the ability to detect human emotions even when their cognition is impaired. In keeping with Kitwood's perspective, adults with dementia are deserving of therapeutic interventions that help maintain quality of life. These interventions must be deliberately designed to support the continued abilities

of individuals, as well attend to individuals' needs imposed by the progression of the dementia. Planning and implementing an intervention adaptable for all participant abilities is an example of respecting the personhood of individuals. Because gains from participating in the activity are related to level of engagement, improving engagement will maximize outcomes thereby best affecting the quality of life of each participant. Another example of respecting personhood when planning an exercise intervention is to consider the social history, or individual interests and past experiences, of each person.

### Research Purpose

One nonpharmacological management strategy for ADRD and associated behaviors is appropriate and challenging exercise. At a time when there are fewer opportunities to engage in positive and meaningful experiences that may elicit feelings of success, exercise is one area where adults with ADRD can achieve significant biological, psychological, and social gains for themselves and those around them. Strength training exercises target the syndromes of disuse and may significantly delay disability and the occurrence of disease. Given the importance of strength for basic activities, including walking, transferring from a seated to standing position, and balance, any interventions that can yield improvements in function could lead to reductions in the burden of providing care and improvements in overall quality of life for both patients and caregivers. The purpose of this program is to improve physical function and performance and ultimately, overall quality of life, for adults with ADRD through the implementation of an appropriate strength training intervention for adults with ADRD.

## LITERATURE REVIEW

## Age, Frailty, and Disability

Bortz's (2002, p. 284) conceptual framework purports that frailty results from the diminished capacities within the musculoskeletal system such that muscle weakness leads to a diminished movement capacity. This then escalates a cascade of other negative health events that, in turn, negatively affect the ability to move. The discovery of effective interventions to prevent or delay limitations in physical functioning or disability in older persons should be a public health priority. Most likely to benefit from such interventions are frail individuals who are not yet disabled and those with functional limitations or early signs of disability who are at high risk of accelerated progression toward disability (Ferrucci, Guralnik, Studenski, Fried, Cutler, & Walston, 2004).

The decline in muscle mass associated with normal aging, referred to as sarcopenia, is a major factor for strength loss in old age. Furthermore, strength declines in the lower extremity are slightly more pronounced than in the upper extremity for old men and women (Hughes, Frontera, Wood, Evans, Dallal, Roubenoff, & Singh, 2001; Onder, Penninx, Lapuerta, Fried, Ostir, Guralnik, & Pahor, 2002) suggesting the likelihood of functional declines, notably in mobility. In fact, diminished leg strength and lower body functioning appear to be strong predictors of disability and institutionalization following functional declines in nondisabled community-dwelling older persons (Guralnik, Ferrucci, Simonsick, Salive, & Wallace, 1995; Guralnik, Ferrucci, Pieper, Levinson, Markides, Studenski, Berkman, & Wallace, 2000).

Lower cognitive skills and the presence of dementia place individuals at higher risk for functional declines and disability but no specific explanations are cited (Agüero-Tores, Thomas, Winblad & Fratiglioni, 2002; Fitz & Teri, 1994; Gill, Richardson, & Tinetti, 1995; Gill, Williams,

Richardson & Tinetti, 1996). “Excess disability” is “a discrepancy that exists when a person’s functional incapacity is greater than that warranted by the actual impairment” (Brody, 1971, p. 125). This excess disability results from external factors such as individuals’ unsupported interactions with the environment or from their personal awareness of cognitive deficits which contributes to negative self-concept and self-worth. Furthermore, caregivers often fail to encourage care receivers to perform physical activities, even basic activities of daily living, to the fullest extent of their capabilities. Physical inactivity ultimately leads to functional declines (Gill, Allore, & Guo, 2003; Keysor & Jette, 2001); consequently, well-intentioned but stressed caregivers may inadvertently contribute to functional decline and disability (Morris & Morris, 1997). Functional decline may be one of the most problematic aspects of dementia in that it leads to institutionalization (Miller, Longino, Anderson, James, & Worley, 1999).

### Beneficial Outcomes of Resistance Training

#### *Resistance Training and Older Adults*

Resistance training, otherwise described as strength training, is the use of resistance, usually body weight or external weights, at intensities close to maximum effort in order to strengthen musculature. All forms of exercise elicit positive effects on the physical and mental health and well-being of older adults (American College of Sports Medicine, 1998; United States Department of Health and Human Services, 1996). Two positive effects largely specific to resistance training are increased muscular strength and enhanced neuromuscular signaling (American College of Sports Medicine, 1998), both of which are strong contributors to the performance of everyday activities. Other forms of exercise such as cardiovascular and flexibility exercises have a supportive role in functional performance. In order to achieve associated health outcomes, the Surgeon General recommends that older adults perform at least two days of

resistance training each week (minimum) on 8 to 10 major muscle groups, and 8 to 12 repetitions for each exercise (United States Department of Health and Human Services, 1996). Gains in muscle strength in the oldest-old have been recorded and determined to be similar to relative strength gains experienced by young adults (Fiatarone, Marks, Ryan, Meredith, Lipsitz, & Evans, 1990; Fiatarone, 1996). Improvements in strength transfer into enhanced or maintained ability to perform everyday functional activities and may postpone disability and subsequent institutionalization (Miller et al., 1999).

*Resistance Training and Adults with Alzheimer's Disease and Related Dementias*

Limited research exists that examines the effects of exercise on adults with ADRD. Comprehensive reviews covering the benefits of and recommendations for exercise in chronic disease populations (American College of Sports Medicine, 1997; Singh, 2002) do not cite the dementia population, signifying the lack of attention and research. Within the limited research, there are inconsistencies in prescribed programs and measured outcomes. Consequently, there are no recommended guidelines for mode and associated dose of physical activity needed to produce positive health outcomes in older adults with ADRD. It is plausible that recommended guidelines for unimpaired older adults are appropriate, based on the intact physiological system of adults with ADRD, yet information informing recommendations for the minimum activity level needed to achieve cognitive and behavioral effects is undetermined. This identifies the need for more mode specific interventions (i.e., resistance training) in order to establish consistent findings about the dose response of adults with ADRD to exercise.

The author of a meta-analysis that was conducted to determine the overall effects of exercise for adults with dementia concluded that strength training and cardiovascular fitness yielded larger effect sizes (ES=0.87, 0.98 respectively) than other modes of exercise training

(Heyn, 2002). One of the limitations in Heyn's meta-analysis (2002) is that it included research that examined the effects of exercise on individuals in long-term care institutions (Lazowski, Ecclestone, Myers, Paterson, Tudor-Locke, Fitzgerald, Jones, Shima, & Cunningham, 1999; McMurdo & Rennie, 1994) not all of whom had a determined diagnosis of dementia but were instead identified by terms such as frail (Sullivan, Wall, Bariola, Bopp, & Frost, 2001), debilitated (Meuleman, Brechue, Kubilis, & Lowenthal, 2000), or impaired (Fisher, 1991). Though the large majority of adults in skilled nursing institutions do have dementia syndromes, a physician's diagnosis of dementia is needed to best interpret and apply the research findings to the appropriate population. However, because dementia is common among nursing home residents, Heyn's research represents an important step in considering the value of exercise for adults with ADRD, even though not all subjects had a diagnosis of dementia.

A variety of exercise intervention programs for adults with dementia incorporate evaluation of outcomes, including measures of physical function such as gait or balance (Teri, Gibbons, McCurry, Logsdon, Buchner, Barlow, Kukull, LaCroix, McCormick, & Larson, 2003), cognitive functioning (Lindenmuth & Moose, 1990; Lindenmuth & Lindenmuth, 1994; Palleschi, Vetta, DeGennaro, Idone, Sottosanti, Gianni, & Marigliano, 1996), affect (Teri et al., 2003), behavior (Alessi, Yoon Schnelle, Al-Samarrai, & Cruise, 1999; Holmberg, 1997; Rolland, Riaval, Pillard, Lafont, Riviere, Albarede, & Vellas, 2000), and communication (Friedman & Tappen, 1991). Yet, only a few documented resistance training exercise interventions for adults with ADRD evaluated strength outcomes (Arkin, 1999, 2003; Brill, Drimmer, Morgan & Gordon, 1995; Francese, Sorrell, & Butler, 1997; Hageman & Thomas, 2002; Thomas & Hageman, 2003). Other interventions have been touted as strength training but do not meet the definition of strength training, and are instead range of motion programs (Mathews, Clair, & Kosloski, 2001), leisure

activities (Schneider, Drake, Simms, & Harren, 2001), or otherwise poorly designed exercise programs with incorporated strength training elements (Toulette, Fabre, Dangremont, Leusel, & Thevenon, 2003; Heyn, 2002, 2003).

## Methodological Considerations of Resistance Training Research for Adults with ADRD

### *Research Design*

Similar methods have been used across the studies that examined the effect of resistance training for adults with ADRD. The research interventions are primarily short-term, using only a pre-, post-test design to evaluate outcomes (Arkin, 1999; Brill et al., 1995; Hageman & Thomas, 2001; Thomas & Hageman, 2003). One exception is Arkin (2003), who continues to collect data on participants at a university-sponsored exercise research facility who have been in the program as many as eight semesters.

### *Sample*

Across studies, program content included resistive training that used external resistance, but the program content and exercise selection varied across studies. The interventions ranged from six weeks to one semester (approximately 16 weeks) and the frequency of the activity was fairly constant across studies at three days each week for approximately 20 minutes each session. It is not possible to determine the intensity of the intervention, defined by the number of repetitions for each exercise and the number of performed exercises within the 20 minute session, because each protocol was not fully presented.

The largest sample size of the research examining effects of resistive training interventions was 28 (Thomas & Hageman, 2003). Small sample sizes are a realistic methodological consideration in dementia care research in that securing access to participants can be challenging and subject attrition can be high. Though there are limited statistics for the length of stay in

nursing homes or in dementia-specific units for adults with ADRD (Zarit & Zarit, 1998), general statistics of nursing home residents indicate that approximately 46% of residents have ADRD. The mean length of stay is 183 days, though nearly 40% of adults reside there longer than one year (Spillman, Kiu, & McGilliard, 2002). For the purposes of research, these numbers indicate that there is a large population of adults with ADRD residing in nursing homes but the health and length of stay for these individuals is variable, and attrition due to heightened morbidity or mortality is likely to be a significant issue.

Further, these studies did not use control or comparison groups, which compromises the capacity to interpret change as an effect of the intervention. Because access to large samples of adults with ADRD is challenging, use of convenience samples is understandable, but control or comparison groups are essential for determining true effects of a program.

#### *Measurement*

Past research of resistance training for adults with ADRD examined strength as an outcome variable, but different strength abilities, such as upper or lower body strength, were evaluated across studies. Furthermore, specific abilities that were measured in more than one study were not measured using the same instrument or procedure. For example, Arkin (2003) assessed lower body strength using a leg press machine, whereas Thomas and Hageman (2003) used a repeated chair stands test and manual muscle testing. Obtaining objective physical measurements can be challenging in individuals with ADRD due to a compromised ability to understand instructions, difficulty in carrying out motor schemas to perform expected or intended movements (Dick, Shankle, Beth, Dick-Muehlke, Cotman, & Kean, 1996), and the variability in behaviors associated with dementia. Brill and associates (1995) described measurement challenges they encountered when using physical performance tests to assess physical functioning

of adults with ADRD. Though this report was published eight years ago, only one study since has statistically evaluated measurement reliability of performance-based assessments in older adults with ADRD. Thomas and Hageman (2002) established pre- and post-test reliability in physical performance measures of hand-grip strength, as well as for the repeated chair stands, six-meter safe gait speed, and timed up-and-go tests. They used a one-week interim between tests to determine interclass reliability. Because evidence comes from only one study with a small sample size of 12 and several test requiring laboratory restrictive equipment, additional research is needed to establish reliability in performance-based measures of persons with ADRD.

A variety of physical performance assessments can be used to assess strength. The only one that assesses upper-body strength is the hand-grip dynamometer test. Grip strength has established validity as a predictor of upper body strength (Schwartz, Cohen, Herbison, & Shah, 1992). In terms of lower body functional ability, several assessments and even variations of assessments exist. The short physical performance battery (Guralnik, Simonsick, Ferrucci, Glynn, Berkman, Blazer, Scherr, & Wallace, 1994) is a comprehensive assessment of three domains of lower body physical functioning including balance, strength, and gait mobility. It is a valid indicator of lower body disability (Guralnik et al., 1995, 2000). Both of these tests have established norms for various ages of older adults without cognitive impairment.

Establishing reliability of measures is especially important in assessing adults with ADRD for two primary reasons resulting from the presence and progression of the cognitive disease. First, the adults may have difficulty understanding, interpreting, or performing the appropriate movements required for the assessment. Second, adults with ADRD may have varying faculties between and even within days, and especially between months, consequently challenging interpretation of change attributable to the intervention. For example, a lack of significance in

change of strength as measured by a sit-to-stand test may result from declined cognitive abilities after three months, resulting in greater difficulty interpreting and performing the test, rather than lack of physical strength. Nonetheless, based on Lawton and Nahemow's (1973) model of environmental press, instructions and associated prompting for performance-based assessments can be adapted according to the abilities of the individual in order to implement the test. However, the test should be performed in such a way as not to compromise the assessment validity. Based on personal experience using physical performance measures to assess adults with ADRD at an adult day services center, my colleagues and I determined that the tests can be appropriately implemented with individually tailored feedback and cueing (Rogers, Gigliotti, Jarrott, & Weaver, 2004).

Establishing norms on performance-based tests for adults ADRD and even in various stages of ADRD will provide a means of understanding the functional abilities of adults with ADRD, how these abilities change throughout the course of the disease, and how they compare to norms for unimpaired older adults. Preliminary analyses of a strength training intervention for adults with ADRD at an adult day services program indicated substantially lower means on several physical performance-based tests as compared to published norms for unimpaired older adults (Rogers & Jarrott, 2004), but no other research compared these two populations on these assessments. A better understanding of functional abilities of adults with ADRD will assist in establishing recommendations for exercise and justifying physical interventions as part of the regular activity schedule at dementia care facilities.

#### *Interpretation of the Findings*

Aside from the issue of measurement reliability, other factors may affect participant outcomes. Statistically insignificant findings in research have been attributed to short and

insufficiently challenging interventions (Brill et al., 1995; Hageman & Thomas, 2002; Thomas & Hageman, 2003). Because the strength of the program is determined by the type of exercise, intensity of each session, duration of each session, and length of the program, each of these factors should be considered in program design. Cited explanations for the lack of statistically significant findings include the requirement for the intervention to last longer than six weeks (Hageman & Thomas, 2002; Thomas & Hageman, 2003) and for more aggressive progression of external resistance (Brill et al., 1995). These explanations provide useful suggestions for designing more effective future interventions.

These considerations are not necessarily shortcomings of previous research but are realistic challenges in conducting a resistance training intervention with a population of adults with ADRD. Even with thoughtful planning, it is expected that some degree of these methodological issues can be realistically expected in future research.

#### Therapeutic Interventions for Adults with ADRD

##### *Intact Abilities and Programmatic Considerations*

The onset and progression of a cognitive disease does not strip an individual of all capabilities. Though severe memory loss is associated with a progressive cognitive disease, the procedural memory component remains largely intact. Activities that utilize this memory system support maintenance of “over-learned” abilities. Such an activity program takes a strengths-based approach (Bowlby-Sifton, 2000) as caregivers couple existing abilities with environmental adaptations (Lawton & Nahemow, 1973) to support the success of adults with ADRD in almost any activity. Orsulic-Jeras, Judge, and Camp (2000) applied this process to Montessori activities. They used “extensions” to adapt an activity for individual abilities. Vertical extensions were *upward* or *downward*, depending on the needs of the individual. Thus

the environmental “press” of the situation was modifiable in an effort to increase engagement and success in the activity, as well as enhancements in the overall quality of life (Orsulic-Jeras et al., 2000; Zygola, 1999).

Optimizing the functional abilities of an individual with ADRD is one example of recognizing personhood. However, many dementia care programs lack opportunities for residents to be stimulated with activities (Nolan, Grant, & Nolan, 1995). Facilities that implement activity programs often do not incorporate the interests of the participants (Kitwood & Bredin, 1992). Many programs infantilize the participants and, consequently, reduce autonomy and dignity of individuals with dementia. Programs such as these have a negative effect on individuals’ identity, self-esteem, and self-concept (Salari & Rich, 2001). Alternatively, Gori, Pientini, and Vespa (2001) reported higher interest in activities that were selected by and meaningful to the participants.

#### Feasibility of Implementing Resistance Training for Adults with ADRD

##### *Programmatic Considerations for Engagement of Adults with Alzheimer’s Disease and Related Dementias in Activity*

Engagement is defined as an individual’s level, or amount, of participation in a specified activity. Because the proposed study will specifically examine adults with ADRD, engagement is defined as the *effort* to appropriately participate in the proposed resistance training program.

The amount of engagement an individual with ADRD can exhibit within each activity session, and cumulatively over the course of the full intervention, is based on several variables such as attention span, severity of impairment, and characteristics of the environment. These variables may affect the adult with ADRD in unpredictable ways within a single day or across days. For example, an individual may have better attention during the morning than during the

afternoon. Another example may be that the individual is more easily distracted on Mondays after returning to the possibly unfamiliar adult day center after the weekend at home. Moreover, the activity should be meaningful and stimulating to participants in order to increase engagement (Gori et al., 2001).

There is not much observational research on adults with ADRD nor on prescribed times, including time of day, length and frequency of times, to observe behaviors. The Menorah Park Engagement Scale (MPES) was developed to capture type and level of engagement by distinguishing five types of participant engagement in Montessori-based activities (Camp & Skrajner, 2004). The types of engagement included competent engagement, passive engagement, self-engagement, other engagement, and non-targeted engagement (see Table 1). Researchers coded participants' levels of participation as "equal to or more than half," "less than half" or "not at all" during a single 10-minute observation period. Heyn (2003) used the MPES to determine engagement in an exercise program but the method and length of time used to observe each participant is unclear. Engleman, Altus, and Mathews (1999) coded participants' engagement in certain daily activities as appropriate, inappropriate or not-engaged. They observed each participant sequentially in turn, 15 times for 3 seconds, in observational blocks lasting as long as 50 minutes.

Though Lawton, Van Haitsma, Perkinson, and Ruckdeschel (1999) and Camp and Skrajner (2004) originally used a single observation period of five minutes, both later modified their protocols by adjusting the periods of observation. Gozali (2002) used observational research for engagement in Montessori activities and found that one 5-minute observational period did not adequately describe overall engagement of individuals observed during the beginning or end of the intervention.

Table A-1

*Types of Engagement Within the Menorah Park Engagement Scale*

Type of Engagement	Description	Example
Constructive Engagement	Participating or commenting on an activity	Performing exercises during an exercise program
Passive Engagement	Listening or watching when performing is expected	Listening to instructor during exercise program but not physically participating
Self-Engagement	Self-stimulating behaviors	Tapping fingers or toes, picking at clothing
Other Engagement	Participating in an uninvolved activity	Dancing during exercise program, reading newspaper during instructions
Non-Engagement	No activity	Sleeping, closing eyes, staring into space

*Note.* From “Resident-Assisted Montessori Programming (RAMP): Training Persons with Dementia to Serve as Group Activity Leaders,” by C. J. Camp and M. J. Skrajner, 2004, *The Gerontologist*, 44, p. 428-429.

The benefits of exercise depend on duration and intensity of participation (Bouchard, 2001). Structuring the environment to meet the needs of the individuals will promote competent engagement. Without environmental adaptations (Lawton & Nahemow, 1973), adults with dementia may have difficulty engaging sufficiently to receive health benefits associated with exercise. Using the MPES to determine engagement, Heyn (2003) noted that in an exercise program designed for adults with dementia, 69% of participants were competently engaged in the exercise half or more of the observed time and another 30% of participants were engaged in the exercises up to half of the observed time. These findings support the notion that adults with

dementia have the potential to engage in and sustain levels of attention in pleasurable activities for extended periods of time.

It is also important to recognize how motivation affects the level of engagement. Even with appropriate cues and environmental programmatic supports, adults with ADRD choose their level of engagement. The number of sessions attended, the percentage of time spent in appropriate engagement, and the number of appropriately performed exercises indicates the feasibility of program participation of adults with ADRD.

### *Designing the Environment*

The program design should meet the definition of a resistance training program and provide the opportunity for positive strength outcomes. In addition, it should be age-appropriate in such a way that it could be used for cognitively intact adults. Elements specific to the implementation include environmental considerations needed to support appropriate engagement of adults with ADRD. Because there is no literature to outline environmental variables associated with program implementation, personal experience and theory inform my recommendations for the program plans (Rogers & Jarrott, 2004).

An exercise program should be performed to music because music is a sensory stimulation strategy that generates pleasure and reduces social, emotional, communicative, and physical disturbances associated with ADRD (Kneafsey, 1997); further, music can increase engagement in exercise (Mathews et al., 2001). Considering the individuals' personhood, music should be selected thoughtfully and in consideration of genres that would be familiar and meaningful to participants. Due to the likelihood that some participants will be easily distracted or over-stimulated, music should be instrumental, so that lyrics do not compete with the facilitator's instructions. Similarly, the volume of the music should be at an appropriate, therapeutic, and

supportive level; the volume should meet the needs of both adults with hearing difficulties and adults who are easily distracted. Very quiet music may not be audible to participants with difficulty hearing and excessively loud and distracting music will decrease appropriate engagement. The musical tempo should correspond to the intensity of the exercise activities. Music with a slower tempo should be used for warming up and warming down and music with quicker tempo should be used during the middle of the session when exercise intensity should be somewhat greater.

The exercise facilitator should stand before the exercise group and use a clear, audible voice to give instructions. He or she should avoid distracting movements and language, and provide direct physical movements to serve as a model. In addition, he or she should support participant engagement in the exercise by using appropriate feedback and cueing.

In addition, other staff should be available within the group to support individuals who need special attention. Staff can provide verbal or physical assistance to direct appropriate engagement. This support should be delivered in a manner that is not distracting to other participants. An example of this would be to have persons who need individual support seated on the sides of the group such that the staff member can kneel beside the participant and not interrupt the visual path to the activity leader of other participants. It is important that staff support is *supportive* and not overly intrusive. For example, physical assistance in the form of cuing or modeling is supportive, whereas actively moving a participant's arm is overly intrusive. Inappropriate intrusion not only compromises the physical outcomes, but may also contribute to diminished feelings of self-worth or competence.

Building from Bowlby-Sifton's (2000) strengths perspective, participants' abilities should be considered when situating individuals within the group space. This affords each individual the

opportunity to maximize his or her abilities with appropriate environmental supports. For example, participants who are at high risk of falling should have an extra chair in front on which to hold for balance and should remain in front of their own chairs. Participants who are high functioning should be asked to sit in the front of the group to act as a motivators for others who are likely to imitate socially appropriate behaviors that they see others exhibiting. Participants who have visual impairments or who are easily distracted should be asked to sit directly before the leader. Participants who are likely to wander or exit the area should be placed in the rear of the group so as not to distract other participants if they leave the program.

Hand-held barbells should be used and not replaced by more everyday household items such as plastic water bottles that are sometimes used as inexpensive exercise weights. Using items such as these may confuse the participants, whereas barbells are recognizable for use with exercise and may serve as a cue.

#### *Progression of Individual Abilities*

Initial assignment of hand-held weights and the anticipated progression in weight is based on ease of ability in performing eight repetitions. If a weight is too light, successively heavier ones should be used, until the eighth repetition elicits moderate fatigue (American College of Sports Medicine, 1998). Some participants can communicate this information; the activities leader will need to make a judgment for others. For any adults who experience medical situations that cause a decline in physical ability, weights can be decreased as needed.

#### Summary

Because of the associated improvements in health, cognition, and inappropriate behaviors, it is intended that strength training interventions will emerge as a worthy form of clinically relevant therapy for adults with ADRD and will complement existing meaningful and pleasurable

approaches to planning activities for adults with ADRD. Failing to implement such beneficial activity could be viewed as negligence in care provision, given the continuum of the Nagi model. Any resulting curtailing of functional decline would have a positive outcome on both the individual and caregivers and could postpone need for institutionalization.

## EXTENDED DESCRIPTION OF METHODS

### Method

The proposed study will employ a repeated measures design comparing exercising and non-exercising adults with dementia. Repeated measures will be conducted on all participants at baseline (pretest), and repeated after 6, and 12 weeks.

#### *Participant Selection*

Because finding a sufficient number of volunteers in the community who meet the criteria for inclusion in this study would be difficult, two assisted living dementia care centers have been chosen as the proposed implementation sites. These locations provides many advantages for identifying a sample of adults with ADRD and implementing a structured exercise intervention. Between the two selected dementia care centers approximately 75 adults with cognitive impairment of varying severity reside, thus providing a readily available and sizable pool of possible research participants. Using this type of a facility alleviates the need to transport participants as the activities are provided on site and the participants will be escorted to the activity by trained staff. Using subjects from the dementia care centers will allow for a lengthened time in the intervention because the participants will likely not relocate due to a health decline, though morbidity and mortality may contribute to attrition.

A convenience sample of older adults with ADRD will be selected from the dementia care centers. Subjects for the treatment and non-treatment groups will be selected by the activities leader based on her awareness of individuals' interests and abilities. The facility's activity structure exists such that the activities leader selects participants for each activity; these participants are then escorted to the activity by staff. Though this means of identifying study participants poses high risk for sample bias, it is the most plausible means of obtaining a sufficient

number of participant who could complete the exercise program. Because the participants will be selected based on past involvement in exercise at the center or based on an expressed interest in such activities, it is likely that the activity will be pleasurable and meaningful to them, which corresponds to the practice implications of Kitwood's (1997) theory of personhood.

Subjects for the comparison group will be identified by the activities leader based on the older adults' tendency to agree to participate in other activities. Subjects are eligible to join the program if they meet all of the following inclusion criteria: (a) physician's diagnosis of dementia; (b) able to follow simple instructions to perform motor movements; (c) responds positively and is willing to participate in program; (d) able to tolerate group interaction; and (e) able to participate without distracting others by exhibiting disruptive behaviors.

Participants will become ineligible to participate in the program if they meet any of the following exclusion criteria: physician recommendation; recent decline in physical health or functioning that prohibits participation; unable to follow simple instructions to carry out motor movements; no longer responds positively or no longer willing to participate; unable to tolerate group interaction; unable to participate in group setting due to disturbing others with disruptive behaviors. Participants excluded on the basis of any of these criteria are permitted to return to the program if they reestablish eligibility based on the entrance criteria. Participants will only be included in the analyses if they participated in at least 80% of the intervention without more than three consecutive absences. Participation in both the treatment and comparison groups is voluntary and participants are free to withdraw from any session or from the entire intervention.

#### *Sample Size*

Based on realistic expectations of subject attrition due to reluctance to attend exercise sessions, illness, or mortality, the minimum sample size at the start of the intervention must be no

smaller than 10 persons per treatment condition. A sample of no more than 30 persons will be obtained, so that there are approximately 15 receiving the treatment and 15 not receiving the treatment. Class sizes will be limited to 15 or fewer in order to minimize distractions, maximize engagement, and manage safety issues. Due to the confinement of the activity schedule, the facilities were unable to provide more than one exercise program at each respective facility during the initial 12 week research period. However, both activities leaders expressed intent to develop opportunities so that all center residents have the opportunity to participate in the program. Though the group size may vary, the program will be held each scheduled day regardless of the number of participants who attend.

#### *Threats to Validity*

Because the design does not involve random assignment to an experimental condition, extraneous variance among subjects cannot be controlled. Examples of extraneous variance may be the severity of the dementia, presence of other illnesses or conditions that might affect physical performance, or extent of prior participation in exercise. However, comparing baseline characteristics of exercisers and comparison subjects will determine the extent of similarity between the groups. I expect no initial differences in group means on age, Mini-Mental Status Exam (MMSE), level of physical functioning, hand grip strength, physical performance battery scores, or quality of life.

I selected an easily accessible sample population; external validity is compromised as adults with cognitive declines who are living in the community or receiving other forms of care might respond differently to the exercise activities. Therefore, the results of this research are generalizable only to residents at similar assisted living dementia care centers.

### *Instruments*

All measures will be completed with both the treatment and comparison group subjects. The lead investigator and a trained graduate assistant will conduct all physical performance assessments. All assessments will be performed approximately the same time each day. Inter-rater reliability will be established for all assessments prior to data collection.

#### *Sample Descriptives and Characteristics*

Descriptive information and characteristics will be collected from the activities leader and center administrator. Items include: physician's diagnosis of cognitive impairment, Mini-Mental Status Exam (MMSE) score assessed by the facility's social worker, sex, date of birth, and extent of recent participation in physical activity.

#### *Participant Attendance*

The activities leader will document daily attendance at the proposed resistance training program in an attendance log. Attendance is not a measure of time or type of engagement and is determined by arrival to the site of the program. The activities leader will also document the amount of hand-held weight used by each participant.

#### *Functional Performance*

Because task segmentation batteries take time to complete and assess a range of task abilities (Morris & Morris, 1997) that the proposed intervention does not expect to affect, such as grooming and eating, the 10-item Physical Functioning Inventory of the Short Form-36 Health Survey (SF-36; Ware & Sherborne, 1992) will be used to assess functional performance. The 10 items assess ability to perform everyday mobility-related tasks. Examples of the items include: ability to lift or carry a dinner tray or laundry, ability to climb a flight of stairs, and ability to bathe or dress self. Items are scored on a 3-point scale with 1 indicating great limitations in performing

an activity and 3 being no limitations in ability to perform the activity. Internal consistency reliability is high ( $\alpha=0.93$ ) (Ware, Snow, Kosinski, & Gandek, 1993). The sum of the scores on the 10-items will be used as the variables, with higher scores indicating better health.

#### *Physical Performance-Based Measures*

*Hand grip strength test.* A Baseline® hydraulic hand dynamometer will be used to assess all subjects' hand grip strength. The standard test protocol recommended by the instrument manufacturer, Fabrication Enterprises Incorporated, will be followed. Each subject will be seated, shoulder adducted and neutrally rotated with elbow flexed to 90 degrees, with forearm in a neutral position and wrist positioned between 0 and 15 degrees of ulnar deviation. The subject will be given one practice trial before the first recorded trial. The test will be administered three times in the dominant arm, with a 30-second rest between trials, and the best score of the three trials will be recorded. The manufacturer recommends using the mean score of the three trials but because of episodic variations in cognitive ability, one trial may negatively affect the mean score and incorrectly indicate lower strength ability. Based on clinical experience, I expect the best score of the three trials to be a better indicator of the actual strength of adults with ADRD, therefore that is the datum that will be used. Scores will be assessed in kilograms and higher scores indicate more strength. All scores will be assessed to the 0.5 kilogram. Established norms for older adults have been published by the instrument manufacturer and for adults with ADRD (Thomas & Hageman, 2002).

*Short physical performance battery.* The short physical performance battery is a comprehensive assessment of lower body functioning, including assessments for balance, gait, and strength. The battery consists of the following three assessments: (a) timed standing balance in the parallel, semi-tandem, and tandem foot positions; (b) timed 2.4 meter walk; and (c) a timed

test of five repetitions of rising from and sitting in a chair. The recommended protocol will be used to administer the test. No practice trials will be administered. All timing will be recorded to the 0.1 second using a stopwatch. Following the recommended test scoring procedures, each score will be assigned a value to represent overall physical ability ranging from 0 to 4 based on the individual's performance. These are then summed into a single indicator with a maximum of 12. Higher scores indicate better physical performance whereas lower scores indicate limitations in functional impairment or disability in older adults (Guralnik et al., 1994, 2000).

#### *Engagement in the Resistance Training Program*

Engagement will be determined by observing and coding videotaped exercise performances of participants in the program. Three sessions will be videotaped, one session during the first week, one during the sixth week (half-way point), and one during the twelfth (final) week. The Menorah Park Engagement Scale© will be used to evaluate type and level of engagement. Using this scale, participant behavior may be constructive engagement, passive engagement, self-engagement, other engagement and non-targeted engagement. A code of 0 indicates not engaged, 1 indicates engaged less than half the time observed, and 2 indicates engaged half the time or more.

The amount of time participants demonstrate each type of engagement will be recorded over three one-minute observation periods and coded categorically. Two stopwatches will be used to measure time engaged. Based on my clinical experience, I expect that no more than two types of engagement will be exhibited during the one minute observation. I modified the original scale by shortening the observation time to one minute. I have selected one minute to better capture multiple observations over the course of the observation period in order to assess true engagement, rather than observing individuals for a single and longer period of time that can result in an

inaccurate representation of a person's involvement over the course of an activity (e.g., if someone who actively joined 20 minutes of a 30 minute activity were observed only during the final 10 minutes of the activity when he or she was not participating).

Participant names will be organized in an established order. Each participant will be observed individually for a one-minute interval until every participant has been observed. Upon completing this first one-minute observation for each person on the list, the cycle will be repeated, gathering a second, and then third, one-minute observation for each person. This will provide observations of participants during various stages of the program. I will rewind the video to collect participant observations if the video ends prior to observing each participant three times. However, one viewing will suffice if the daily census is small. During each minute of observation, the observer will record the type of engagement and its corresponding categorical time assessment. I will also estimate the mean from the three one-minute observations for each type of engagement.

Before beginning evaluation of engagement, inter-rater reliability will be established with another researcher skilled in the use of the MPES to determine if levels of engagement are assessed appropriately. The two observers will watch the video and record scores for the same participant's engagement simultaneously. The observers' records will be compared to determine similarity. At least 90% agreement will be established between the two observers. This percentage of agreement is standard across observational research and research using the MPES, (Fleiss, 1981, p. 218; Judge, Camp, & Orsulic-Jeras, 2000; Landis & Koch, 1977; Orsulic-Jeras et al., 2000). An inter-rater reliability check will be repeated prior to coding the video at each of the three waves of measurement, which will help reduce observer drift, or the re-characterization of

what qualifies as a type of engagement which compromises the validity of an assessment (Smith & Glass, 1987).

Though the participants' effort to engage appropriately will be coded as constructive engagement, that coding will not capture whether the exercises are performed properly. It is anticipated that constructive engagement alone is not a sensitive assessment to interpret strength outcomes based on engagement because high levels of inappropriate constructive engagement are not expected to transfer into similar strength gains as appropriate constructive engagement would provide. Therefore, I will watch the videotaped images of exercisers specifically to capture appropriate engagement and record the number of repetitions correctly performed for each exercise. A percentage score will be computed to determine a value for correct engagement.

### *Quality of Life*

The Quality of Life- Alzheimer's Disease instrument (QOL-AD; Logsdon, Gibbons, McCurry & Teri, 1999) is a 13-item instrument that assesses various domains of quality of life for older adults. Sample items in the questionnaire include feelings about physical health, mood, and relationships with family and friends. It will be administered to subjects in an interview format. Subjects rate each item on a four-point ordinal scale with 1 being poor and 4 being excellent. The scale has established internal reliability for patient reporting ( $\alpha=.88$ ) and high test-retest reliability ( $r=.76$ ). Discriminate validity is established by moderate negative relationships with responses on both the Hamilton Depression Scale ( $r=-.43$ ) and Lawton-Brody ADL scale ( $r=.39$ ) (Logsdon et al., 1999).

### *Procedure*

Administrators at the dementia care centers have agreed to participate in the proposed study and assist in subject recruitment. The program will be implemented beginning in September

2004 and will last for 12 weeks. The administrator and activities leader at the dementia care centers have agreed to send family caregivers informed consent forms to authorize the older residents' participation in the program and the investigator's use of photographs and videotaped segments at professional presentations. Older adults who have consent for participation but not for use of their images will be assessed, but will not be photographed or videotaped. The staff members have also agreed to acquire medical clearance by a physician for each participant. Informed consent forms will also be mailed to family caregivers of participants in the comparison group. A representative from the Virginia Tech Institutional Review Board has agreed that no medical clearance is needed for the non-treatment group (D. M. Moore, personal communication, March 25, 2004). I will obtain copies of all informed consent forms prior to beginning the exercise sessions or other data collection. Participation for both the intervention and comparison group members is voluntary and participants are free to withdraw from any session or the entire program without consequence.

### *Exercise Program*

The program is an established physical activity program (see Appendix B) consisting of exercises targeting major muscle groups involved in performing everyday physical activities and generally lasts approximately 30 minutes. The program protocol and a board listing the program activities will be provided to each center's activities leader. The activities leader at each facility will serve as the facilitator for the program which will be held three times each week. The program is progressive and easily adapted to varying physical abilities; it can be performed fully seated, seated with three transitions to standing, or fully performed in a standing position. I designed the program and it has been successfully implemented for more than one year within an adult day services center serving clients with ADRD and various physical conditions. Further, I

have presented the program protocol to regional and state level audiences (Rogers, Gigliotti, Jarrott, & Weaver, 2004).

The activities director from the site where the program was piloted has agreed to introduce the program to the activities leaders at the dementia care centers and will assist as a consultant for program implementation considerations, including room set-up, placement of participants within the group, and successful feedback strategies. I will provide ongoing feedback to the dementia care centers facilitators and be present to observe the program to ensure that it is correctly implemented.

Each session will consist of the activities leader and no more than 15 participants. It is anticipated that there will be at least one other staff member present to assist participants who need individual attention and to encourage engagement in the exercises.

#### *Environmental Considerations*

Based on Lawton and Nahemow's model of environmental press (1973), special consideration should be given to the environment and the means of facilitating appropriate engagement for the participants. The exercise program will use music to support the activity as a multi-sensory strategy intended to enhance engagement and targeted outcomes associated with the therapeutic intervention. Music complementing the activity program will be provided for the facilitator.

The room will be safe for exercising and have few sensory distractions. The activities leader will face the group, and each participant should be seated with room to stand with arms outreached but not touching other participants. Participants should be seated in straight-backed chairs with armrests.

Recognizing special needs of individuals within the group, the facilitator will develop a seating arrangement that maximizes opportunity for engagement and manages safety issues. Participants will be escorted to the activity site by program staff and asked to sit in the assigned seats.

Staff support will be present to support engagement and to minimize safety risks by using appropriate cues and prompts. It is anticipated that there will be a staff person on each side of the group or with persons who need individual attention.

#### *Progressive Nature of the Program*

An objective of the exercise program is to guide individuals through an increasingly challenging program in an effort to maintain, and perhaps enhance, their functional abilities. For example, a progressive exercise program increases the weight of the hand-held weights. In addition, it is structured to transition the individual from a seated position to standing thereby enhancing lower body strength and balance. Because the program content does not change, the familiar continuity is maintained for the participants, which is especially valuable to adults with ADRD.

Appropriate starting weight will be determined using established procedures described in the literature review. Assessments for increasing the weight will occur every two weeks. For any adults who experience medical situations that cause a decline in physical ability, weights will be decreased as needed. The center staff has confirmed that they have appropriate weights for the program.

#### *Data Collection*

I will assess physical performance measures in treatment and comparison group participants two weeks prior to program implementation and again one week prior to

implementation. Based on these data, I will use Cronbach's alpha to indicate reliability for the hand grip strength assessment and the short physical performance battery to determine whether these measures are reliable for use with adults with ADRD. The second set of measurements will be used as the baseline physical measurements. The physical performance measurements will be repeated in both groups during the sixth (half-way) and twelfth weeks (final) of the program.

I will meet two weeks prior to the baseline physical assessments and program implementation with the activities leader and center administrator of each site to collect descriptive information for each participant.

At the conclusion of every session, the activity leader will complete the daily attendance log and record names of participants present at the start of the exercise program. If any individuals leave prior to a session's conclusion, the activity leader will note the reason in the attendance log. In addition, the pounds of hand-held weight used by each participant during the exercise will be recorded.

During the third session of the first week, the lead researcher will videotape the program to code engagement of participants. This will give participants a few days to get acquainted with the activity before capturing baseline abilities. Participants will be videotaped again during the mid-point week (week six) and again during the last week (week 12) of the intervention. Coding will occur immediately after each session is videotaped. The lead researcher will interview participants using the QOL-AD once during each the first and last weeks of the program.

#### *Statistics and Analyses*

The goal of the proposed program is to help participants achieve a sense of order in a disoriented world and to experience success through enhanced health, physical function, and quality of life. I expect to create an atmosphere of safety, predictability and acceptance that will

foster muscle strengthening that will ultimately intervene in the process of disablement. I anticipate that participants will experience some degree of confidence and success that will overall affect well-being and functioning outside of the activity session. Therefore, the primary objective of this program is to enhance quality of life of adults with ADRD through the implementation of an engaging strength training intervention that elicits improvements in physical abilities and functioning.

#### *Preliminary Data Profile and Statistics*

I will examine the data for homogeneity of variance and skewness within treatment and comparison groups. If the data for age and cognitive status (MMSE scores) are non-normatively skewed, the data will be standardized.

The baseline means of age, MMSE score, grip strength measurement, score on the short physical performance battery, and QOL-AD score, as well as the percentage of gender distribution, will be compared between the treatment and comparison groups in order to determine whether baseline group differences exist. Each of the aforementioned baseline variables is a possible covariate for certain outcome measures, but will only be included in statistical analyses if a high correlation exists with the outcome variable of interest. There is potential to confound the analysis if the influence of these variables is not recognized and statistically controlled.

Effect sizes will be calculated in order to consider not only the statistical significance in evaluating the value of the research results but also the practical or clinical significance. Effects are as much the function of the research design and procedures as they are of the impact of the treatment. Because small sample sizes effectively reduce power and make it very difficult to achieve statistical significance at even the .05 level (Lipsey, 1990), assessing practical or clinical

significance provides consideration for the effect the intervention had on individuals (Thompson, 2002).

Most social science studies typically are underpowered for detecting all but large effects, that is, effect sizes .96 and greater in gerontology research (Lipsey, 1990). Therefore, effect sizes may not precisely indicate the impact of the treatment on individuals, or the substantive significance of the treatment (Newton & Rudestam, 1999).

### Research Questions

*Research Question 1: Is there consistency in measurement of specific physical performance assessments for adults with ADRD?*

Hypothesis 1: There is consistency in measurement of adults' with ADRD upper body strength as assessed by scores of hand grip strength measured one week apart.

Hypothesis 2: There is consistency in measurement of adults' with ADRD lower body physical performance as assessed by scores on the short physical performance battery measured one week apart.

To determine reliability in measurement of both the short physical performance battery and hand grip dynamometry, I will determine the intra-class correlation coefficients (ICC) by testing subjects on two occasions separated by a one-week interim. These measurements will be assessed prior to beginning the intervention. Values of the ICCs are expected to be 1.00, or no change in score at follow-up.

*Research Question 2: Does the strength training intervention prevent a decline in outcome measures?*

Hypothesis 1: The strength training intervention was appropriately designed for adults with ADRD such that participants did not demonstrate a smaller percentage in constructive engagement over time.

Hypothesis 2: The strength training intervention was appropriately designed for adults with ADRD such that participants did not demonstrate a smaller percentage of appropriately performed exercise repetitions over time.

Mean percentage scores for both constructive and appropriate engagement will be used to present engagement in the program. The mean score of constructive engagement during at least half of the intervention will be used in the analysis of hypothesis 1. The percentage of appropriately performed exercise repetitions at pretest, 6 weeks and 12 weeks will be used in the analysis of hypothesis 2.

Hypothesis 3: The strength training intervention sustains upper body strength such that scores in hand grip strength did not decrease.

Hypothesis 4: The strength training intervention sustains lower body strength such that scores on the short physical performance battery did not decrease.

Hypothesis 5: The strength training intervention sustains physical function such that scores on the PF-10 did not increase.

Hypothesis 6: The strength training intervention sustains quality of life such that scores on the QOL-AD did not decrease.

A repeated measures analysis of variance will be used to compare scores for each of the four assessments. It is hypothesized that there will be no decline in outcome measures as a

result of participation in the exercise program and as such, scores that are maintained or increase without statistical significance may suggest clinically significant outcomes.

*Research Question 3: Is there a relationship between attendance at the exercise sessions and outcome measures for the treatment group?*

Hypothesis 1: Attending greater percentage of resistance exercise sessions will positively relate to engagement as assessed by higher scores of constructive engagement.

Hypothesis 2: Attending greater percentage of resistance exercise sessions will positively relate to engagement as assessed by higher percentages of performed exercise repetitions.

Hypothesis 3: Attending greater percentage of resistance exercise sessions will support higher upper body strength outcomes as assessed by higher change scores between pretest and 12-weeks on hand grip strength.

Hypothesis 4: Attending greater percentage of resistance exercise sessions will support better lower body performance as assessed by higher change scores between pretest and 12-weeks on the short physical performance battery.

Hypothesis 5: Attending greater percentage of resistance exercise sessions will support improved performance in everyday activities as assessed by less change between pretest and 12-weeks on scores of the PF-10 inventory.

Hypothesis 6: Attending greater percentage of resistance exercise sessions will support improved quality of life as indicated by higher change scores on the QOL-AD.

I will examine Pearson-product correlations between percentage of attended sessions and each outcome variable. A new variable will be created to assess change scores of the outcome variable in hypotheses 3-6. Though high correlations do not indicate causation (e.g. greater attendance predicts greater hand grip strength), a study with a small sample size needs a significant correlational coefficient ( $r \geq .8$ ) to suggest a relationship between variables. This is useful information for future research.

*Research Question 4: Is there a relationship between level of engagement and outcome measures for the treatment group?*

Hypothesis 1: Higher levels of appropriate engagement in a strength training program as indicated by the percentage of performed exercise repetitions will support higher upper body strength outcomes as assessed by higher change scores on hand grip strength.

Hypothesis 2: Higher levels of appropriate engagement in a strength training program as indicated by the percentage of performed exercise repetitions will support better lower body performance as assessed by higher change scores on the short physical performance battery.

Hypothesis 3: Higher levels of appropriate engagement in a strength training program as indicated by the percentage of performed exercise repetitions will support improved performance in everyday activities as assessed by less change in SF-10 scores.

Hypothesis 4: Higher levels of appropriate engagement in a strength training program as indicated by the percentage of performed exercise repetitions will support improved quality of life as indicated by higher change scores on the QOL-AD.

I will examine Pearson-product correlations between percentage of appropriately performed exercises and each outcome variable. A new variable will be created to assess change scores of each outcome variable in hypotheses 1-4. Though causation cannot be determined by correlation alone (e.g. greater appropriate engagement predicts greater hand grip strength), a high significant correlation ( $r \geq .8$ ) in a study with a small sample size suggests a relationship between variables that can be explored further in future research with a larger sample and more advanced statistical procedures.

I will investigate through research questions 3 and 4 for a minimum number of sessions and a minimal percentage of appropriately performed exercises needed to achieve gains in outcome measures though this may not be possible given the small sample size. This information may inform the design and implementation of future activity programming at dementia care centers.

*Research Question 5: Will the treatment group score higher on change scores of physical assessments than the comparison group following strength training?*

Hypothesis 1. The treatment group will perform better in upper body strength than the comparison group at follow-up (6- and 12-week) as indicated by higher change scores on hand grip strength.

Hypothesis 2: The treatment group will perform better in lower body physical functioning than the comparison group at follow-up (6- and 12-week) as indicated by higher change scores on the short physical performance battery.

Because there is no literature documenting the change in physical performance of adults with dementia over time as assessed by these measures, it is uncertain whether or how the comparison group will change over 12 weeks. However, it is expected that the treatment group will maintain or improve strength. A new variable will be created to represent change scores between pre- and post- measurements for the treatment and comparison groups. I will employ an independent samples analysis of variance to determine whether significant differences exist between groups, expecting that the treatment group will perform better than the comparison group for both physical performance measures.

*Research Question 6: Will the treatment group score higher on physical functioning than the comparison group following strength training?*

Hypothesis 1: The treatment group will perform better in performance of everyday tasks than the comparison group at 12-week follow-up as indicated by lower scores on the PF-10.

I will employ an independent samples analysis of variance to determine whether significant differences exist between groups, expecting that the treatment group will perform better than the comparison group for the physical functioning measure. As noted under the prior research question, it is uncertain how the comparison group will perform on this performance-based measures over time, but the treatment group is expected to maintain or improve performance.

*Research Question 7: Will the treatment group report higher increases in quality of life than the comparison group following strength training?*

Hypothesis 1: The treatment group will indicate higher increases in quality of life than the comparison group at 12-week follow-up as indicated by higher scores on the QOL-AD.

A new variable will be created to represent change scores between pre- and post-measurements for the treatment and comparison groups. I will use an independent samples analysis of variance to determine whether there are any significant differences between the change scores of the treatment and comparison groups on the QOL-AD.

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## Appendix B

**Program Content: Phase I**  
**Week 1**

**Seated, weights beside chair**

Finger touches 2\*8

Hand squeezes palms up 1\*8, palms down 1\*8

Wrist curls 1\*8, reverse 1\*8

Elbow bends 1\*8

Shoulder flexion 1\*8

One arm abduction/adduction, holding at AB 1\*8, 4 count hold, Switch arms

Look to the right, Look to the left, repeat each side

**Pick up weights from chair or floor**

Shoulder shrugs 1\*8

Shoulder rolls backward 2\*8

Single arm curl 1\*8, switch arms

Upright pull-ups 1\*8

**Set weights aside on chair (floor staff assists in clean-up, facilitator does not)**

Toe taps in front (alternating feet) 2\*8

Ankle rolls inward 1\*8, outward 1\*8 (each foot separately)

Toe raises 1\*8

Heel raises 1\*8

Single leg extensions 1\*8, 4 sec hold in extension on count 8, switch legs

Rock side to side (lifting buttocks off chair seat) 1\*8

Rock forward to backward (moving in seat) 1\*8, switch feet

March in seat (Safely raising knees)3\*8

Climb ladder rungs with arms and feet 2\*8 (“Reach higher...”)

Row boat 1\*8 (“Fight the waves, row harder...”)

Wash Window (one arm) 1\*8 (“It’s the biggest window in your house...”), switch arms

Knead the bread dough 2\*8 (“Too much flour, it’s thick dough...”)

Create the sun/Setting sun (“Reach high into the sky/Slow sunset...”) 3\*, slower each time

Raindrops downward to floor (“lots of raindrops, ..., one raindrop...”) 3 \* slowly  
alternated with “spider walks” up the web 2 \* slowly

1 deep breath

**Program Content: Phase 2**  
**Weeks 2-4**

**Standing, weights beside chair**

Finger touches 2\*8

Hand squeezes palms up 1\*8, palms down 1\*8

Wrist curls 1\*8, reverse 1\*8

Elbow bends 1\*8

Shoulder flexion 1\*8

One arm abduction/adduction, holding at AB 1\*8, 4 count hold, Switch arms

Look to the right, Look to the left, repeat each side

**Stand, begin marching in place until everyone standing**

Mini-squat \* 1

**Pick up weights from chair or floor**

Shoulder shrugs 1\*8

Shoulder rolls backward 2\*8

Single arm curl 1\*8, switch arms

Upright pull-ups 1\*8

**Sit on front half of chair, set weights aside on chair or floor (floor staff assists in clean-up, facilitator does not)**

Toe taps in front (alternating feet) 2\*8

Ankle rolls inward 1\*8, outward 1\*8 (each foot separately)

Toe raises 1\*8

Heel raises 1\*8

Single leg extensions 1\*8, 4 sec hold in extension on count 8, switch legs

**Stand, begin marching in place until everyone standing**

Mini-squat \* 1

Rock side to side 1\*8

(adjust feet to semi-tandem) Rock forward to backward 1\*8, switch feet

(adjust feet back to parallel) Mini-squat \* 3

March in place (Safely raising knees) 3\*8

1 deep breath

**Sit on front half of chair**

Climb ladder rungs with arms and feet 2\*8 (“Reach higher...”)

Row boat 1\*8 (“Fight the waves, row harder...”)

Wash Window (one arm) 1\*8 (“It’s the biggest window in your house...”), switch arms

Knead the bread dough 2\*8 (“Too much flour, it’s thick dough...”)

Create the sun/Setting sun (“Reach high into the sky/Slow sunset...”) 3\*, slower each time

Raindrops downward to floor (“lots of raindrops, ..., one raindrop...”) 3 \* slowly  
alternated with “spider walks” up the web 2 \* slowly

1 deep breath

**Program Content: Phase 3  
Weeks 5-8**

**Standing, weights beside chair**

Finger touches 2\*10

Hand squeezes palms up 1\*10, palms down 1\*10

Wrist curls 1\*10, reverse 1\*10

Elbow bends 1\*10

Shoulder flexion 1\*10

One arm abduction/adduction, holding at AB 1\*10, 4 count hold, Switch arms

Look to the right, Look to the left, repeat each side

**Stand, begin marching in place until everyone standing**

Mini-squat \* 3

**Pick up weights from chair or floor**

Shoulder shrugs 1\*10

Shoulder rolls backward 2\*10

Single arm curl 1\*10, switch arms

Upright pull-ups 1\*10

**Sit on front half of chair, set weights aside on chair or floor (floor staff assists in clean-up, facilitator does not)**

Toe taps in front (alternating feet) 2\*10

Ankle rolls inward 1\*10, outward 1\*10 (each foot separately)

Toe raises 1\*10

Heel raises 1\*10

Single leg extensions 1\*10, 4 sec hold in extension on count 8, switch legs

**Stand, begin marching in place until everyone standing**

Mini-squat \*3

Rock side to side 1\*10

(adjust feet to semi-tandem) Rock forward to backward 1\*10, switch feet

(adjust feet back to parallel) Mini-squat \* 3

March in place (Safely raising knees)3\*10

1 deep breath

**Sit on front half of chair**

Climb ladder rungs with arms and feet 2\*10 (“Reach higher...”)

Row boat 1\*10 (“Fight the waves, row harder...”)

Wash Window (one arm) 1\*10 (“It’s the biggest window in your house...”), switch arms

Knead the bread dough 2\*10 (“Too much flour, it’s thick dough...”)

Create the sun/Setting sun (“Reach high into the sky/Slow sunset...”) 3\*, slower each time

Raindrops downward to floor (“lots of raindrops, ..., one raindrop...”) 3 \* slowly alternated with “spider walks” up the web 2 \* slowly

1 deep breath

**Program Content: Phase 4  
Weeks 9-12**

**Standing, weights beside chair**

Finger touches 2\*12  
 Hand squeezes palms up 1\*12, palms down 1\*12  
 Wrist curls 1\*12, reverse 1\*12  
 Elbow bends 1\*12  
 Shoulder flexion 1\*12  
 One arm abduction/adduction, holding at AB 1\*12, 4 count hold, Switch arms  
 Look to the right, Look to the left, repeat each side  
 Mini-squat \* 3

**Pick up weights from chair or floor**

Shoulder shrugs 1\*12  
 Shoulder rolls backward 2\*12  
 Single arm curl 1\*12, switch arms  
 Upright pull-ups 1\*12

**Set weights aside on chair or floor (floor staff assists in clean-up, facilitator does not)**

Toe taps in front (alternating feet) 2\*12  
 Ankle rolls inward 1\*12, outward 1\*12 (each foot separately)  
 Toe raises 1\*12  
 Heel raises 1\*12

**Sit on front half of chair**

Single leg extensions 1\*12, 4 sec hold in extension on count 8, switch legs

**Stand, begin marching in place until everyone standing**

Mini-squat \*3  
 Rock side to side 1\*12  
 (adjust feet to semi-tandem) Rock forward to backward 1\*12, switch feet  
 (adjust feet back to parallel) Mini-squat \*3  
 March in place (Safely raising knees)3\*12  
 1 deep breath

**Sit on front half of chair**

Climb ladder rungs with arms and feet 2\*12 (“Reach higher...”)  
 Row boat 1\*12 (“Fight the waves, row harder...”)  
 Wash Window (one arm) 1\*12 (“It’s the biggest window in your house...”), switch arms  
 Knead the bread dough 2\*12 (“Too much flour, it’s thick dough...”)  
 Create the sun/Setting sun (“Reach high into the sky/Slow sunset...”) 3\*, slower each time  
 Raindrops downward to floor (“lots of raindrops, ..., one raindrop...”) 3 \* slowly  
 alternated with “spider walks” up the web 2 \* slowly  
 1 deep breath

Appendix C  
Additional Statistics

Table C-1

*Intercorrelations Among Participant Characteristics and Scores of Physical Ability Tests for All Participants*

Physical Performance Test	Occasion of Measurement	Characteristics		
		Gender	Age	MMSE score
Grip Strength	Pretest	.658**	-.082	.188
	6 Weeks	.774**	.062	.198
	Posttest	.657**	-.154	.444*
Stands Time	Pretest	-.225	.440*	-.393
	6 Weeks	.022	.197	-.604**
	Posttest	.554**	.305	-.423
Walk Time	Pretest	-.392	.200	-.508*
	6 Weeks	-.220	.464*	-.461*
	Posttest	-.217	.295	-.422
PF-10 Score	Pretest	-.131	.032	.001
	Posttest	-.101	-.220	.130

\* $p < .05$  \*\* $p < .01$

Table C-2

Intercorrelations Among Participant Characteristics and Scores of Physical Ability Tests and Performance Variables Sorted by Treatment Group

		Characteristics		
		Gender	Age	MMSE Score
		Exercisers ( <i>n</i> = 17)		
Grip Strength				
	Pretest	.673**	-.345	.280
	6 Weeks	.840**	-.026	.266
	Posttest	.751**	-.205	.479*
Stands Time				
	Pretest	-.155	.610*	.056
	6 Weeks	.056	.366	-.680**
	Posttest	.598*	.348	-.421
Walk Time				
	Pretest	.335	.412	-.595*
	6 Weeks	-.219	.524*	-.462
	Posttest	-.193	.349	-.486
PF-10 Score				
	Pretest	-.237	-.113	.527*
	Posttest	-.189	-.397	.194
Percentage of Appropriately Performed Exercises				

	Pretest	-.017	-.267	.570*
	6 Weeks	-.030	-.205	.479*
	Posttest	.145	-.206	.531*
Percentage of Appropriately Performed Exercises (overall)		-.084	-.261	.563
Percentage of Sessions Attended		.036	.392	-.056
Non-Exercisers ( $n = 8$ )				
Grip Strength	Pretest	.658	.492	-.118
	6 Weeks	.709	.418	-.162
	Posttest	.038	.246	.421
Stands Time	Pretest	-.436	-.006	.228
	6 Weeks	-.109	.010	-.662
	Posttest	.557	.450	-.080
Walk Time	Pretest	-.581	-.470	-.210
	6 Weeks	-.700	-.630	-.393
	Posttest	-.277	.125	-.343
PF-10 Score	Pretest	.108	.452	.356
	Posttest	.170	.289	-.032

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\*  $p < .05$  \*\*  $p < .01$

Table C-3

*Intercorrelations Among Indicators of Participation in Exercise and Percentages of Change in Scores of Physical Abilities*

	Percentage of Sessions Attended	Overall Percentage of Repetitions Appropriately Performed
Grip Strength	-.243	.329
Walk Time	.160	-.019
Stands Time	-.126	-.411
PF-10 Score	.174	.113
Percentage of Sessions Attended	--	.234
Percentage of Repetitions Appropriately Performed	.234	--

Table C-4

*Means, Standard Deviations, and Between Group Differences for Percentages of Change in Physical Performance Tests*

Physical Performance Tests	Group	Means	<i>SD</i>	<i>t</i>	<i>p</i>
Grip Strength (kg)	Exercisers	-9.69	22.84	1.21	.289
	Non-Exercisers	-13.41	32.54		
Walk Time (sec)	Exercisers	-7.07	18.63	1.02	.329
	Non-Exercisers	4.75	37.85		
Stands Time (sec)	Exercisers	8.24	33.20	1.04	.326
	Non-Exercisers	36.05	78.18		
Scores on PF-10	Exercisers	17.28	13.11	.003	.960
	Non-Exercisers	17.99	14.37		

Table C-5

*Quality of Life Scores and Participant Characteristics for All Participants and Occasions*

Occasion of Measurement	Characteristics		
	Sex	Age	MMSE Score
Pretest	-.205	-.267	.279
6 Weeks	.018	-.216	.274
Posttest	-.288	-.286	.302

Table C-6

*Correlations Among Quality of Life Scores and Participant Characteristics Sorted by Treatment*

*Group*

Occasion of Measurement	Group	Characteristics			Percentage of sessions attended
		Sex	Age	MMSE Score	
Pretest					
	Exercisers	-.501*	-.394	.448	-.172
	Non-Exercisers	.454	-.048	-.253	--
6 Weeks					
	Exercisers	-.036	-.356	.371	-.619*
	Non-Exercisers	.246	.354	-.382	--
Posttest					
	Exercisers	-.386	-.364	.378	-.021
	Non-Exercisers	.295	-.680	-.630	--

\* $p < .05$

Table C-7

Means and Standard Deviations of Quality of Life Scores by Group and Occasion of Measurement

Occasion of Measurement	Treatment Group			
	Exercisers		Non-Exercisers	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Pretest	3.07	.41	3.05	.35
6 Weeks	2.87	.41	3.12	.29
Posttest	3.13	.45	3.06	.04

List of Figures

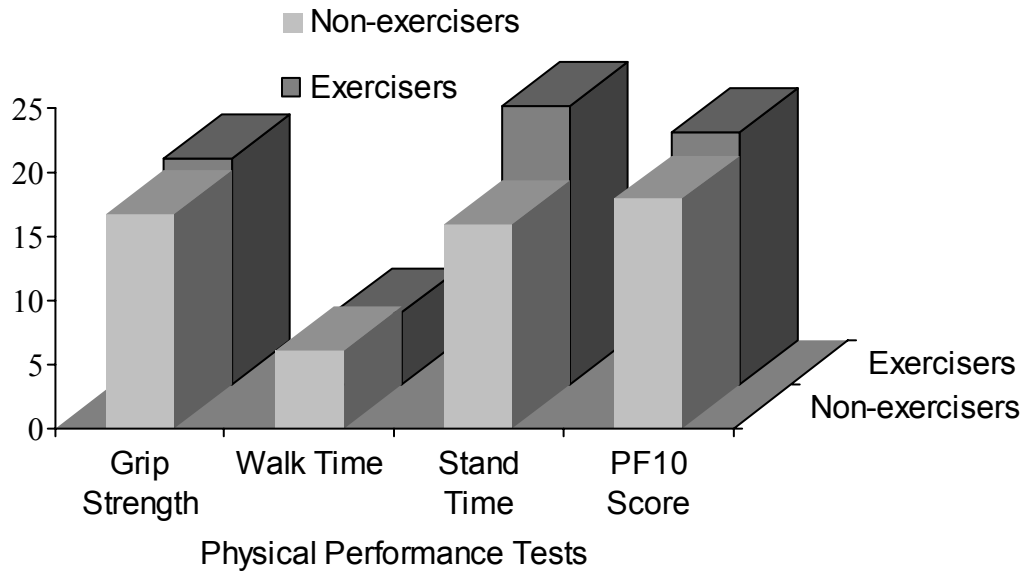


Figure C-1. Scores of physical ability and functioning at 12 weeks by treatment group.

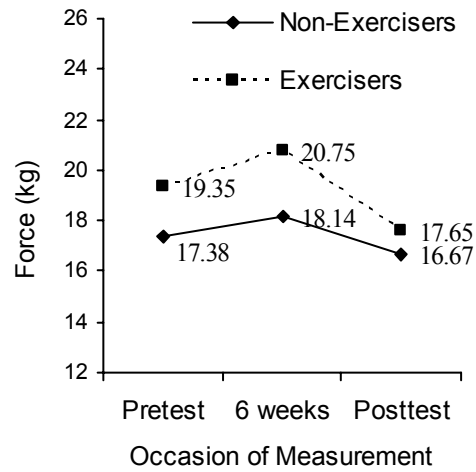


Figure C-2.. Grip strength by time and group.

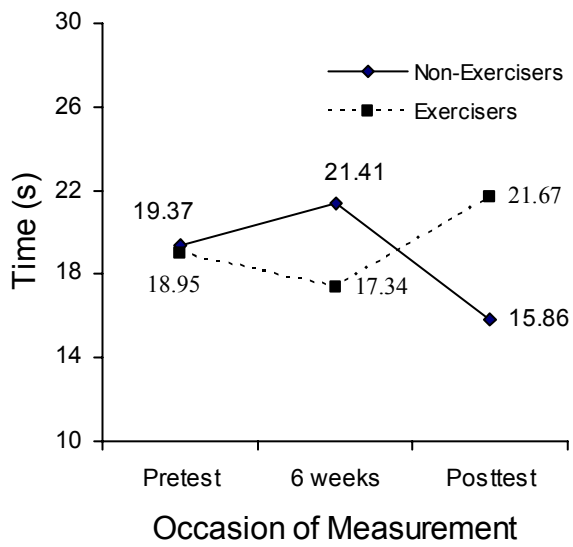


Figure C-3.. Time of five repeated chair stands by time and group.

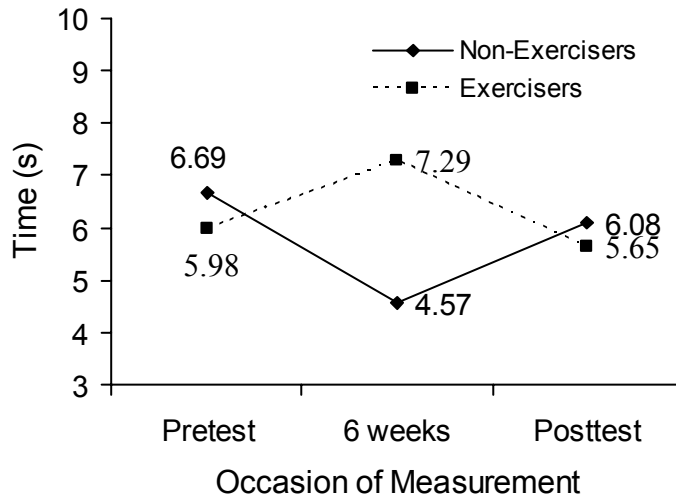


Figure C-4. Time of 4-meter walk by time and group.

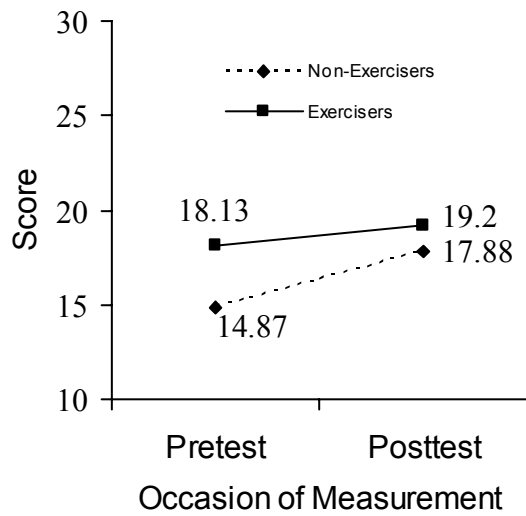


Figure C-5. Scores on PF-10 inventory by time and group.

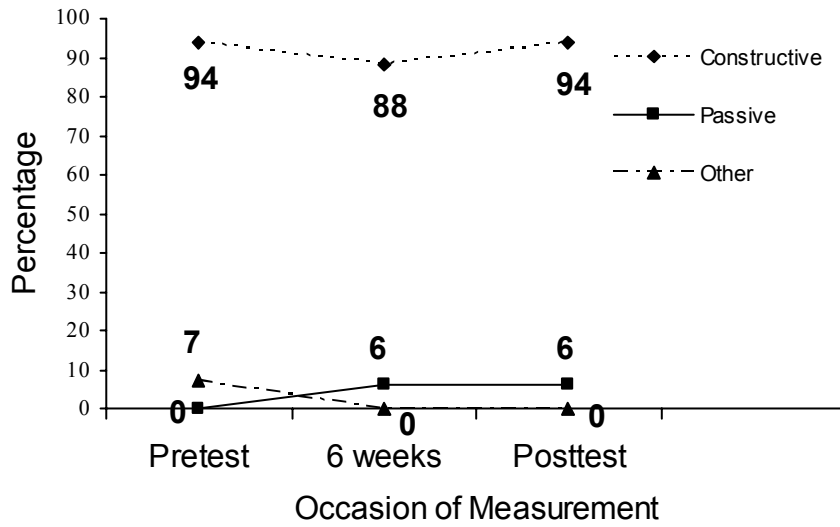


Figure C-6. Change over time in percentage of participants exhibiting each type of engagement during at least half of the observation.

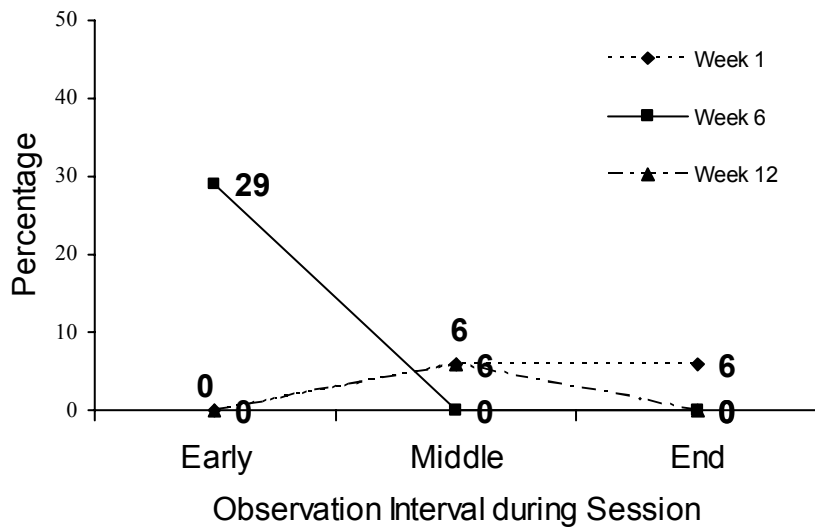
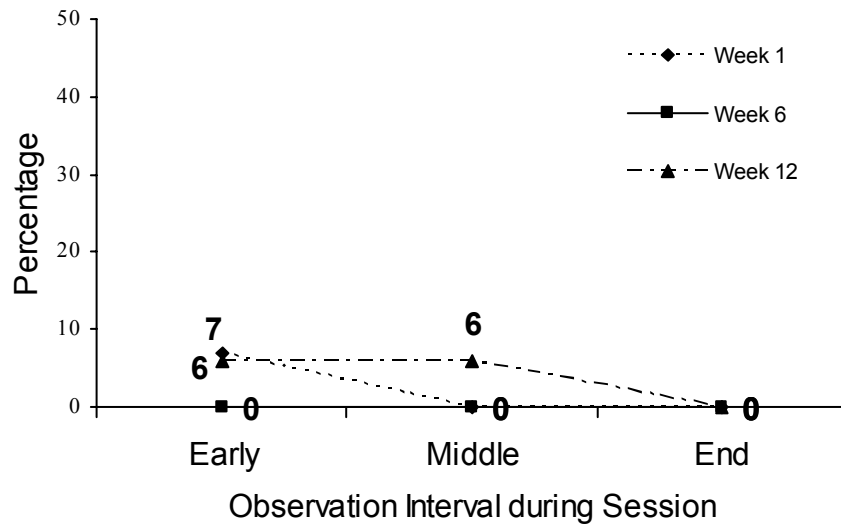


Figure C-7. Percentage of participants passively engaged during at least half of the observation period, by observation period.



*Figure C-8.* Percentage of participants engaged during at least half of the observation period in engagement that is neither constructive nor passive engagement, by observation period.

## Appendix D

## Strength Training for Adults with Dementia

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### Justification of Project

Older adults with severe cognitive impairment usually experience significant declines in memory, language, and functional ability. Physical health, however, may remain intact throughout the disease. The comparative rate of physical change for adults with dementia as adults without dementia is unknown. Because many caregivers and dementia care programs find it difficult to engage adults with dementia in safe, appropriate physical activity, presumably many persons with memory problems experience premature declines in physical health resulting from learned helplessness.

This project is designed to develop an understanding about the (a) the feasibility of a strength training intervention for adults with dementia and (b) psychosocial and physical changes that occur for adults with dementia after exercising. Primary analyses will examine the effects for adults with Alzheimer's disease or a related dementia (ADRD) of participation in a strength training intervention implemented over three months.

### Procedure

The study participants will be collected from a local dementia care assisted living retirement facility. A recruited sample of older adults with dementia will serve as participants in a strengthening exercise program and others will be recruited as non-participating comparisons. The caregivers of participants with dementia will be required to provide informed consent for their relative's participation in the program and/or data collection procedures of the research project. Exercisers must be medically cleared by their primary physician prior to participation in the exercises although persons who are non-participating comparisons will not be asked to receive physician clearance to be eligible for inclusion in the research study. Approximately 15 persons will be recruited for each of the four groups.

Data collection for the proposed study takes multiple forms due to the comprehensive nature of the expected outcomes. The researchers will assess physical aspects of participant well-being, quality of life, and participant engagement in the exercise program. For all older adults participating in the study, measurements will be collected prior to beginning, during and after completing the program. Most physical measures will be performed in a private and controlled situation at the facility from which the participants were recruited. Numerous physical abilities will be measured. A hand-held grip dynamometer will be used to generally assess upper body muscular strength. The participant will be asked to squeeze the handle of the grip dynamometer to produce the measurement. A sit-to-stand test will assess lower body strength. The participant will be asked to repeatedly sit and rise from a chair five times as able. A timed standing balance assessment will measure static balance. The participant will be asked to stand with both feet parallel, shoulder width apart, secondly, with feet in a semi-tandem position and lastly, with feet in a tandem position. Mechanical or personal assistance will be provided. The participants'

ability to walk a four-meter course will be assessed twice. The participants will be permitted to use any assistive walking device as needed. A second staff member will serve as a “spotter” to ensure the participants’ safety during all tests. Trained graduate students will interview individual exercise participants to assess participant quality of life. The interviews will be conducted following three separate exercise sessions. Videotaping three exercise sessions will capture participant engagement in the exercise program.

### **Risks and Benefits**

The activities proposed in this study pose minimal risk to the participants. The activities will take place in familiar surroundings at the participants’ facility of residence at the continuing care retirement facility. All measurements will be collected by trained graduate students experienced in collecting these measures.

### **Confidentiality/Anonymity**

All Virginia Tech staff and students involved with this study will be educated about the confidential nature of this project. Participants will be identifiable only by an identification number, the key to which will be kept in a secure space to which only the principle investigators and graduate research assistants will have access. No names will appear on observation forms in order to promote anonymity. Additionally, participants’ names will not be released in publications or presentations regarding the study. Videorecordings will be maintained in a secure location available only to the researchers.

### **Informed Consent**

Informed consent forms will be presented to caregivers of the adult participants with dementia by staff at the continuing care retirement facility. Caregivers will be encouraged to contact center or project staff to review the purpose, procedures or details of the project. Caregivers will be asked to sign the informed consent form and return it to the center. A second informed consent form will be provided requesting permission for the researchers to use videotaped exercise sessions for presentations or professional purposes.

## **Biographical Sketch**

Principle Investigator:

Shannon E. Jarrott, Ph.D., Assistant Professor

Virginia Polytechnic and State University, Human Development

Dr. Shannon E. Jarrott is an assistant professor in the department of Human Development at Virginia Tech. She received a Ph.D. in Human Development and Family Studies with a minor in gerontology at the Pennsylvania State University in 1999. Her research interests and experience focus on dementia care including the experiences of family caregivers and therapeutic activities for adults with dementia in institutional care settings.

Dr. Jarrott has conducted caregiving research in the United States and Sweden, specifically surveying adult day service programs in Sweden and the US. The findings of the study have been published and presented both nationally and internationally.

Dr. Jarrott is the Director of Research for Virginia Tech's Adult Day Service program. She has conducted internally and externally funded research at the ADS program involving the use of horticultural therapy, modified Montessori activities, and intergenerational programming. She recently completed an SPIRES funded validation study of an observational measure used to assess the affect and activity of older adults with dementia in institutional care settings.

## **Informed Consent for Participants in Research Projects Involving Human Subjects**

**Title:**

A STRENGTH TRAINING PROGRAM FOR ADULTS WITH DEMENTIA: A COMMUNITY PHYSICAL ACTIVITY INTERVENTION PROMOTING BETTER QUALITY OF LIFE THROUGH IMPROVED HEALTH FUNCTIONING.

**Investigator(s):**

Shannon E. Jarrott, Ph.D., Department of Human Development

Sharon D. Rogers, M.S., Department of Human Development

**I. Purpose:**

The main objective of this project is to introduce a strengthening program. It will provide residents with an opportunity for physical activity and expression. Research on the effects of the activity components this program have demonstrated positive outcomes for elders in the following areas: improved balance, postural stability, fall prevention, cardiovascular enhancement, reduced pain, stress, and anxiety, improved flexibility and range of motion in persons suffering from osteoarthritis, relaxation and other improvements in quality of life indicators. This program may provide physical and cognitive benefits, improved affect, increased activity within the environment, reduced agitation, and fewer problem behaviors.

**II. Procedures:**

The strength training program will involve two main objectives/procedures, which are outlined in the subsequent paragraphs.

The first procedure will be to implement the program three times each week over an initial three-month period. This will be conducted with the activities director as the instructor and graduate research assistants and center staff as aides. The activity director will incorporate the strengthening program into the program's regular schedule of activities and adults will be able to choose whether they wish to join the program activities. Sessions will last between 25 and 40 minutes.

The second procedure involves repeated assessments of the participants for physical and psychosocial effects of participation in the program. Using an observational scale, graduate assistants will assess the levels of engagement of the adult participants during the activities. Physical measurements to assess effects of the intervention include: standing balance, sit-to-stand ability, walking ability, and hand grip strength. All physical measures will be assessed prior to and after completing the complete exercise program. All participants will be interviewed for responses to questions assessing quality of life.

All information will be collected using trained graduate student observers and videotape. The videotape will be used to confirm the student's observations and maintain reliability. Observations will help determine the effects of the physical activities on the participants.

### III. Risks and Benefits:

This program offers only minimal risk to the participants; very similar to other activities offered at the retirement facility. This program can result in physical and cognitive benefits, improved affect, increased activity within the environment, reduced agitation, and fewer problem behaviors. No promise or guarantee of benefits will be made to encourage participants to participate in the study. No compensation will be given to those who choose to participate in the physical activities.

### IV. Confidentiality:

Participant identity is completely confidential. The data collected during the strength training program will not be released at any time, to anyone other than the principle investigator without the written consent of the participants or their guardians. If videotapes are used during the study, the main investigator and the observer will only see them.

### V. Freedom to Withdraw:

Participation is completely voluntary. Participants may stop at any time without penalty.

### VI. Approval of Research:

This research project has been approved, as required, by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University, by the Department of Human Development and Adult Day Services.

**IRB Approval Code:** 02-591      **IRB Approval Date:** 06/30/04      **Expiration Date:** 06/30/05

### VII. Participant's Responsibilities:

I voluntarily agree to allow my relative to participate in this study. I will tell my family member that he/she will be asked to participate in the program, and that I support his/her participation in this activity. I understand that my relative does not have any responsibility or obligation if he/she chooses not to participate at any time.

Should I have any questions about this research or its conduct, I may contact:

Shannon Jarrott, Ph.D.      sjarrott@vt.edu

Assistant Professor

Sharon D. Rogers      srogers@vt.edu

Graduate student, lead researcher

David M. Moore, Ph.D.      moored@vt.edu

Chair, IRB

Office of Research Compliance

Research & Graduate Studies

### VIII. Caregiver's Permission

I have read and understand the Informed Consent and conditions of this project. I have had all my questions answered. If there are specific activities or measures that I am unwilling to consent to, I am aware that I must contact the main investigator to complete appropriate paperwork documenting the excluded activities. I hereby acknowledge the above and give my voluntary consent for full participation:

Caregiver's Signature \_\_\_\_\_ Date \_\_\_\_\_

Participant's Name (printed): \_\_\_\_\_

I hereby give voluntary consent for the program staff to contact my family member's physician regarding his/her ability to join the strength training program.

Caregiver's Signature \_\_\_\_\_ Date \_\_\_\_\_

### Use of Videotape for Professional Purposes

I have read and understand the conditions of this project and recognize that the videotaped sessions will be used for the purposes of this project. I also recognize that the results of this project will be presented to professional audiences and that my relative's videotaped images may be used as part of these presentations. I hereby acknowledge the above and give my voluntary consent for use of my relative's videotaped images strictly for the purposes of use during professional presentations:

Caregiver's Signature \_\_\_\_\_ Date \_\_\_\_\_

Participant's Name (printed): \_\_\_\_\_

## Physician Information Form

To: [Physician]

From:

Date:

RE: [Participant]

Your patient, \_\_\_\_\_, a client at \_\_\_\_\_, has the opportunity to participate in a strengthening exercise program starting in July 2004. The program has been approved by Virginia Tech's Institutional Review Board. The patient's caregiver, \_\_\_\_\_, has given voluntary consent for your patient to participate in the program and has also given us permission to contact you regarding the inclusion of this person in the program.

The main objective of the program is to provide participants with an opportunity for physical activity and expression. Research on the effects of the activity components of have demonstrated positive outcomes for elders in the following areas: improved balance, postural stability, fall prevention, cardiovascular enhancement, reduced pain, stress, and anxiety, improved flexibility and range of motion in persons suffering from osteoarthritis, relaxation and other improvements in quality of life indicators. We expect that this program will provide physical and cognitive benefits, improved affect, increased activity within the environment, reduced agitation, and fewer problem behaviors.

Before we include your patient in the program, we want to know if there are any limitations that would preclude the person from participating either fully or partially in the program. If there are any limitations that require accommodation during the program, please list them below. Please sign the form in the space provided.

Thank you for your time.

Patient Limitations:

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 Signature

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 Date