Translating Strong for Life into the Community Care Program

BY

MARGARET K. DANILOVICH
B.A., Concordia University, River Forest, 2005
D.P.T., Northwestern University, Chicago, 2007

THESIS
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Defense Committee:

Susan Hughes, Chair and Advisor
Richard Campbell, Biostatistics
Daniel Corcos, Northwestern University
Amy Eisenstein, Northwestern University
David Marquez, Kinesiology
This thesis is dedicated to my parents.
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I would like to thank my family and friends who provided a never-ending source of encouragement.
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<tr>
<td>ACSM</td>
<td>American College of Sports Medicine</td>
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<td>ADL</td>
<td>Activities of daily living</td>
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<td>CCP</td>
<td>Community Care Program</td>
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<td>CCSI</td>
<td>Community Care Systems, Inc. of Illinois</td>
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<tr>
<td>EASY</td>
<td>Exercise and Screening for You</td>
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<td>HCA</td>
<td>Home care aide</td>
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<td>HCBS</td>
<td>Home and Community Based Services</td>
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<tr>
<td>IADL</td>
<td>Instrumental activities of daily living</td>
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<td>JDI</td>
<td>Job Descriptive Index</td>
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<td>MCC</td>
<td>Multiple chronic conditions</td>
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SUMMARY

Physical activity has substantial health benefits for older adults. Older adults receiving home and community-based services have functional limitations often hindering access to physical activity programs offered in the community. Thus, there is a need to develop and test delivery mechanisms to bring physical activity programming to this vulnerable population of older adults. In this dissertation, I provide results of a study investigating the feasibility of translating an evidence-based physical activity program, Strong for Life, into the Community Care Program through a randomized controlled trial.

I enrolled 32 home care aides and their 42 older adult clients receiving home care aide services through the Community Care Program. I randomized the home care aides and clients into an intervention and usual care group or a usual care only control group. At baseline, older adult clients in both group had substantial levels of frailty and physical impairment underscoring the need for physical activity interventions to address these mobility and strength deficits. Fidelity check data showed that Strong for Life was implemented safely and with good fidelity. Program evaluation data demonstrated that home care aides and clients found Strong for Life to be acceptable and practical. Both parties also voiced the need for continued physical activity programming within the Community Care Program. Intervention group clients demonstrated greater median change in strength and mobility measures between baseline and post-test compared with the control group, with medium effect sizes for grip strength, global self-reported health, and mental health. Qualitatively, both home care aides and clients reported benefits of Strong for Life participation by enhancing client mobility and home care aide job satisfaction.
I. INTRODUCTION

A. **Background**

Currently only 37% of all older adults engage in leisure-time physical activity (PA), and this rate decreases with age such that only 14% of adults over the age of 85 engage in PA (US Department of Health and Human Services - Healthy People 2020, 2011; Struck and Ross, 2006). Physical activity is defined as any bodily movement produced by skeletal muscles resulting in energy expenditure (Caspersen et al., 1985). Leisure-time PA is defined as light to moderate PA, such as exercise, sports, or recreation, that is performed at a frequency of five or more times per week for more than 20 minutes at each session (CDC, 2011). Regular PA improves the health of older adults and those with difficulties in activities of daily living (ADL) (Prohaska et al., 2006; Cadore et al., 2014; Fairhall et al., 2012; Hughes, 2010). Given the low engagement in PA among older adults and the potential benefits of PA, it is critical that successful programs reach a wider audience than those typically reached through group-based community programs led by exercise experts, such as trained fitness instructors or personal trainers. Despite high levels of efficacy and effectiveness, most PA programs for older adults are not widely disseminated to subgroups such as homebound older adults, who may need them most.

In 2010, more than 1.3 million persons received community-based care through Medicaid waiver programs in the United States (Eiken and Lelchook, 2013). Fifty-five percent of these individuals were older adults and/or persons with physical disabilities (Eiken and Lelchook, 2013). The 1915(c) waiver allows for the provision of long-term care services, both medical and non-medical, in a home setting (Medicaid, 2014). Illinois provides this service through its Community Care Program (CCP), which serves over
100,000 frail elderly annually. The purpose of the CCP is to provide services to help older adults who might otherwise require nursing home placement remain in their homes. These CCP services provide a cost-effective alternative to nursing home care and assist older adults to maintain their independence in order to age in place. The CCP targets low-income adults 60 years of age or older who have been deemed eligible for nursing home care. The CCP population is characteristically female, minority, has low socioeconomic status, and advanced age (Ward, 2013). Services offered through the CCP include case management, home care aides (HCAs), adult day services, and emergency response systems. Physical activity programs are not included with any of these services. Given the demonstrated benefits of PA participation in reducing physical impairment and enhancing independence, there is a significant need to provide PA programs to this large subgroup of the older adult population—those older adults at risk for nursing home placement who are unable to easily and safely access these important PA programs in the community.

Community Care Program clients have an assessed need for long-term care services often because of the effects of multiple chronic medical conditions. Multiple chronic conditions present in this population cause functional impairments and fragility in physical health that render this population in need of long-term care (Vogeli, 2007). The most common medical conditions that render older adults homebound are hypertension, diabetes, and heart disease (Beck, 2009). This population also has increased rates of disability, healthcare utilization, and mortality because of the interactive effects of multiple medications, multiple chronic medical conditions, and the increased likelihood and frequency of condition exacerbations (Vogeli, 2007; Henninger, 2012). Coordination of care is also difficult because of the high number of healthcare providers needed to manage
multiple medical diagnoses with high rates of healthcare utilization, making this population a high healthcare cost population to serve (Fried, 2004). Healthcare utilization, physician visits, medication use, and hospital admission rates are all higher in populations with multiple chronic conditions (Fried, 2004). Given these impairments, the challenges of multiple condition management, and the high health costs associated with managing the health needs of this population, cost-effective interventions to help members of this population manage their own conditions and improve their functional independence are urgently needed.

The presence of multiple chronic conditions (MCC) influences dimensions of health beyond the physical. Behavioral choices and lifestyle decisions are also impacted and usually limited by the presence of MCC (Putnam, 2002). Participation in ADL, instrumental ADL (IADL), and social roles often become altered or limited (Putnam, 2002). These consequences can adversely impact quality of life and overall well-being. The presence of MCC shifts the locus of control from an internal mechanism to an external control often lowering one’s self-efficacy for condition management (Henninger, 2012). These cumulative impacts on physical, mental, and social health create a need for additional services to assist the older adult to remain in the community or can cause the older person to transition to more supportive living environments. Interventions that empower older adults to manage their conditions by developing and expanding their physical and social capacity are needed to help older adults age in place. Interventions that can prevent and/or delay hospitalization or other costly care are needed to reduce overall healthcare costs, as well as the complications that commonly arise from hospitalizations (Kleinpell et al., 2008).
Despite the presence of multiple chronic medical conditions, older adults are still amenable to change, and interventions have been proven to improve health by enhancing disease management, reducing the burden of disability, and improving independence (Loeb, 2003; US Preventative Task Force, 2002). Successful interventions have been characterized as focusing on ADL and IADL preservation, addressing disease self-management, incorporating elements of self-efficacy and social support, and being compromised of multi-components (Gitlin, 2006; Cattan, 2005).

Physical activity, in particular, promotes healthy aging by reducing functional limitations in older adults (Guccione, 2011). Resistance exercise training improves functional capacity and endurance, thereby enhancing older adults’ functional reserve and capacity to perform ADL and IADL (Langlois, 2013; ACSM, 2009). Physical activity programs focused on resistance exercise lead to strength gains that support improvements in physical function and decreased fall risk contributing to decreased rates of morbidity and mortality (Guccione, 2011).

In summary, older adults with MCC enrolled in the CCP are a high-cost and high-risk population as evidenced by high healthcare utilization, prevalence of functional impairments, and determined need for nursing home care. Community Care Program services attempt to maintain older adults in their homes by providing services, predominantly HCAs, to perform ADLs or IADL services for and with their clients. Examples of ADL services include help with bathing and dressing, and IADL services include meal preparation and laundry management. Older adult CCP clients also are generally sedentary and unable to reach PA programs available in the community. Current CCP services neither address nor meet client PA needs. This dissertation study sought to investigate whether
HCAs can disseminate resistance exercise programming to their CCP clients. This novel approach sought to take an already existing provider (the HCA) with an established HCA-client relationship and expand the HCA’s scope of care to include that of PA leader and motivator. Currently, the substantial cost and limited workforce available to bring exercise programming into individual homes for 1:1 exercise has limited the implementation of PA programs for homebound persons. This dissertation study tested the novel approach of expanding the skills of a provider already present in the home to determine if these paraprofessionals can safely provide an evidence-based PA program for their older adult clients.

1. **Theoretical framework**

The conceptual framework for the proposed study drew on elements of self-efficacy from Bandura’s Social Cognitive Theory and the prioritization of relationships from Carstensen’s Socioemotional Selectivity Theory to enhance the implementation of a PA program with a homebound population. Current data show that, on average, frail older adults do not participate in PA programs (Healthy People 2020, 2011; Struck and Ross, 2006). The inability to readily access evidence-based PA programs offered in the community limits participation by this population. There is a significant need to disseminate evidence-based interventions to this population. This dissertation study trained HCAs in an evidence-based PA program which enabled them to support and motivate PA participation by their clients. Given the close nature of the HCA-client relationship, HCAs are ideal candidates to serve as trusted sources of health information and chronic disease management education. Rather than directly training older adults to perform a PA program, training HCAs as exercise leaders and motivational coaches
provides an additional level of reinforcement for participation and support through their natural relationship with their clients that should contribute to increased PA adherence and engagement.

Chronic disease self-management programs promote health among those with chronic illness (Lorig, 1996). Elements of these self-management programs include instruction and education in the facilitation of active coping strategies, self-empowerment, condition education, and development of self-efficacy (Loeb, 2003). Using trained HCAs as PA leaders with their clients may successfully bring modified self-management concepts into the home environment to improve the health of frail older adults. Since HCAs have frequent contact with their clients, training these staff to work with their clients to motivate PA participation, provide assistance and feedback on goal setting for health, and facilitate problem solving related to condition management and PA performance is likely to be an effective strategy to reach this high-risk segment of the older adult population. The central theorem of the Socioemotional Selectivity Theory is that older adults prioritize social relationships over the acquisition of knowledge during their remaining years. Knowledge of disease management and a PA program, thus, may not be a priority for CCP clients. Using HCAs to provide knowledge may cause important health education to be better received, leading to higher rates of participation and adherence.

Much of the literature on PA programs for older adults is limited by the short duration of interventions tested. To maintain treatment effects, it is imperative that individuals continue a PA program on an ongoing basis to establish permanent behavior change and experience health and functional status benefits. The social support provided by HCAs, as well as the frequent nature of the client visits, are expected to contribute to
improved program adherence since the close HCA-client relationship has the capacity to facilitate more permanent behavior change.

Figure 1. Theoretical framework for Strong for Life in the Community Care Program

With advancing age, older adults selectively prioritize time to focus on emotional relationships over knowledge acquisition (Carstensen, 1999). Health education provided through a trusted source (the HCA), rather than by an unfamiliar person, should theoretically enhance knowledge uptake as demonstrated by constructs of the Social Cognitive Theory listed below (Figure 2). All constructs are addressed during the HCA training in SFL Improving education regarding the positive health benefits of physical activity and combining this with ongoing social support provided by the HCA will lead to greater client engagement in PA and more permanent PA behavior change.
2. **Type of study**

This pilot study evaluated the feasibility of training HCAs in Strong for Life (SFL) and the ability of this program to be offered within the Community Care Program (CCP). This is a feasibility study in that the delivery model has not been tested with this program before and results will be used to determine parameters such as sample size, willingness of clients and HCAs to be recruited, and characteristics of outcome measure responses that will be used for later efficacy studies. The study is considered a pilot study as this small trial is a miniature version of a future main study whereby it will be determined if processes such as recruitment, randomization, intervention, and measurement can run smoothly. The study used a two-group randomized trial to examine
the effects of translating Strong for Life into the CCP. The study population included two sets of participants: 1) home care aides and 2) CCP clients. Home care aides were first recruited and enrolled in the study. Half were randomly assigned to receive SFL training, and the other half were assigned to a usual care control group. All HCAs recruited at least one client to participate in the study. A total of 56 consent ing clients were enrolled. All client participants were tested at baseline using observed measures of physical performance, as well as self-reported health and self-efficacy for exercise. Home care aides were surveyed regarding their job satisfaction and their evaluation of SFL training. Clients in both groups were provided with a pedometer and instructions to wear it for one week prior to beginning SFL to capture their average amount of ambulatory activity at baseline. During the third and fourth weeks of the program, research staff contacted all intervention group participants to monitor adherence and fidelity to the program. At the end of the 12-week program, all clients were retested on physical performance measures and self-reports of health, self-efficacy, as well as evaluations of SFL. Clients also wore pedometers again for one week’s time to capture average daily ambulatory activity at the end of the physical activity program. All home care aides completed a post-intervention job satisfaction survey and program evaluation.

B. **Statement of the Problem**

Several successful evidence-based community physical activity programs are currently available for older adults such as Fit and Strong!, Enhanced Fitness, and A Matter of Balance. Despite the prevalence of these programs, homebound older adults are often unable to access these facility-based programs. Older homebound adults with MCC are a
population that is significantly in need of PA interventions to maintain their functioning and independence to delay the negative impacts of their comorbid conditions. If this population is able to access a high quality, evidence-based program, it is likely to experience benefits of PA similar to those experienced by other, more healthy, older adults.

C. **Purpose of the Study**

It is well established that PA participation positively benefits older adults in the areas of physical functioning, delayed frailty, and reduced morbidity and mortality (Prohaska, 2006; Hughes, 2011; Guccione, 2011; ACSM, 2009). Strong for Life is an evidence-based PA program originally designed for frail and/or functionally impaired community-dwelling older adults. It is a strength training program that targets sedentary older adults with physical disabilities, and it has produced significant improvements in muscle strength, tandem gait, and functional ability, with high adherence and participation rates and no adverse events (Jette et al., 1996). It was reasonable to assume that chronically ill, homebound older adults participating in the SFL program would also experience these same benefits.

Although SFL has demonstrated benefits in social functioning (Etkin et al., 2006), strength, gait, and disability in the broader community (Jette et al., 1999), it has not been tested with older adult clients receiving home and community-based services. This study addressed this knowledge gap by testing the feasibility of implementing SFL with CCP clients using HCAs as exercise leaders for their clients. This study also explored the feasibility of expanding the job role of HCAs to include SFL leadership. Finally, this study provided preliminary data on the efficacy of SFL with CCP clients.
The study used a mixed-methods approach to examine the feasibility of training HCAs to implement the Strong for Life program with CCP clients. Data on client physical performance, self-rated health, ambulatory activity, and self-efficacy for exercise, along with evaluation information from HCAs and clients regarding the issues involved in implementing SFL in the home was used to explore the utility of a home-based, evidence-based PA program for homebound older adults.

D. **Research Questions**

This study investigated the feasibility of offering the SFL resistance exercise program in the CCP led by HCAs. The specific questions to be addressed in this study are:

1. Is implementing SFL in the CCP using HCAs as exercise leaders feasible?
2. Do older adult clients who participate in the SFL program achieve higher levels of physical functioning, self-rated health, ambulatory activity, and self-efficacy for exercise between baseline and the end of the 12-week intervention compared to the control group?
3. Does HCA job satisfaction change between baseline and the end of the 12-week intervention?
4. Are clients and HCAs satisfied with the SFL program as offered in the CCP?
5. What barriers are encountered and how are they surmounted to facilitate successful program implementation?

1. **Study limitations**

This study was limited to one community partner: Community Care Systems, Inc. of Illinois (CCSI). Although CCSI operates across the state of Illinois, only the Cook County office participated in this pilot. Study participation was limited to those HCAs
employed in the Cook County office of CCSI who spoke English, had at least one client whom they visit at least two days per week, and were willing to participate in training, measurement, and intervention procedures. Client participation in this study was limited to those enrolled in the CCSI CCP in Cook County who were not currently participating in any regular PA defined as 30 minutes of participation at least three days a week, spoke English, and did not have health conditions that contraindicate participation in a PA program. Access to and ability to use video or DVD equipment was also required since the SFL program consists of a 35-minute exercise tape that participants follow while performing the program.

E. **Significance**

Currently, very little effort has been directed at improving the functioning of older adults receiving home and community-based services. There is every reason to believe that these underserved adults will experience benefits in response to PA that are similar to their more healthy older adult counterparts. The benefits of PA participation may help prevent or delay nursing home placement in this population, thus lending credence to the hypothesis that SFL is an effective intervention that can be implemented within the CCP and will promote the health of this population.

Home care aides may also benefit from this program. Program participation could enable HCAs to expand their role beyond that of ADL/IADL assistant to a more active role serving as an agent to promote the health and well-being of their clients. This expansion of job responsibility has the potential to contribute to improved job satisfaction and decreased caregiver burden, burnout, and staff turnover within the CCP.
Beyond the individuals directly involved in this study, other groups are likely to benefit from this work. Given the large and expanding number of older adults in the United States population, public health interventions that reduce the burden of MCC are needed. Many questions also remain regarding strategies to effectively engage frail, older adults in PA programs. This study provided information regarding the feasibility and effectiveness of using HCAs as exercise leaders to provide PA interventions to engage older adults receiving home and community-based services in PA programs. Finally, interventions focused on ADL and IADL preservation for frail older adults have found improvements in self-reported physically healthy days (Barile, 2013). This study collected preliminary data on the efficacy of SFL in improving self-efficacy for exercise, ambulatory activity, self-rated health, and physical performance measures necessary to perform ADL and IADLs.

F. **Summary**

The population of older adults in the United States with MCC is expanding rapidly (Friedman, 2012). There is an urgent need to engage this population in PA programs that can reduce functional impairments, as well as the mitigate the progression and severity of disability. Resistance exercise helps older adults improve strength and muscle power (ACSM, 2009). These strength improvements can lead to preservation and improvement in performance of ADLs and IADLs, reducing the probability for additional care or transition to more supportive living environments.

Since resistance exercise may help contribute to preserve the independence of older adults, investigation into optimal strategies to provide resistance exercise programs for homebound older adults at risk of nursing home placement is needed. This study examined
the feasibility of implementing an evidence-based resistance exercise program, Strong for Life, with homebound older adults in the Community Care Program. Results provide initial evidence on the utility of using HCAs to deliver SFL as a successful, safe, and feasible PA program within the context of the Community Care Program.
II. LITERATURE REVIEW

A. **Introduction**

This chapter provides overviews of the literature regarding 1) the population with multiple chronic conditions, 2) the Community Care Program, and 3) the effectiveness to date of physical activity interventions, specifically resistance exercise for older adults.

B. **Demographics of Population with Multiple Chronic Conditions**

Chronic medical conditions are a growing issue in the United States. Persons with multiple chronic conditions (MCC) make up a significant and expanding segment of the US population. In 2010, half of all US citizens had more than one chronic condition (Ward et al., 2013), increasing to three-quarters among older adults (Friedman, 2012). Advancing age is associated with a greater prevalence of MCC such that 74% of persons between the ages of 65 to 69 have MCC and 88% of those 85 years and older have MCC (Wolff, 2002). Among persons over the age of 65, 61.9% of women and 62.5% of men have two or more chronic conditions. While the prevalence rate of MCC by gender is roughly equal, the larger number of older females in the population (23.0 million compared with 17.5 million men) means that MCC affect a greater number of women in the population. Multiple chronic conditions also disproportionately affect those with lower socioeconomic and minority status (Ward et al., 2013; Ralph et al., 2013). Multiple chronic conditions are an increasing public health burden. Statistically significant increases in the prevalence of MCC have occurred from 2001 to 2010 (Ward et al., 2013). Specifically, the percent of the US population with MCC has risen from 44.7% in 1995 to 47% in 2010 with projections to increase to 49.2% by 2030. These epidemiologic projections indicate that the growing population of older adults
with MCC will require public health intervention in order to age in place successfully. One such example of current public health interventions to address the needs of this population is the State of Illinois Community Care Program (CCP).

C. **Community Care Program**

1. **Home and Community Based Services waiver program history**

   Medicaid Home and Community Based Services (HCBS) waivers were enacted in 1981 as part of the Omnibus Budget Reconciliation Act. The 1915(c) HCBS waivers grant States the option to provide home and community-based non-medical services as alternatives to institutional care (Medicaid, 2014). Currently, more than 1.3 million individuals receive community-based care through a Medicaid waiver (Medicaid, 2014); 55% of these individuals are older adults and/or adults with physical disabilities (Eiken and Lelchook, 2013).

   a. **Illinois 1915(c) waiver**

      Under the 1915(c) waiver, Illinois offers the CCP, which serves over 100,000 elderly at risk for nursing home placement. The purpose of the CCP is to provide non-medical services to help older adults remain living in their home. These services provide a cost-effective alternative to nursing home care and assist older adults in maintaining their independence. Eligible individuals for CCP services in Illinois are those 60 years of age or older who have non-exempt assets of $17,500 or less and score more than 29 points on the Determination of Need instrument that is used to assess whether the individual is eligible for nursing home placement. Services offered through the CCP include case management, home care aides, adult day services, and emergency response systems.
Physical activity (PA) programs are not included within the CCP. Current Illinois spending on the 1915(c) waiver for older adults is 285 million dollars (Eiken et al., 2013).

2. **Illinois state-wide profile of the Community Care Program population**

The average age of a CCP participant in Illinois is 78. Females make up the majority of the CCP population (74%), 60% live alone, and 60% reside in Cook County. Roughly half (51%) of participants are white and 36% are black. However, in Cook County, the CCP population is 58% black and 24% white. By service, 62% of CCP clients receive HCA services only while an additional 24% receive HCA services and emergency home response (Health and Medicine Policy Research Group Center for Long-Term Care Reform, 2009). Client DON scores increase with age with the greatest number of IADL impairments occurring in the tasks of performing laundry, housework, meal prep, and mobility outside the home. These IADL deficits are the most significant predictor of the need for HCA utilization (Health and Medicine Policy Research Group Center for Long-Term Care Reform, 2009). Bathing is the most frequent ADL impairment requiring the need for HCA assistance.

D. **Problems Unique to Populations with Multiple Chronic Conditions**

As defined by Warshaw, multiple chronic conditions are “conditions that last a year or more and require ongoing medical attention and/or limit activities of daily living” (2006). Multiple chronic conditions contribute to the unique health needs of the affected population including fluctuating health status, healthcare coordination difficulties, and higher rates of morbidity and mortality. Each is discussed below.

1. **Fragile health**

The presence of MCC is associated with fluctuating and more rapid declines in health status (Wolff, 2002). While variable illness trajectories occur within specific
conditions, overall presence of MCC worsens health outcomes and contributes to decreased life expectancy (Lunney, 2003).

MCC influence both morbidity and mortality. The number of MCC is associated with increasing mortality rates. In a study of 52,306 older adults with MCC, the relative risk of death over a five-year follow-up period was 4.07 for those with four or more conditions compared with a relative risk of 1.45 for those with only one condition (Lee et al., 2007). Age-adjusted mortality rates vary by the type of chronic condition from 2.94% for the dyad of hypertension and osteoarthritis to 40.41% for cancer and COPD (Lee et al., 2007). This finding indicates that the type of chronic conditions rather than the number of conditions alone has a significant impact on mortality.

Increased numbers of chronic conditions are associated with an increased risk for hospitalization, increased numbers of emergency room and physician office visits, and greater utilization of home health services (CMS, 2012). Medicare expenditures per capita rise substantially with additional numbers of conditions as evidenced by an annual per capita Medicare cost of $2,025 among individuals with zero or one chronic conditions versus $5,698 for older adults with two or three chronic conditions and $32,658 for individuals with six or more chronic conditions (CMS, 2012). Persons with two or more chronic conditions represent 65% of Medicare beneficiaries, yet comprise 95% of Medicare expenditures (Wolff, 2002). These statistics show the cumulative effect of MCC on increasing healthcare costs via the increased need for providers, medications, and other healthcare services.

Multiple chronic conditions also significantly affect older adults by increasing functional impairments and reducing independence. Fifteen percent of Medicare
beneficiaries with MCC have functional limitations as defined as the need for physical assistance with at least one of five ADLs (toileting, transferring, eating, dressing, bathing) (Komisar and Feder, 2011). This group of Medicare beneficiaries account for 32% of total Medicare spending (Komisar and Feder, 2011). Average Medicare spending for those with MCC and functional limitations is double the spending for those with MCC but no functional limitation (Komisar and Feder, 2011). These findings underscore the costly nature of the combined effects of MCC and functional limitations versus MCC alone and support the need to address functional limitations in this population to help reduce healthcare expenditures.

The combination of MCC with functional limitations also leads to increased hospitalization costs. Individuals with two or more MCC and ADL difficulty are 13% more likely to be hospitalized compared to older adults with MCC and no functional limitations (Fried, 2004). The combined impact of MCC and corresponding functional limitations creates high healthcare utilization, increasing expenditures and rendering this population significantly in need of cost-effective interventions to promote functional improvements and improve health.

2. **Coordination of care problems**

Older adults with MCC face worse health outcomes, in part, due to coordination of care difficulties (Wolff, 2002). Persons with MCC often see multiple providers across different care settings (Chen et al., 2000). The medical healthcare model has traditionally focused on the management of single conditions, which contributes to errors or leads to care omissions for those with MCC (Nolte et al., 2008; Wolff, 2002). There is also an increased potential for delayed care for those with MCC due to greater difficulties
navigating health systems and the different insurance payers often used for those with multiple health problems (Mollica and Gillespie, 2003).

a. **Risk for hospitalization**

Coordination of care challenges increase the likelihood of otherwise avoidable hospital admissions. Increasing numbers of chronic conditions are associated with incremental increases in the rate of preventable hospital admissions. Wolff and colleagues found that older adults without any chronic conditions had a preventable hospital admissions rate of 1.0 per 1,000 beneficiaries (2002). This rate increased to 19.5 per 1,000 beneficiaries in older adults with two chronic conditions. For those with three chronic conditions, this rate doubled, and for those with 10 or more chronic conditions, the rate was 362.5 per 1,000 beneficiaries. Medicare beneficiaries with two or more chronic conditions accounted for 98% of hospital readmissions in 2010, with 70% of these occurring in the group of beneficiaries with six or more chronic conditions (CMS, 2012). These rates signify the substantial increase in hospitalization that occurs as greater numbers of chronic conditions negatively affect health.

While research has shown that the type of conditions rather than the total number of conditions is more predictive of mortality risk, the findings of increased hospitalization rates as the number of chronic conditions increases point to the complexity of this population. With a single or dyad chronic condition, there is a greater likelihood that interventions can successfully treat or reverse disease progression. As older adults have larger numbers of conditions, the cumulative effect of both type of condition and the systemic effects of multiple conditions creates care complexities, increased care needs, and a more fragile health status that causes older adults to be at greater risk for hospitalization.
Proactive interventions to minimize these risks and avoid unnecessary hospitalizations are needed to promote health effectively in this population.

b. **Risk for nursing home placement**

Multiple chronic conditions are associated with physical impairments that often affect the ability of older adults to perform IADLs and ADLs. As older adults progressively decline on the hierarchy of ADLs, the need for caregiving assistance increases. This care is provided through either formal or informal caregiving services with high financial costs, or through nursing home placement, which has a high financial expense, as well as associated psychosocial costs.

The Older Americans Act defines physical disability as an impairment or impairments that limit participation in major life activities such as self-care, mobility, or the ability to live independently (Fried et al., 2004). Multiple chronic conditions are associated with the development of these types of impairments (Fried et al., 2004), the severity of which often increases over time (Parekh, 2011). Greater severity of functional limitations associated with MCC leads to a higher likelihood of participation restrictions in self-care and mobility. These restrictions are significant because they are associated with an increased risk of nursing home placement (Gaugler et al., 2007).

A meta-analysis of nursing home predictors by Gaugler and colleagues found that older adults with one ADL impairment had a 1.88 odds ratio of nursing home placement (2007). The presence of one or two ADL impairments is associated with an odds ratio of nursing home placement of 2.45. With three or more ADL impairments, the odds ratio of nursing home placement increases to 3.25 (Gaughler et al., 2007). This work substantiates
the importance of preserving ADL abilities for this population to prevent nursing home admission.

Activities of daily living items comprise a hierarchy ranging from easiest to most difficult in the order of eating, continence, transferring/locomotion, toileting, dressing, and bathing (Morris et al., 2013). Given this continuum of difficulty of ADL tasks, intervening proactively through early identification, ideally when a person only has a single high level ADL impairment, has the potential to significantly reduce the risk of further functional decline. This preservation of function in ADLs can also be expected to contribute to improved healthcare outcomes and decreased healthcare costs.

c. **Significance of consequences of multiple chronic conditions**

Multiple chronic conditions can also influence an older adult's perception of aging and reports of well-being. Rowe and Kahn's seminal work argues that the absence of disability and physical illness are requirements for successful aging (1987). However, many older adults consider themselves to be aging successfully despite medical conditions (Friedman, 2012). This paradox was substantiated by Strawbridge et al., who found that one quarter of older adults with three or more conditions report successful aging, while one-third of those without any chronic conditions report not aging successfully (2002). The Strawbridge study supports the hypothesis that successful aging is possible in the presence of disability or chronic illness. Therefore, there exists a complex relationship between MCC and self-perceptions of aging that requires greater investigation to determine the mediators of this relationship and the factors that enable persons with MCC to age successfully.
An important construct of successful aging is self-reported health-related quality of life. Increasing age has been associated with a decreased quality of life, especially when a person has greater than six medical conditions and long-standing illness (Barile, 2012). A cross-sectional survey of older adults in Great Britain found that quality of life was negatively associated with long-standing illness, self-care deficits, social participation limitations, and ADL difficulties (Paul et al., 2007). These studies suggest that the presence of MCC alone does not directly decrease quality of life, but rather the long-standing nature of chronic conditions and their impact on functioning and social roles more substantively impact quality of life.

In addition to impacting quality of life, MCC also influence successful aging through the construct of self-rated physical health. While quality of life measures capture greater information related to mental health due to the overall construct of well-being that is tested in quality of life measures, self-rated health measures capture greater information about physical functioning (Smith, 1999). Self-rated health is negatively associated with the number of MCC (McDaid, 2013). Among adults with no chronic conditions, only 11.9% rated themselves with poor health. In contrast, 89.5% of adults reporting four chronic conditions rated themselves as having poor health (McDaid, 2013). While the overwhelming majority of persons with four chronic conditions stated their health was poor, less than half (47.2%) of this group identified themselves as having poor quality of life. This study provides evidence that older adults can maintain high quality of life, despite poor health if factors such as minimal impact on functioning and the preservation of social roles and identity persist. Since the chronicity of conditions and interactive effects of multiple diseases alter quality of life, interventions designed to address functioning and
social participation may help to maintain quality of life in the populations with MCC, rather than intervening on the disease alone.

E. **Importance of Intervention for this Population**

Young, Frick, and Phelan have theorized that quality of life can be maintained and successful aging can occur despite the presence of multiple comorbidities (2009). Reliance on strategies such as coping, adaptation, resilience, and spirituality may maintain or even improve health for the population with MCC (Young et al., 2009). Findings from this study are important because they indicate that this population is capable of responding to intervention, thereby encouraging the development and testing of interventions for these individuals.

1. **Characteristics of successful interventions for this population**

   Because the literature regarding interventions for the population of older adults with MCC is in its infancy, many questions remain regarding the exact or ideal formula for effective interventions for those with MCC. However, it appears that successful interventions share some commonalities, and these aspects are important to include and further test in public health interventions.

   a. **Multicomponent interventions**

   The US Preventative Services Task Force has stated that multicomponent interventions are promising for use with adults with MCC (2002). Because this population has multiple medical issues, multicomponent interventions with a broader focus may be more able to readily address the range of deficits that older adults with MCC have. Gitlin and colleagues found that a multicomponent intervention targeting multiple
mutable environmental and behavioral factors in a population with MCC successfully created and maintained improvements in quality of life for up to one year following the intervention (2006). These findings indicate that successful interventions need to be multidimensional in order to fully address the broad needs of the population with MCC.

b. **Focus on activities of daily life preservation**

Maintaining independence by decreasing the extent of ADL limitations is of great relevance to the population with MCC given their risk for nursing home placement and the correlation between ADL limitation and institutionalization. However, research findings regarding the ability of physical activity interventions to successfully decrease ADL impairments are inconsistent. A systematic review of 62 studies found that resistance training alone does not decrease the risk of ADL disability in frail older adults (Latham et al., 2004). A later Cochrane review of 121 studies concluded that resistance training does reduce ADL disability (Liu et al., 2009). However, neither study stratified results by the severity of participant frailty, which may have biased findings. Specifically, Gill and colleagues concluded that ADL disability can be decreased through interventions focusing on preservation of ADLs for those with moderate but not severe levels of impairment (Gill et al., 2004; Gill et al., 2002).

These findings highlight an important limitation of the current research, which is the lack of stratification by level of disability. The key finding is that interventions likely do not work equally for all levels of disability; therefore, exercise prescription focusing on task-specific and impairment-specific training is vitally important to prevent functional decline. Ineffective interventions or interventions performed too late in the disease course
may not lead to reduction in ADL disability, and preservation of function will not be maintained.

c. **Development of self-efficacy**

Self-efficacy helps older adults with MCC cope with their chronic diseases. Self-efficacy is a person's belief that he or she can carry out a behavior in order to reach a self-determined goal. The person's degree of self-efficacy is beneficial in helping the individual reach that goal (Rimer and Glanz, 2005). Self-efficacy is not a general feeling, rather it is a person’s confidence that they can achieve an expected outcome related to a task or behavior that is context specific (Bandura, 1997). An important component of self-efficacy theory is that the stronger the individual’s belief in his or her own abilities, the more likely he or she will be able to initiate and maintain a given behavior (Lee, 2008). Thus, self-efficacy plays a significant role in motivating and sustaining health behavior change.

d. **Embedding of elements of the Social Cognitive Theory**

The Social Cognitive Theory (SCT) developed by Bandura is often suggested as a successful framework for understanding how older adults cope with chronic disease and make positive behavioral choices. Social Cognitive Theory posits that relationships between personal, environmental, and behavioral factors are influential in determining behavior change and behavior choices (Goran, 2006). Within SCT, behavior change is driven by the individual's self-efficacy, personal goals, and outcome expectations. In contrast to the belief that the environment shapes behavior, SCT focuses on the extent to which thought processes and behavioral factors influence and intervene on the environment, as well as the environment’s influence on personal and behavioral factors.
According to SCT, behavior change is driven in phases (Rimer and Glanz, 2005). The first phase is the promotion of the desired behavior. Then, skills to acquire the desired behavior are provided. Networks are developed to help maintain the desired behavior, and over time, reinforcements help to ensure adherence to the behavior change. The last step is generalizing the behavior change across all levels of environmental and relationship interaction. Self-efficacy or the context-specific belief about one’s personal abilities is embedded in all phases of the model.

e. **Incorporation of social support**

Defined as “the emotionally sustaining qualities of relationships (e.g., a sense that one is loved, cared for, and listened to),” social support has direct and indirect effects on health (Umberson, 2010). Social support can be provided via multiple mechanisms: instrumental support helps with tasks, informational support provides advice, and emotional support provides the feeling of being cared for (Umberson, 2010). The literature overwhelmingly substantiates the positive physical and mental benefits of social support in reducing stress, creating a better sense of life purpose, improving personal control, and physiological effects including reductions of stress hormones and blood pressure (Umberson, 2010).

Social support improves health access and advocacy for quality care in populations with MCC. Individuals with MCC tend to participate less effectively in their own care programs (Vogeli, 2007). Social support provides needed encouragement to aid older adults with MCC to take greater initiative managing their own health and lifestyle behavior decisions. The presence of MCC has been associated with an external locus of control, with this effect more pronounced in females than in males (Henninger, 2012). Social support
may help to promote an enhanced internal locus of control by empowering older adults to become more active agents in their own disease management. This, in turn, is likely to lead to improved self-efficacy and behavior change.

Social support also works to decrease the impact of stressful situations by providing support to face difficult situations (Cohen and Syme, 1985). This is important because persons with MCC often face disease exacerbations, hospitalizations, and transitions in care. Social support also buffers the effects of disability by strengthening the “environmental mat” upon which an older adult stands (Putnam, 2002). The environmental mat theory posits that the amount of disability a person experiences is related to the strength of their environmental supports in physical, social, and cultural terms. Support across these multiple contexts strengthens the ability of the older adult to maintain health and age successfully in the presence of disease fluctuations. Social support also promotes well-being as suggested by the direct effects hypothesis (Gorin, 2006). This theory states that social support is present in social relationships at all times, and the security of knowing that social help will be there whenever needed promotes well-being (Gorin, 2006).

Social support is important for older adults with MCC because social support is a significant important predictor of physical activity levels and self-efficacy (Anderson-Bell, 2011). Just as self-efficacy for PA predicts actual PA (Bozoian, 1994; McAuley and Courneya, 1992; McAuley 1994), increased social support should theoretically drive increased participation and adherence to PA programs.
F. **Theoretical Framework for Strong for Life in the Community Care Program**

Jette et al. used constructs from SCT in their original development of Strong for Life. This dissertation pilot study extends this framework to focus on social support from home care aides as a means to provide observational learning (modeling) opportunities to enhance self-efficacy for PA with their clients leading to increased participation in a resistance-training PA program (Strong for Life).

G. **Resistance Exercise for Older Adults**

Aging is associated with a loss of muscle mass and strength. Loss of muscle mass occurs due to atrophy of muscle fibers, as well as degeneration of motor neurons in the spinal cord (Kryger, 2007). These losses can have profound consequences for older adults because the loss of strength and muscle power contributes to functional deficits (such as reduced gait speed or inability to walk community distances) and the loss of independence in ADLs and IADLs (Rollan, 2008; Reid, 2008). However, it is well established that resistance exercise can counteract age-related changes in muscle tissue and can lead to improvements in muscle strength, reduction of functional limitations, and preservation of function (ACSM, 2009).

The American College of Sports Medicine (ACSM) resistance exercise guidelines are rated as evidence level A that older adults can increase their strength and muscle power as a result of resistance training (2009). Resistance exercise can be divided into constructs related to muscle strength, power, and endurance. Older adults are capable of improving strength with increases reported from less than 25% to greater than 100% as a result of training (ACSM, 2009). However, strength improvements are likely influenced by age,
gender, duration of the intervention program, and the type of training employed (ACSM, 2009).

<table>
<thead>
<tr>
<th>Construct</th>
<th>Description</th>
<th>Specific way SFL targets this construct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reciprocal determinism</td>
<td>Dynamic interactions between the environment, person, and behavior</td>
<td>Home care aides promote exercise in home environment. Increased strength makes ADL tasks easier to perform.</td>
</tr>
<tr>
<td>Behavioral capability</td>
<td>Knowledge and skills to perform a behavior</td>
<td>Home care aides promote mastery learning along with VHS/DVD.</td>
</tr>
<tr>
<td>Expectations</td>
<td>Anticipated outcomes of a behavior</td>
<td>Home care aides facilitate discussion regarding benefits of strength training.</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>Confidence in ability to take action and overcome barriers</td>
<td>Home care aides facilitate goal setting to create small, feasible behavior changes. Home care aides create behavioral contract with clients. Home care aides monitor and reinforce participation.</td>
</tr>
<tr>
<td>Observational learning (modeling)</td>
<td>Behavioral outcome from watching the actions and behaviors of others</td>
<td>Home care aides are credible and valued role models who perform the targeted behavior. Strong for Life video uses older adults to model successful performance of exercise routines.</td>
</tr>
<tr>
<td>Reinforcements</td>
<td>Responses to a behavior that change the likelihood of reoccurrence</td>
<td>Calendar provides visual reward and incentive. Home care aides provide positive verbal reinforcements for participation.</td>
</tr>
</tbody>
</table>
Interventions that address muscle power (force and velocity) versus those that simply focus solely on muscle strength (force) are likely to be of greater benefit to the elderly. The use of higher-velocity training programs has been successfully implemented in the elderly population. Sayers and Gibson investigated the use of a 12-week high-speed power training program compared with a traditional resistance exercise program for 72 older adults with mean age 70 (2010). Participants in the high-velocity training program improved significantly in peak power velocity and overall peak velocity compared with a traditional resistance training program. This finding suggests the need to consider velocity of movement in exercise prescription to address muscle power deficits to promote strengthening in older adult populations.

Muscle endurance relates to the ability to generate repeated contractions over time. Although endurance enables people to participate in longer duration activities, ACSM recommendations for this aspect of muscle performance are graded “C” due to low levels of evidence and findings that suggest that lower intensity training does not improve endurance to the extent that higher intensity training programs do (2009).

The ACSM recommends performing resistance exercise at least two days per week at a moderate to vigorous intensity with eight to 10 exercises involving eight to 12 repetitions each as well as functional activities such as stair climbing that use major muscle groups. No recommendation is given regarding the mode of resistance training.

In summary, the literature supports the efficacy of progressive resistance exercise training for healthy older adults at an intensity of 40-80% of one repetition maximum completed two or three times per week to improve strength and delay or reduce functional
decline. It is unknown if this is the optimal exercise prescription for all populations of older adults, including those with frailty or mobility limitations.

1. **Resistance exercise for frail, homebound older adults**

Frail older adults are likely to reap the same benefits from resistance exercise participation as their healthy counterparts; however, the degree of improvement or benefit may be muted. Liu and Latham’s 2009 Cochrane Review on progressive resistive exercise for older adults found a larger effect size for healthy versus frail older adults. However, this result is likely confounded by the fact that frail older adults exercised at a lower intensity than healthy older adults.

A meta-analysis of the effectiveness of resistance exercise training found significant increases in muscle strength as a result of training, but effectiveness differed between frail versus non-frail older adults (Martins, 2013). Overall improvements in muscle strength were found across all elderly subjects, but healthy older adults had a greater effect size in comparison to older adults with functional incapacity (1.30 vs. 1.01). Brill and colleagues investigated the use of free weight resistance training for older adults in a continuing care retirement community (1998). After eight weeks of training, statistically significant improvements were found for grip strength, six-meter walk gait times, chair rise, stair climb, and static balance tests. These positive results suggest the effectiveness of resistance training in creating strength gains for older adults with functional impairments.

Cadore investigated the benefits of a two time per week, 12-week resistance exercise program for frail older adults with a mean age of 93, and found statistically significant improvements in gait speed, Timed Up and Go (TUG), 30-second chair rise, and
incidence of falls. Intervention group subjects also had corresponding increases in isometric strength and muscle cross-sectional area.

While numerous studies have examined progressive resistance exercise training for frail older adults, frailty is not synonymous with being homebound. There is a paucity of research on the effects of resistance training for homebound older adults. Weewing-Dijksterhuis’s systematic review of exercise training for older adults residing in long-term care or in a nursing home found nine randomized controlled trials that measured strength. Of the nine, four found very strong or strong effects in improving strength through progressive resistance exercise. Stolee et al. investigated a volunteer-led, home-based exercise program. The average age of subjects was 80, and 28 out of 32 participants had at least one chronic condition. Volunteers led elders in the VON SMART in-home exercise program. Statistically significant improvements were found in the 30-second chair rise, Berg Balance Scale, Activities Balance Confidence Scale, ADL and IADL limitations, and Forward Reach Test. An interesting aspect of this study was that participants reported increased motivation and adherence as a result of the volunteer visit to their home each week. This study demonstrates the ability of resistance exercises to be effective with homebound participants, as well as the important role that social support for exercise has in improving self-efficacy and contributing to increased exercise adherence.

In summary, this body of literature shows that older adults with some degree of disability are likely to benefit from resistance exercise. However, the magnitude of improvements possible may be reduced compared with healthy older adults. Homebound older adults may benefit from resistance programs completed in the home to the same degree that non-homebound older adults benefit from programs completed in the
community. However, questions remain regarding the effectiveness of resistance training for older homebound adults with MCC due to a paucity of studies with this specific population. The proposed study addresses this gap by providing data on the feasibility of resistance exercise participation for this population, as well as information regarding health changes that may occur in response to a resistance exercise training program. These findings will contribute to the development of optimal exercise programs that can be offered for homebound older adults.

2. **Strong for Life**

   Strong for Life is an evidence-based resistance exercise program originally designed for frail and/or functionally impaired older adults. Participants have shown significant improvements in muscle strength, gait stability, and functional ability, with high adherence and participation rates and no adverse events (Jette et al., 1996). The SFL program consists of a 35-minute video of a resistance exercise routine that includes a warm up, 11 upper and lower extremity resistance exercises that use Therabands for major muscle groups, and a cool down. Cognitive behavioral strategies embedded within the program include a motivational video, positive reinforcements, and behavioral incentives. Enrollees in SFL are encouraged to exercise at least three times per week and to progressively increase the difficulty of the Theraband resistance bands used.

   a. **Strong for Life research**

      Originally designed in 1996, the initial SFL trial included 92 non-disabled, community-dwelling older adults aged 66 to 87. Average adherence rates were 58%, and most participants reported completing two sessions of the program per week. Researchers found significant improvements in knee extensor strength, self-reported vigor,
self-reported anger for males, and social functioning (Jette et al., 1996). Greater levels of improvement in functioning and adherence were found in younger subjects and in male subjects.

A follow-up study completed by Jette et al. in 1999 investigated the effects of SFL for 107 older adults. Physical therapists completed two home visits to instruct older adults in the program. Adherence rates were 89%, and statistically significant improvements were seen in strength, disability, and gait stability. For this iteration of the program, cognitive behavioral strategies were embedded in the program instruction, leading researchers to hypothesize that this enhancement contributed to improved adherence rates.

More recently, researchers found that SFL could be successfully implemented within Faith in Action sites using trained volunteers. Etkin et al. had physical therapists train volunteer trainers in SFL (2006). The volunteer trainers then implemented the program with older adult participants. Researchers found that adherence to the exercise program was good with participants reporting exercising 2.2 times per week, volunteer trainers were capable of being trained in SFL, and SFL could be implemented safely with frail older adults.

H. **Conclusion**

As this review of the literature demonstrates, older adults with MCC are a population amenable to change through multi-component interventions that focus on preservation of function rather than simply reduction of number of chronic diseases. To enhance and sustain behavior change, elements of self-efficacy and social support are
necessary to promote positive coping strategies, empowerment, and adherence to interventions.

Many questions remain regarding the optimal interventions and ways to implement programs for homebound older adults with MCC. Information regarding the efficacy of resistance training will provide needed information regarding the optimal exercise prescription for this population. Furthermore, understanding how to best optimize environmental and personal supports to promote behavior change will help to ensure lasting behavior change.

Investigations of novel strategies to address the link between physical health, quality of life, and the ability to prevent or delay nursing home placement to promote independence for the population of older adults with multiple chronic conditions are needed. Since many older adults with MCC are unable to safely or easily access beneficial community services, there is a significant need to investigate strategies with which to reach this vulnerable segment of the population. Knowledge of the feasibility of training home care aides in SFL as a mechanism to provide an evidence-based resistance exercise program directly in the home can be used to design an optimal program of services that should be offered to clients in the Community Care Program.

Specific to this pilot, little is known about the feasibility to train HCAs to instruct clients to use SFL; whether and how homebound clients will participate in SFL; and the ability of homebound clients to demonstrate strength and/or functional changes with SFL, especially considering that SFL does not focus on muscle power or closed-chain, functional exercises. This pilot will address these specific gaps in the current literature by addressing the following important questions:
1. Is implementing SFL in the CCP using HCAs as exercise leaders feasible?

2. Do older adult clients who participate in the SFL program demonstrate trends showing improvement in physical functioning, self-rated health, ambulatory activity, and self-efficacy for exercise between baseline and the end of the 12-week intervention?

3. Does HCA job satisfaction change between baseline and the end of the 12-week intervention?

4. Are clients and HCAs satisfied with the SFL program as offered in the CCP?

5. What barriers are encountered and how can they be surmounted to facilitate successful program implementation?
A. **Introduction**

This chapter presents the research design, procedures, measures, data collection, and data analysis. The primary goal of this pilot was to evaluate the feasibility of training HCAs to implement SFL with their homebound clients. I hypothesized that implementing SFL in the CCP would be feasible based on previous work that indicated that frail older adults can safely participate in PA programs (Gine-Garriga, 2014) and that lay caregivers can safely administer exercise for older adults with disability in the home (Steinberg, 2009; Etkin, 2006).

The secondary goal of this pilot was to determine the effects of SFL on older adult CCP clients. I hypothesized that clients participating in SFL would demonstrate trends showing positive improvements in physical performance measures, self-efficacy for exercise, self-rated health, and ambulatory activity at week 13 compared to a no treatment control group.

The final aim of this study was to examine the ability of HCAs to implement and lead SFL safely with their clients, and the impact of expanded work responsibilities on HCA job satisfaction. I hypothesized that increasing HCAs’ knowledge and skills would lead to improved perceptions of their significant role in maintaining their clients’ health, thereby contributing to improved job satisfaction.
B. **Research Design**

1. **Design**

   The design used in this study was a randomized clinical trial with pre- and post-test measures as shown in Figure 3 (Appendix E).

2. **Study population**

   The two populations examined in this study were older adults enrolled in the CCP and HCAs who provide services to them within the CCP. The sampling frame for this study was HCAs employed by CCSI who provide care to older adults enrolled in the CCP in Cook County. Non-probability, purposive sampling was used in order to identify a subset of the HCAs who had clients for whom they made a minimum of two visits per week and were willing to participate in a randomized trial.

3. **Setting and recruitment**

   a. **Participating site**

      The CCP provides cost effective services to help older adults maintain their independence in their homes as an alternative to nursing home placement. Community Care Systems, Inc. of Illinois serves individuals enrolled in CCP and is the partner agency site for implementation of this study. The CCSI Cook County office employs approximately 250 HCAs and was the site of HCA and client recruitment for the study.

   b. **Eligibility criteria**

      1) **Home care aides**

         Inclusion criteria for HCAs included primary English speaking, having one or more clients whom they visited two or more days per week, employed by the
CCSI Cook County office, and willingness to participate in measurement and intervention procedures.

2) **Clients**

Inclusion criteria for clients included primary English speaking, access to video or DVD equipment, no current participation in regular exercise, no other health problems that contraindicated participation in PA as determined by the EASY: Exercise and Screening for You (Resnick, 2008), age > 65 years, and willingness to participate in measurement and intervention procedures. If a client screen indicated need for physician consent based on the EASY screen results, a completed, signed physician consent was required for study inclusion. The EASY was developed out a concern that mandatory, medical screening prior to physical activity initiation is a significant barrier for older adults, especially as research supports that this population can complete low to moderate level physical activity safely without prior medical clearance (Resnick, et al., 2008). This screening tool was utilized in this study to identify those clients with serious medical conditions who would benefit from a primary health care evaluation to determine the safety and their enrollment in physical activity. If this medical condition was a chronic problem that had previously been evaluated, it is likely that the older adult can safely begin a physical activity program with modifications and tailored physical activity advice, thus allowing older adults who can benefit from physical activity greater ease and access to programming.
c. **Recruitment**

Recruitment occurred in two stages. First, I recruited HCAs. Once individual HCAs were enrolled in the study, recruitment of those enrolled HCAs’ clients occurred.

1) **Home care aides**

I recruited HCAs (n=32) from the CCSI office to participate in the study via flyers mailed to all HCAs and through presentations at staff in-services. Prospective HCA subjects contacted research staff for a telephone screen to ensure eligibility. Those HCAs determined eligible on telephone pre-screening were notified of the training date and signed informed consent prior to the training session.

2) **Community Care Program clients**

I sent recruitment flyers to all clients in the eligible HCA caseloads. Flyers directed interested clients to call the research hotline for a telephone pre-screening. Based on telephone pre-screening, if a client required physician clearance as determined by the EASY, research staff faxed the client’s physician using a private, secure machine under the investigator’s control in order to minimize the risk of any breaches of privacy and/or confidentiality. If the client passed the telephone pre-screening, research staff contacted the client to set up a time for an in-home meeting to discuss more specific information about the program, sign the informed consent, and participate in baseline physical performance measures and survey questionnaire completion.

d. **Randomization**

The HCA was the unit of randomization for this study. Randomization sequences were determined by blocking the number of client service hours in five
categories (4-10, 11-15, 16-20, 21-25, and 26 or greater hours) such that 50% of client subjects in each category were assigned to the control group. I stratified by client hours as a proxy for the severity of the client’s functional impairments. Clients are assessed at CCP entry for ADL and IADL impairment and allocated service hours reflect these impairments such that higher hours are associated with greater functional impairments. I used a Matlab computer program that guaranteed a 50/50 split in each cell. Group allocation was uneven between randomization and the beginning of the intervention, as five clients were determined to be ineligible due to no longer receiving CCP services or changes in their HCA. Post randomization, two HCAs in the intervention group did not show up for training and were subsequently not enrolled in the study.

e. **Training**

Home care aides randomized to the intervention group were trained to lead SFL with their clients. The half-day training provided information about SFL, opportunities for HCAs to receive hands-on experience performing the SFL program, and instruction in how to monitor, progress, and motivate client physical activity. At the conclusion of training, I evaluated the HCAs’ competence in leading SFL with their clients by evaluating their performance in leading and correcting exercises. Training provided HCAs with all information regarding the study and contact information for research personnel should any questions or concerns arise. Home care aides also completed the Job Descriptive Index questionnaire regarding their current job satisfaction and an evaluation of the SFL training program. Home care aides randomized to the control group were provided with a half-day training on workplace ergonomics and back safety training. These
HCAs also completed the Job Descriptive Index regarding their current level of job satisfaction.

f. **Intervention**

Strong for Life is an evidence-based resistance exercise program developed and tested at the Boston University Roybal Center and MGH Institute for Health Professions. Home care aides and clients were instructed to perform this program three times per week for 12 weeks. Home care aides introduced SFL to their clients at the first session by teaching clients how to operate the VHS/DVD player, watching clients perform SFL exercises along with the video instruction, and providing feedback on successful exercise technique. Home care aides worked with clients to determine the initial level of Theraband resistance that should be used and instructed clients to track program adherence with a calendar log. During week two, HCAs again led clients more directly in performing the 35-minute SFL program with the video tape, corrected exercise technique, and answered clients’ questions or concerns about the previous week of exercise activity. Home care aides led SFL directly with their clients two times per week for the first two weeks and then encouraged participation at every usual care visit for the remaining ten weeks. Throughout the course of the study, HCAs were instructed to communicate pertinent client concerns to research staff and to motivate their clients to perform SFL at each regularly scheduled client visit. During weeks three to 12, HCAs were instructed to encourage their clients to increase the resistance band difficulty once clients were capable of performing 10 repetitions of an exercise with ease. Home care aides randomized to the control group performed usual care that did not include PA coaching with their clients.
g. **Compensation**

Home care aides were paid $20 per hour for the four-hour Strong for Life training and $10 per session to lead their client in SFL twice a week for the first two weeks for a total of $120. Clients were paid $10 for participating in baseline performance measure testing and $10 for follow-up measurement.

C. **Data Collection and Outcomes**

1. **Procedures and data collection**

Data collectors for this study included two research assistants (Master’s of Public Health candidates). Research staff were trained on the study protocol, informed consent, participant screening, protocol for participant compensation, and assessment of physical performance measures.

a. **Procedures for home care aides**

Home care aides completed a brief telephone screen to determine eligibility. Informed consent forms were distributed to eligible HCAs immediately prior to the training session. Home care aides were randomized prior to the training session and received notification on group assignment upon arrival for the training session. Home care aides randomized to the intervention group received SFL training, and HCAs randomized to the control group received workplace ergonomics and back safety training. The half-day training session was held at UIC on different floors of the Institute for Health Research and Policy. Upon check-in at UIC, HCAs received an opaque envelope that directed them to a room location for their assigned training.
b. **Home care aide data collection**

Home care aides who completed SFL training completed an on-site SFL training evaluation survey immediately following the training session. All HCAs in both groups completed baseline job satisfaction questionnaires prior to their respective training sessions. Follow-up HCA job satisfaction questionnaires were distributed during week 13 in person to all HCAs.

c. **Procedures for Community Care Program clients**

After clients were determined eligible on the telephone screen, research staff met with clients in their homes to obtain informed consent, administer questionnaires, and complete physical performance measures. For those clients deemed to require physician approval for participation, research staff contacted the clients’ physicians to obtain a signed physical activity clearance form prior to the client enrollment. One week before the SFL intervention started, research staff distributed Omron pedometers to all treatment and control group clients. Clients were asked to wear the pedometer for a one-week observation period. Research staff collected pedometers and data were uploaded for analysis. Home care aides were given all SFL materials at the training session and distributed those to their clients. Following the 12-week intervention, research staff distributed pedometers to all clients with instructions to wear them for an additional one-week observation period. Following the observation period, research staff conducted follow-up performance measure testing on all clients. After the performance measures were collected, an unblinded data collector administered SFL program evaluation.
d. **Fidelity assessment**

Research staff monitored SFL program fidelity to ensure that HCAs and clients performed SFL as intended and to note modifications that occurred with implementation in the client’s home. Research staff contacted all treatment group clients to schedule a fidelity visit during weeks three and four. Research staff attended one SFL session in each client’s home to monitor program content fidelity using a fidelity checklist. If research staff noted any inappropriate modifications or safety issues, HCAs and clients received follow-up education to correct the deficiency.

2. **Study measures**

a. **Outcome measures**

This study sought to assess the feasibility of providing SFL in the CCP with HCAs serving as trainers for their homebound clients. As outlined by Bowen et al., feasibility studies investigate elements of acceptability, demand, implementation, practicality, adaptation, integration, expansion, and limited-efficacy testing of a public health program (Bowen et al., 2009). Outcome measures in this study addressed all of these feasibility domains as shown in Table II.

b. **Acceptability**

Acceptability is the extent to which the involved participants in a program react to an intervention (Bowen, 2009). In this study, acceptability was defined as the extent to which HCAs and CCP clients judged SFL to be suitable, satisfactory, and appealing. Client and HCA program evaluation surveys were used to document the acceptability of SFL within the CCP. Home care aides rated their level of satisfaction with SFL and answered open-ended questions regarding the perceived benefits of and barriers
to implementing this program with their clients. Home care aides also were asked whether SFL training adequately prepared them to lead SFL with their clients, and if SFL should be offered within the CCP in the future. Clients rated their satisfaction with SFL and answered open-ended questions regarding the benefits and barriers of implementing SFL in their homes. Clients also provided information on their satisfaction with having their HCA provide SFL training in addition to their usual care. Home care aides and clients were instructed to contact research staff with any adverse reactions. Rates of adverse reactions provided additional information regarding client response to SFL. Together, these data provided information from both HCAs and CCP clients about program satisfaction, perceived appropriateness, and intent to continue with SFL.
### TABLE II
FEASIBILITY CONSTRUCTS, STRONG FOR LIFE OUTCOMES, AND MEASUREMENT METHODS

<table>
<thead>
<tr>
<th>Construct</th>
<th>Measurement method</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptability</td>
<td>HCA and client program evaluation surveys</td>
<td>Program satisfaction Qualitative data on perceived positive or negative aspects of SFL Rates of adverse reactions</td>
</tr>
<tr>
<td>Demand</td>
<td>Enrollment rates Utilization logs</td>
<td>Enrollment rates for HCAs and CCP clients. Rate of program participation for CCP clients using tracking logs.</td>
</tr>
<tr>
<td>Implementation</td>
<td>HCA training evaluation surveys</td>
<td>HCA competency in leading SFL Fidelity check: success or failure of SFL execution as originally intended Factors affecting implementation ease or difficulty</td>
</tr>
<tr>
<td></td>
<td>HCA and client program evaluation surveys</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fidelity check</td>
<td></td>
</tr>
<tr>
<td>Practicality</td>
<td>Program evaluation surveys Training evaluation surveys CCP manager interviews</td>
<td>Ability of participants to carry out SFL activities Implementation barriers</td>
</tr>
<tr>
<td>Adaptation</td>
<td>Program evaluation surveys Fidelity check</td>
<td>Types of modifications needed to carry out SFL with this population</td>
</tr>
<tr>
<td>Integration</td>
<td>Job Descriptive Index questionnaire HCA survey Interviews with CCP manager</td>
<td></td>
</tr>
<tr>
<td>Limited efficacy testing</td>
<td>Client physical performance measures Pedometers</td>
<td>Client changes on physical performance measures and changes in average daily ambulatory activity</td>
</tr>
</tbody>
</table>

**c. Demand**

Demand is the extent to which a new program is likely to be used in the future and can be estimated using data related to program uptake in a particular population or setting (Bowen, 2009). In this study, demand was measured by assessing the
degree to which HCAs and clients desired SFL to be offered as part of the CCP usual care services. Recruitment of HCAs and the successful completion of their training was one indicator of the demand for this intervention within this population. Recruitment of older adults and their rate of program participation was a second indicator of demand. The rate of program participation provided information on the actual use of SFL. This measure is a good indicator of client demand for evidence-based resistance exercise programs offered in the home. Clients were instructed to perform SFL three times per week for 12 weeks for a maximum of 36 sessions. Program participant rates were calculated by dividing the number of sessions completed as indicated on the calendar logs by 36 total possible sessions.

d. **Implementation**

Implementation focuses on the extent to which an intervention delivered in an uncontrolled context compares to the proposed or originally designed intervention (Bowen, 2009). I assessed implementation in multiple ways. Fidelity checks performed by research staff in the homes of client participants provided data on SFL program implementation in the home led by HCAs compared to the originally designed SFL program. Two trained research assistants assessed client performance on all 11 exercises in the SFL program and evaluated if clients performed exercises with correct form and use of equipment. Quantitative data from the fidelity checks provided information regarding the rates of success or failure of SFL execution. Program evaluation questions gathered information regarding barriers and facilitators to implementation and adaptations made to the program in the home setting.
e. **Practicality**

Practicality is the ability of the intervention to be delivered using existing resources or in spite of constraints on resources, time, commitment, or a combination of those factors (Bowen, 2009). I used program evaluation surveys to explore the ability of HCAs to provide exercise motivation in weeks three to 12 during regularly scheduled CCP client visits when time with a client is constrained. Strong for Life training program evaluations were used to assess the viability of using paraprofessional HCAs to provide physical activity educational resources to their clients.

f. **Adaptation**

Adaptation refers to any changes made when implementing a program with a different format or new population (Bowen, 2009). Jette et al. originally designed SFL for older adults with some level of physical disability (1996). Adapting this program for older adults who are homebound and have multiple chronic medical conditions could require changing procedures or program content. Fidelity check information and HCA and client program evaluations documented any modifications needed to enable this program to be successfully implemented with this population.

g. **Integration**

Integration refers to the ability to assimilate a new program within an existing system (Bowen, 1999). This study explored the effects of expanding services provided in the CCP to include a PA program. I used SFL program evaluations to determine the extent to which SFL is sustainable within the current CCP culture and organization. Program evaluation questionnaires provided information regarding integrating SFL within the usual care HCA duties. Job satisfaction questionnaires quantified information from
HCAs on the effects of implementing SFL within the CCP. Data from the National Health Statistics Reports suggest that HCAs have lower levels of job satisfaction and feelings of validation regarding the necessity of their employment (2011). Expanding the role of the HCAs in the CCP could improve job satisfaction and validate the importance of this role in promoting health for clients, leading to reduced turnover among these important direct care workers.

To assess job satisfaction, I explored the facets of general job satisfaction and satisfaction in work on present job using items from the Job Descriptive Index (JDI). These scale items are most applicable to aides working in a home care setting. One of the most frequently used job satisfaction measures, the JDI has a range of test-retest reliability between .35 to .82 and internal consistency of .28 to .95 (Kinicki, 2002).

h. **Limited-efficacy testing**

While the primary aim of this study was to determine the feasibility of implementing SFL in the CCP, a secondary aim was to assess the efficacy of the SFL intervention with clients in the CCP. Secondary outcomes included physical performance measures to capture changes in physical functioning, ambulation, self-rated health, and self-efficacy for exercise.

1) **Strength**

Strength was assessed via three measures: 1) hand held dynamometry for the knee extensors, 2) 30-second chair rise test, and 3) grip strength with hand dynamometry. These three tests assess lower and upper extremity strength and provide measures of functional strength that are important in the performance of ADLs. Knee extensor strength is a predictor of functional ability and mortality (Swallow, 2007).
Abizanda and colleagues found that knee extensor strength had a moderate negative relationship with scores on the Lawton Brody Index (r=-0.296), TUG (r=-0.329), and Geriatric Depression Scale (r=-0.294) (2012). A strong positive relationship also exists between knee extensor strength and the six-minute walk test (r=0.410) (Abizanda et al., 2012). Measuring quadriceps strength via a hand-held dynamometer provides a more objective measure of strength than traditional manual muscle testing and has been shown to be valid and reliable in elderly, frail, and disabled populations (Kelln, 2008). The procedure for the knee extensor strength measure was that clients remained seated with their backs against a chair. The dynamometer was held perpendicular to the knee at the halfway distance point between the inferior patella and the midpoint of the medial and lateral malleoli. The client was instructed to extend his or her lower leg approximately 45 degrees and maintain an isometric contraction for three to five seconds. Each client performed two trials on each leg, and the average force in Newtons across trials was calculated for each leg with the larger number used for analysis.

The 30-second chair rise test assessed lower body strength during a functional task. As equipment needs are minimal, this test can be easily performed in a variety of settings, which made it attractive for use in this study where measurement procedures occurred in the home. Research staff brought a standard height chair to each home to ensure standardization of testing across all participants. Clients were asked to rise from a chair as many times as possible within 30 seconds with their arms across their chest or using their arms from the arm rests for a modified test version.

Grip strength is an important marker of frailty and is associated with other performance measures, as well as with self-reported measures of health (Stevens, 2012...
and Sirola, 2004). Since this measure is relatively easy to perform and does not require complicated directions, it is appropriate for use with frail, homebound older adults targeted in this pilot. Grip strength was assessed with a hand dynamometer. Research staff demonstrated the use of the instrument to the client prior to testing. Clients were tested in a seated position, arms at their side and not touching their body. Clients were instructed to keep their elbow bent slightly. Clients were asked to squeeze the dynamometer with as much force as possible, being careful to squeeze only once for each measurement. Each client was tested on two trials for each hand with a break of 20 seconds between each trial to avoid the effects of muscle fatigue. Each trial was recorded to the nearest kilogram with trials averaged for a total score for each hand. I analyzed dominant and non-dominant hands separately.

2) **Mobility**

Given space constraints in the home setting, mobility measures for this study were limited to the Timed Up and Go (TUG), gait speed, and pedometer step counts.

Psychometric properties for the TUG are well established, and normative data exist to compare CCP participants to the general population by age. Given the strong positive relationship between the TUG and Berg Balance Scale (Hofheinz, 2010), the TUG is more appropriate to use in the home setting with frail older adults who could be subject to floor effects on the Berg. To administer, research staff asked each client to sit on a standard armchair, place his/her back against the chair, and rest his/her arms on the chair arms. Any assistive device the client used for walking was used in testing. The client was instructed to walk to a line 10 feet away when prompted, turn around at the line, walk back
to the chair, and sit down. Staff began timing with a stopwatch upon saying the word “go” and stopped timing when the client’s buttocks touched the seat of the chair. Clients were instructed to use a comfortable and safe walking speed (Podsiadlo and Richardson, 1991). Research staff recorded two trials and I calculated an average for analysis.

Gait speed was important to assess with this population given the association between gait speed and functional status, hospitalizations, mortality, functional decline, and falls (Fritz and Lusardi, 2009 and Studeneksi, 2011). Given the frail and potentially precarious health status of the population in the CCP, gait speed is an important predictor of future health needs and functional abilities. Gait speed was assessed using the 20-foot walk test with a five-foot acceleration and deceleration length. A rope marked with these distances was used to ensure reliability between testers and in different home settings. Clients were instructed to walk at a comfortable, usual walking speed, and one trial was recorded.

Since the ultimate goal of SFL is not simply to improve strength but to translate strength gains into functional improvements for older adults, the assessment of functional tasks are necessary to track changes towards these goals. Research staff instructed clients to wear a pedometer for one week (seven consecutive 24-hour periods) before beginning SFL and for one week following completion of the program. Pedometer data was used to explore changes in ambulatory activity (total amount of daily step counts) between client groups and within client groups.

3) **Self-efficacy for exercise**

Home care aides were trained to lead and motivate clients to participate in SFL three times per week. Home care aides led their clients in person in SFL
once a week for the first two weeks of the program and then served as motivators and exercise leaders during the remaining 10 weeks, encouraging their clients to perform the program three times per week and assisting clients as needs arose. Self-efficacy for exercise was assessed to determine if the motivation and social support provided by the HCA translated into improved confidence to engage in physical activity behavior change. Self-efficacy for exercise was measured using the Self-Efficacy for Exercise Scale. This scale assesses confidence in the ability to exercise three times per week for more than 20 minutes in spite of a variety of barriers to physical activity. The scale has high internal consistency (.92) and validity compared with the SF-12 (Resnick and Jenkins, 2000).

4) Social support and exercise

I hypothesized that increased amounts of social support and motivation for physical activity would lead to improved adherence rates among clients performing SFL. I used the Social Support and Exercise Scale (Sallis et al., 1987) to measure perceived social support for exercise behaviors. This 15-item scale measures both positive and negative social interactions that might influence exercise activity. This scale has good internal consistency (.90) and test-retest reliability (Sallis et al., 1987).

5) Self-rated health

The PROMIS-global health scale (Hays, 2009) was used to assess self-rated overall health. This scale is easy to administer and represents multiple domains of physical and mental health. This scale has high internal consistency (.92) and high internal consistency reliability (.81 - .86) (Hays, 2009). Because this scale has both physical and mental sub-scales, it is a valuable tool for summarizing overall health.
6) **Sample size**

Our goal was to recruit 56 clients to maximize the number of subjects possible for this pilot given financial constraints. Since this study was a pilot, it was not sufficiently powered to test the effects of SFL on the health and functional status of CCP clients. However, findings were expected to provide information on the feasibility of random assignment and estimates of variance components, along with trend data on outcomes that can be used to estimate sample sizes needed to design larger follow-up studies.

D. **Analysis**

Data analysis for this study took two forms: a quantitative analysis of HCA and client outcomes, as well as a qualitative analysis of data on SFL feasibility and acceptability. Quantitative data were analyzed using R software version 3.2.1 and SPSS, and qualitative data was analyzed using Excel.

The first aim of the study was to demonstrate feasibility of the SFL program within the CCP as evidenced by client SFL adherence rates greater than 67%, HCA and client SFL satisfaction rates greater than 75%, and greater than 75% of clients and HCA implementing SFL with fidelity. Rates for adherence, satisfaction, and fidelity were selected based on recommendations from previous research (King et al., 1997) and rates in previous SFL studies (Etkin, 2006; Jette, 1999). To achieve this aim, I analyzed data for trends related to these parameters. The maximum number of sessions that client participants could complete over the 12-week study was 36 sessions. To calculate adherence, I divided the number of sessions clients reported on their adherence calendar by the 36 maximum
numbers of sessions. Satisfaction rates involved calculating group means on a 10-point Likert scale used by participants to rate their satisfaction with SFL. Fidelity rates were determined by analyzing fidelity check forms to calculate rates of conformity with SFL as prescribed using the 11 items in SFL as the denominator.

Qualitative data were also used to demonstrate feasibility of SFL in the CCP. I coded and analyzed answers to open-ended items on the HCA and client program evaluations and HCA SFL training evaluation surveys. All survey questions were first inspected to develop categories of major themes for each survey item. After initial codes were established, each survey was re-read and codes were assigned. After the initial coding, categories and corresponding codes were re-read to determine if categories needed to be altered, additional categories created, subcategories developed, or categories collapsed. Once categories were refined and responses coded using the definitive categories, frequency of responses per category guided the development of major themes for each survey item. I analyzed frequency tabulations to identify patterns and trends to determine congruence with quantitative data.

I investigated recruitment procedures to determine the period necessary to recruit and enroll participants, the ease of accessing HCAs and clients within the CCP, along with attrition rates and reasons for loss to follow-up. Analysis of screening procedures provided information regarding whether the inclusion and exclusion criteria were too restrictive or too loose for this population to help inform follow-up studies.

I also examined attrition from measurement in both participant groups to learn whether attrition was systematically biased in terms of demographic characteristics of
participants who attrited from measurement and in terms of baseline measures of the study outcomes.

The second aim of this study was to assess client improvements in physical performance measures, self-efficacy for exercise, self-rated health, and ambulatory activity as a result of SFL participation. I used demographic data and descriptive statistics to describe the sample demographic characteristics and to assess group equivalence at baseline. I used the Wilcoxon rank sum tests to measure differences between group outcomes on the Self-Efficacy for Exercise Scale, TUG, 30-second chair rise, grip strength, quadriceps strength, gait speed, PROMIS-global health, and average daily step count at 13 weeks compared to baseline. The non-parametric version of the paired samples t-test, the Wilcoxon-rank sum test, was used due to non-normal distribution in the data in several of the outcome measures. Median change scores were used to investigate the magnitude of difference in client performance from pretest to posttest by group assignment.

The third aim of this study was to determine whether HCAs were able to implement and lead SFL with their clients safely, and in so doing, improve their overall job satisfaction. I used HCA SFL training evaluations to document HCAs’ confidence in leading SFL with their clients. I investigated safety by calculating rates of adverse reactions by participating clients. Finally, I analyzed the HCA results on the Job Descriptive Index at baseline and at the completion of the program with t tests to examine the influence of SFL on job satisfaction.

1. **Missing data**

I employed a variety of strategies to minimize missing data. First, SFL HCA training incorporated motivational strategies to encourage SFL participation. Home care
aides reminded their clients at each visit to perform SFL and to fill out the adherence calendar to track days performing SFL. These prompts were designed to improve program adherence rates and use of the exercise calendar. Research staff performed fidelity checks during weeks three to five to ensure that the intervention was being implemented correctly. Finally, before conclusion of the SFL program, clients were contacted to set up a time for follow-up performance measurement testing. Clients were contacted by phone up to five times to set a time for follow-up testing. Contacting clients multiple times helped to improve the likelihood of securing a time for testing and minimized the risk of missing data due to loss to follow-up.

Despite these efforts to minimize missing data through multiple reminders and contacts with research participants, missing data occurred for some variables in this study. I analyzed missing data to determine if data was missing completely at random (MCAR), or data were considered missing at random (MAR) or nonignorable. To determine if the missing data was MCAR, I investigated whether the mean and variance of control variables varied between observed and unobserved cases on the outcomes of interest.

E. Conclusion

This feasibility study investigated the ability to provide SFL within the CCP using HCAs as trained exercise leaders and coaches. Findings regarding the feasibility of training HCAs in SFL to provide an evidence-based resistance exercise program in the home will provide currently unavailable knowledge regarding the optimal program of services that can and should be offered to CCP clients in the future.
IV. PERFORMANCE MEASURES AND RISK FOR ADVERSE CARE OUTCOMES AMONG OLDER ADULT USERS OF MEDICAID HOME AND COMMUNITY BASED SERVICES

A. Abstract

1. Objectives

   This study used validated performance measures to examine physical functioning among older adults receiving Home and Community Based Services (HCBS) through a Medicaid waiver program.

2. Methods

   Older adults (n=42) participated in physical performance tests that assessed grip strength, 30-second chair rise, Timed Up and Go (TUG), and gait speed.

3. Results

   A majority, 72% of females and 86% of males, had weak grip strength, 72% of clients were categorized as frail, 57% met criteria for fall risk, 83% had lower extremity strength impairments, and 98% were unable to ambulate more than 1.0 meters/second. The most significant predictors of weekly hours of HCA care approved for clients were race and gait speed.

4. Conclusion

   The levels of functional performance demonstrate that homebound clients are at risk for falls, hospitalization, and mortality, and indicate an urgent need to assess performance in addition to self-reported ADL and IADL limitations for this population. Performance measures associated with quantifiable risk for adverse outcomes can be critical indicators for referrals and services needed to enhance the safety and improve care outcomes for homebound elderly.
B. **Background**

It is well established that the majority of older adults wish to age in place and preserve their autonomy (Ryan and Deci, 2006). Preservation of function in ADL or IADL will enable older adults to possess the mobility, self-care, and home management skills needed to continue to live safely in their own homes. Since increased age is associated with functional decline (Schwartz, 1997), older adults often employ compensatory strategies or seek alternative living arrangements when the challenges of the home environment surpass their functional capabilities. One such compensatory strategy available to Medicaid-eligible older adults is HCBS financed through Medicaid waiver programs. Home and Community Based Services include supportive services such as emergency response systems, Adult Day Services, and Home Care Aides (HCAs), who provide assistance with ADL, IADL, and home management tasks.

Home care aides are the primary supportive service provided through HCBS, and client ADL and IADL impairments are a major driver of HCBS utilization (Health and Medicine Policy Research Group, 2009). An analysis of HCBS users in Illinois found that a one-unit decline in IADL performance was associated with a 5% uptake in volume of HCA utilization. Similarly, a one-unit decline in ADL performance was associated with a 2.3% increase in volume of HCA utilization (Health and Medicine Policy Research Group, 2009). Older adults were also found to have significant numbers of self-reported ADL and IADL impairments. Many were unable to perform most or all of the components of a variety of tasks; 93% had deficiencies in meal preparation, 99% in housework, 82% in bathing, 59% in dressing, and 59% in transfers.
Illinois provides HCBS to older adults through its CCP. The Illinois Department of Aging utilizes a Determination of Need (DON) instrument to assess CCP clients upon entry to the program and yearly thereafter. The DON assesses the functioning of older adult clients by capturing composite data on client performance using the Mini-Mental State Examination, self-reported ADL and IADL performance, and self-reported unmet ADL and IADL needs. Specific information on client physical performance beyond self-reported ADL and IADL functioning is not obtained.

While ADL capacity is an important marker of overall functioning, self-reported ADL performance does not capture information on gait speed, strength, or balance. These performance constructs strongly contribute to the capacity to perform ADL and IADL and also have known associations with risks for adverse outcomes including falls, hospitalizations, and mortality (Fritz and Lusardi, 2009; Shumway-Cook et al., 2000; Cesari et al., 2009). For older HCBS clients, specific information on physical performance that has established associations with health outcomes could enable agencies to improve care by proactively intervening with referrals to needed services external to the HCBS program or modification of interventions to address specific areas of physical impairment.

The primary objective of this study was to examine physical performance levels among older adult clients of the CCP in Illinois who volunteered to participate in an exercise trial. Our purpose was to assess the physical performance of these clients using measures with known predictive associations with risk for falls, hospitalization, and mortality in order to provide insights into the levels of physical performance in this population and the extent to which measured levels predict risk of adverse outcomes absent an intervention. This exploratory study was driven by the following research
questions: 1) What percentage of older adult clients are at risk for falls, hospitalization, and mortality? 2) Do client physical performance measures correlate with the hours of weekly HCA care received? and 3) Are there differences in hours of HCA care, TUG, grip strength, and gait speed in clients who are able to rise from a chair without their upper extremities versus those who are not?

To our knowledge, this is the first study to report prevalence data on levels of physical performance among HCBS waiver clients using measures with known associations to adverse health outcomes such as fall risk, hospitalization, and mortality. We hypothesized that a substantial number of clients would be categorized as at-risk for falls, hospitalizations, and all-cause mortality based on validated physical performance measures given known levels of ADL and IADL impairment in this population.

C. **Methods**

1. **Design and sample**

This study employed an exploratory and descriptive design. A sample of 42 community-dwelling older adults aged 65 and older living in the Chicagoland area and receiving HCBS through Community Care System, Incorporated, a licensed Community Care Program vendor, participated in this study. Inclusion criteria were: age > 65 years, primarily English-speaking, not currently participating in regular exercise as defined as 30 minutes three or more days per week, receiving services through the Community Care System, Incorporated’s Cook County office, and no health problems that contraindicate participation in physical activity as determined by the EASY: Exercise and Screening for You (Resnick, 2008). Participants received $10 for participation in testing. This study
protocol was approved by the University of Illinois at Chicago Institutional Review Board (2013-1152).

2. **Data Collection**

Data collection occurred during a one-week period in September 2014. Two trained research assistants who were Masters of Public Health students visited participants’ homes for testing. Although the environment varied because testing took place in participants’ homes, research staff used the same test conditions across all participants. The same scripted instructions and equipment were employed to standardize testing across participants, despite changes across test settings.

3. **Measures**

a. **Grip strength**

Grip strength is an important marker of frailty and is associated with other performance measures, as well as self-reported measures of health (Stevens et al., 2012; Giampaoli et al., 1999; Sirola, 2004; Syddal et al., 2003). While a number of cut point scores for classification of weak grip strength in older adults have been suggested, the most commonly reported range for weak grip is 16-21 kg in females and 30-37 kg for males (Lauretani et al., 2003; Sallinen et al., 2011; Dodds et al., 2014). For analysis, we used cut-points of 20 kg for females and 30 kg for males (Lauretani et al., 2003), as those values have been associated with risk for poor mobility.

Participants completed two trials of grip strength on each hand with a Jamar Hand Hydraulic Dynamometer following standardized procedures (Fess, 1992). The average value over two trials for each hand was calculated and the higher value regardless of hand dominance was used for analysis.
b.  **Thirty-second chair rise test**

The 30-second chair rise test assesses the number of times an individual can rise from a chair in 30 seconds. Normative values exist for this test (Bohannon, 2007), which has excellent test-retest reliability ($r=.89$) and inter-rater reliability ($r=.95$) (Jones et al., 1999). Lower levels of functional ability are associated with scores less than eight unassisted repetitions (Rikli and Jones, 1999).

Participants completed the 30-second chair rise using a standard height chair with arms crossed over their chests. Research staff instructed participants to fully stand and sit down as many times as possible within 30 seconds. If participants were unable to stand from the chair without upper extremity (UE) support, research staff noted the modification and had the participant complete the test with the use of the UEs. We analyzed participants performing the 30-second chair rise with and without UE assistance separately.

c.  **Timed Up and Go**

Developed by Podsiadlo and Richardson in 1991, the Timed Up and Go (TUG) is one of the most commonly used outcome measures to assess fall risk in older adults. Timed Up and Go scores greater than 15 seconds predict fall risk at a rate of 87% (Shumway-Cook, 2000). The TUG has excellent test-retest, inter-rater, and intra-rater reliability (Shumway-Cook et al., 2000; Hofheinz, 2010). Timed Up and Go specificity and sensitivity are high with values of 93.3% and 80%, respectively (Shumway-Cook, 2000). The TUG has also been shown to predict global all-cause mortality in ambulatory older males (De Buyser et al., 2013).

All participants completed two trials of the TUG with the average of the two trials used for analysis. All participants completed the measure using a standard height chair.
with armrests. Participants began in a seated position, stood when instructed, walked around a small object placed 10 feet away, and then returned to a seated position in the chair. Research staff provided standardized instructions to all participants to complete the test as quickly as possible.

d. **Gait speed**

Suggested as the “sixth vital sign,” self-selected gait speed predicts future functional status, hospitalizations, health care utilization, functional decline, and falls (Fritz and Lusardi, 2009; Karpman and Benzo, 2014). Walking speed declines with age with noticeable decreases between the ages of 70 and 80, especially in males (Bohannon, 2008). Older adults able to walk more than one meter/second are more likely to be independent in ADL, less likely to be hospitalized, more likely to be community ambulators, and able to cross a street safely (Fritz and Lusardi, 2009). Speeds less than 0.6 meters/second are associated with ADL and IADL dependency, as well as increased hospitalization risk (Fritz and Lusardi, 2009). Conversely, hospitalization risk decreases by 40% for every 0.2 meters/sec increase in gait speed (Studenski, 2003). A speed of 0.6 meters/second has also been suggested as a threshold for prognosing further functional decline in older persons with some level of existing impairment (Abellan van Kan et al., 2009). Finally, gait speed has been shown to be an independent predictor of five-year all-cause mortality in older adults. Specifically, gait speeds less than 0.5 meters/second are associated with higher all-cause mortality (Toots, et al., 2013).

Research staff measured gait speed as the time required to complete a 10-foot walking distance at a self-selected, comfortable, usual pace with a five-foot acceleration and
deceleration length. All participants performed this measure twice with the average speed of the two tests used for analysis.

4. **Data analysis**

   We used SPSS 22.0 software to analyze data. Descriptive statistics including percentages were used to describe the sample. Bivariate analyses were conducted among the independent variables and between the independent and dependent variable (hours of weekly care) through correlation matrices using Pearson’s correlation coefficients. We partitioned the sample into two groups based on ability to rise from a chair with or without using upper extremities. We analyzed between-group differences using an independent t-test. Finally, we modeled the hours of care received using hierarchical regression in order to investigate the ability of demographic characteristics and physical performance measures to predict hours of weekly care received. Demographic characteristics were entered at step one, grip strength was entered at step two, and mobility measures (TUG and gait speed) were entered at step three. An alpha level of p<.05 was used in all tests of statistical significance.

5. **Results**

   a. **Demographics**

   Table one displays client demographics. Overall, the sample was 83% female, 75 years old, 50% African-American, and received over 13 hours of HCA care weekly. Varied educational attainment was present with 52% having a high school degree or beyond, 21% attending but not completing high school, and 17% had only a grade school-level education. In comparison with the Illinois Community Care Program population state-wide, this sample had a greater percentage of female participants, was slightly younger, and had
a larger representation of African-American clients (Table III). Male participants were on average 82.6 years old and received on average 10 hours of HCA care per week.

b. **Performance measures**

Client characteristics on performance measures are shown in Table IV. Overall, a majority of participants had weak grip strength. Using a cut-off score of 20 kg for females and 30 kg for males, 25 out of 35 females (71.4%) were characterized as having weak grip strength. For males, six out of seven (86%) clients were characterized as having weak grip strength.

**TABLE III**
BASELINE DEMOGRAPHIC CHARACTERISTICS OF SAMPLE AND STATE-WIDE ILLINOIS COMMUNITY CARE PROGRAM POPULATION

<table>
<thead>
<tr>
<th>Total participants n = 42</th>
<th>Total Sample % or mean</th>
<th>Illinois Community Care Program Population % or mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Female</td>
<td>83</td>
<td>74.4</td>
</tr>
<tr>
<td>Age in years</td>
<td>74.8</td>
<td>77.9</td>
</tr>
<tr>
<td>Weekly Hours of Care</td>
<td>13.5</td>
<td>Data not available</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>50</td>
<td>11.4</td>
</tr>
<tr>
<td>White</td>
<td>43</td>
<td>85.2</td>
</tr>
<tr>
<td>Hispanic</td>
<td>5</td>
<td>5.5</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Clients exhibited substantial variability on the 30-second chair rise test. Only 31% of participants were able to rise from a chair without using their UE to assist. Furthermore, only 17% of participants met the threshold of eight repetitions indicating that 83% of the
sample should be categorized as having lower levels of functional ability. Nearly 10% of the sample was unable to rise from a chair even with the use of their UE and required physical assistance from another person to stand.

**TABLE IV**
CHARACTERISTICS OF SAMPLE ON PERFORMANCE MEASURES – TOTAL AND BY GENDER

<table>
<thead>
<tr>
<th></th>
<th>All Clients – Mean</th>
<th>Male Clients - Mean</th>
<th>Female Clients – Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grip Strength (kg)</td>
<td>17.3</td>
<td>21.1</td>
<td>16.5</td>
</tr>
<tr>
<td>30 second chair rise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed without arms</td>
<td>4.9 (completed by</td>
<td>8.0 (completed by n=2)</td>
<td>7.9 (completed by n=11)</td>
</tr>
<tr>
<td>Completed with arms</td>
<td>7.9 (completed by n=29)</td>
<td>6.6 (completed by n=5)</td>
<td>4.9 (completed by n=24)</td>
</tr>
<tr>
<td>TUG (sec)</td>
<td>22.5</td>
<td>16.4</td>
<td>24.6</td>
</tr>
<tr>
<td>Gait speed (m/sec)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Overall, TUG scores ranged from 5.49 seconds to 2 minutes and 27 seconds with three clients unable to complete the test due to mobility impairments. Based on TUG performance, 57% of clients were classified as at risk for falls with TUG performance scores greater than 15 seconds.

Slow gait speed was prevalent throughout the sample. Only one client could ambulate more than the 1.0 meters/second standard required for community ambulation (Fritz and Lusardi, 2009). In the sample, 64% of clients were at risk of hospitalization and
further functional decline based on their inability to ambulate more than 0.6 meters/second (Fritz and Lusardi, 2009; Abellan van Kan et al., 2009). Finally, 52% of participants were at increased risk of all-cause mortality due to an inability to ambulate faster than 0.5 meters/second (Toots et al., 2013).

We investigated the relationship between physical performance measures, demographic characteristics, and hours of weekly care received. Due to the modification required by clients on the 30-second chair rise test, we analyzed groups separately: those able to complete the test following standardized procedures versus those completing the modified version using UE. Results are shown in Tables V and VI.

For those performing the 30-second chair rise without modifications, statistically significant correlations were found between gait speed, hours of care, TUG, and chair rise repetitions. For the clients requiring their UE to stand from a chair, statistically significant correlations were found between gait speed, age, and chair rise repetitions. Hours of HCA care were significantly correlated with the number of chair rise repetitions.
**TABLE V**
RELATIONSHIP BETWEEN AGE, PERFORMANCE MEASURES, AND HOURS OF CARE – COMPLETED CHAIR RISE TEST WITHOUT MODIFICATIONS (N=13)

<table>
<thead>
<tr>
<th></th>
<th>Hours of Care</th>
<th>Age</th>
<th>TUG</th>
<th>Gait Speed</th>
<th>Grip Strength</th>
<th>Chair Rise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours of Care</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.05 p=.87</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TUG</td>
<td>0.22 p=.47</td>
<td>.159</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gait Speed</td>
<td>-0.55 p=.05*</td>
<td>-0.24</td>
<td>-0.64</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grip Strength</td>
<td>-0.34 p=.24</td>
<td>0.19</td>
<td>-0.03</td>
<td>0.33 p=.27</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>Chair Rise</td>
<td>-0.40 p=.18</td>
<td>0.13</td>
<td>-0.39</td>
<td>0.68 p=.01*</td>
<td>0.00 p=.99</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*p<0.05

**TABLE VI**
RELATIONSHIP BETWEEN AGE, PERFORMANCE MEASURES, AND HOURS OF CARE – COMPLETED CHAIR RISE TEST USING UPPER EXTREMITIES (N=29)

<table>
<thead>
<tr>
<th></th>
<th>Hours of Care</th>
<th>Age</th>
<th>TUG</th>
<th>Gait Speed</th>
<th>Grip Strength</th>
<th>Chair Rise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours of Care</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.25 p=.19</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TUG</td>
<td>0.24 p=.20</td>
<td>0.31</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gait Speed</td>
<td>-0.17 p=.37</td>
<td>-0.43</td>
<td>-0.32</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grip Strength</td>
<td>-0.11 p=.57</td>
<td>-0.27</td>
<td>-0.06</td>
<td>0.03 p=.89</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>Chair Rise</td>
<td>-0.36 p=.05*</td>
<td>-0.24</td>
<td>-0.23</td>
<td>0.73 p=.001*</td>
<td>0.29 p=.13</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*p<0.05
We used an independent t-test to further investigate group differences between those clients who were able to rise from a chair without the use of the UE and those who were unable. A two-group comparison is presented in Table VII. Across all variables, participants who were unable to stand from a chair without UE assistance had lower physical performance scores compared with those who were able to stand from a chair unassisted. Statistically significant differences were found in age, weekly hours of care, and gait speed between those who could stand unaided and those who could not.

**TABLE VII**

GROUP DIFFERENCES IN ABILITY TO STAND FROM A CHAIR

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Able to stand from chair without upper extremities: n=13 Mean</th>
<th>Unable to stand from chair without upper extremities: n=29 Mean</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>71.69</td>
<td>76.14</td>
<td>0.04*</td>
</tr>
<tr>
<td>Weekly hours of care</td>
<td>10.62</td>
<td>14.84</td>
<td>0.03*</td>
</tr>
<tr>
<td>TUG</td>
<td>17.94 sec</td>
<td>25.63</td>
<td>0.12</td>
</tr>
<tr>
<td>Gait speed</td>
<td>0.65 m/sec</td>
<td>0.42 m/sec</td>
<td>0.01*</td>
</tr>
<tr>
<td>Grip strength</td>
<td>18.81 kg</td>
<td>16.57 kg</td>
<td>0.14</td>
</tr>
</tbody>
</table>

*p<0.05

We next examined correlations between the hours of weekly care, client demographics, mobility measures, and strength measures. We examined correlations among the predictor variables and found correlations were very weak to moderate ranging between r=-.08 (p=.63) and r=-.43 (p<.05). No independent variables were highly
correlated, and collinearity statistics were all within accepted limits indicating no multicollinearity among independent variables.

We then used hierarchical regression to model hours of care as a function of these predictor variables (Table VIII). In the first step of hierarchical regression, demographic variables were entered as predictors for weekly hours of HCA care. This model was not statistically significant (F test: 2.439; p=.08). The addition of grip strength in the second step was not statistically significant (R square change = .036; p=.20). In the final step, mobility measures (TUG and gait speed) were added into the model. This model was statistically significant (F test: 3.283; p=.01). The individual contribution of mobility measures was statistically significant (R square change = .162; p=.02) and accounted for 16% of the variance in weekly hours of HCA care.

6. Discussion

Although many studies have reported high self-reported ADL and IADL impairment in HCBS populations, this study is the first, to our knowledge, to examine valid performance to assess this issue. Consistent with previous research describing the pervasiveness of self-reported ADL and IADL deficits in this population (Health and Medicine Policy Research Group, 2009; Schwarz, 1997), the majority of older adults in this study were found to have significant grip strength and mobility limitations when assessed using performance measures.
TABLE VIII
SUMMARY OF HIERARCHICAL REGRESSION ANALYSIS FOR VARIABLES PREDICTING WEEKLY HOURS OF CARE

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unstandardized Beta</th>
<th>t-value</th>
<th>P value</th>
<th>R</th>
<th>Rsquare</th>
<th>Change in Rsquare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td>.402</td>
<td>.161</td>
<td>.161</td>
</tr>
<tr>
<td>Age</td>
<td>.08</td>
<td>.63</td>
<td>.52</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>4.18</td>
<td>2.13</td>
<td>.04*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-4.80</td>
<td>-1.78</td>
<td>.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td>.445</td>
<td>.198</td>
<td>.036</td>
</tr>
<tr>
<td>Age</td>
<td>-.13</td>
<td>-.96</td>
<td>.35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>3.04</td>
<td>1.61</td>
<td>.12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-2.80</td>
<td>-1.05</td>
<td>.30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grip strength</td>
<td>-.22</td>
<td>-1.30</td>
<td>.20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
<td></td>
<td></td>
<td>.600</td>
<td>.360</td>
<td>.162*</td>
</tr>
<tr>
<td>Age</td>
<td>-.19</td>
<td>-1.35</td>
<td>.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>3.04</td>
<td>1.63</td>
<td>.11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-1.14</td>
<td>-.40</td>
<td>.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grip strength</td>
<td>-.22</td>
<td>-1.40</td>
<td>.17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gait speed</td>
<td>-8.62</td>
<td>-2.57</td>
<td>.02*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TUG</td>
<td>.04</td>
<td>.86</td>
<td>.40</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<.05

Based on the associations between the performance measures tested in this study and risk of adverse outcomes, a substantial majority of participants in our sample could be classified as at-risk persons. Using Fried's frailty criteria: low physical activity, weight loss greater than 10 pounds, weakness in grip strength, and slow gait speed (Fried et al., 2001), 72% of clients (n=30) are frail given their documented grip strength, gait speed, and self-reported low physical activity levels.

We argue that these findings contribute important new information specifying the significant percentage of the sample at risk for falls, hospitalization, and all-cause mortality.
based on physical performance disability that is not captured by traditional self-reported ADL or IADL assessments.

Significant differences in hours of care between clients who could rise from a chair without their UE and those who could not suggests that the allocation of hours of care that agencies provide based on unmeasured physical performance has some validity. The finding that decreased gait speed and inability to rise from a chair unaided are associated with increased hours of care is consistent with the allotment of client hours based on self-reported greater physical limitation. However, nearly 10% of this sample was unable to rise from a chair at all. The inability to stand without physical assistance is a significant indicator of mobility impairment and places older HCBS clients at risk for serious adverse outcomes including falls, malnutrition, or pressure wounds, since these persons are unable to transfer on their own in order to perform basic requirements of daily life activities. The association between ability to rise from a chair and increased hours of care received suggests that a simple assessment of the ability to rise from a chair could serve as a valuable and quick screening tool to determine those at risk for functional decline.

This study found that gait speed was the strongest predictor of hours of care received. Gait speeds less than 1.0 meters/second indicate a need for interventions to reduce fall risk (Montero-Odasso et al., 2005). The finding that only one participant in the study was able to walk faster than this threshold supports the need for targeted interventions in this population to improve gait speed in order to improve functioning and decrease fall risk. Furthermore, the slow average gait speed seen in this sample suggests that these individuals face substantial limitations or complete inability to ambulate in the community. Since HCBS are designed to support and maintain individuals in community
settings, interventions to address the mobility requirements necessary for community living are urgently needed. Lastly, given the association between slow gait speed and risk of hospitalization, the prevalence of slow gait speed in this sample underscores the vulnerability of this population. Gait speed levels documented in this study indicate that 64% of clients are at a high risk for hospitalization and loss of community living. In this study, mobility measures explained 16% of the variance in hours of care received. This finding along with previous research showing gait speed is a strong predictor of future functioning provides justification that gait speed should be considered in client assessments when prescribing hours of care.

a. **Practical implications**

To translate these study findings into practical implications, we argue that HCBS waiver programs incorporate standardized physical performance measures into their regular client assessments. The performance measures used in this study can be implemented with minimal training, time, and equipment needs, and could be implemented by paraprofessionals serving HCBS clients. Utilizing existing care providers to implement this data collection is likely to be a cost-effective way to obtain important client information which could be used to facilitate referrals for additional services such as rehabilitation services, physical activity programs, or medical follow-up to complement standard care.

b. **Limitations**

Several factors limit the generalizability of findings. This study examined physical performance in a small sample of total users of the CCP in Illinois. Sedentary participants were drawn from a single geographic location and restricted to a
large provider agency in Illinois. Future studies need to explore the diverse population of older adult waiver recipients both by ethnic background and geographic region. The small number of males, 17% of our sample, further limit our findings. Further investigation into the physical performance of males who receive HCBS is needed in order to more broadly generalize findings to that population. Finally, we were unable to control for specific types of chronic health conditions faced by participants in the study. Certain conditions such as osteoarthritis or stroke have strong associations with mobility limitations, and a history of these mobility-impacting conditions could influence performance on physical outcome measures.

7. Conclusions

This study provides the first report, to our knowledge, of levels of physical performance using measures that are validated predictors of adverse outcomes in a sample of older adult HCBS waiver recipients. Identifying specific characteristics of this population is critical for developing appropriate health promotion efforts. Findings from this study affirm that this population has functional limitations, but for the first time highlight the significant risks for adverse health outcomes that are associated with clients’ low performance in upper and lower extremity strength, mobility, and gait speed. Despite limitations, this study obtained important new information about Community Care Program client physical functioning that is not currently obtainable using existing assessment tools. The results of this study advance what is known about the frail, homebound population and identify areas that are important to address in future research and practice, such as the use of these measures as part of routine client assessments. The use of these tools to classify clients relative to risk for falls, hospitalization, and mortality
moves assessment beyond ADL and IADL in order to promote more coordinated care by
screening clients for needed referrals to other healthcare providers or targeted evidence-
based interventions that can improve physical function.
V. FEASIBILITY OF IMPLEMENTING STRONG FOR LIFE IN THE COMMUNITY CARE PROGRAM

A. Abstract

This study used a randomized controlled trial to test the implementation of SFL, a resistance exercise intervention. We enrolled 32 HCAs and trained them to serve as exercise leaders for 42 of their homebound older adult clients enrolled in the Community Care Program. Outcomes including program satisfaction, training evaluations, program fidelity, and Job Descriptive Index (JDI) scores were analyzed using mixed-methods. Findings indicated that clients and HCAs view SFL as highly satisfactory, SFL can be implemented safely, and HCAs can adapt SFL to meet their clients’ needs. As baseline, HCAs had high job satisfaction, but participation in SFL contributes to work achievement and pride. These results show that it is possible to train HCAs to implement a resistance physical activity program with their clients, that participation positively affects both care partners, and that this model is a practical delivery mechanism to provide exercise for adults receiving Home and Community-Based Services.

B. Background

Aging is associated with a decline in multiple systems that contribute to the development of functional impairments. Physical activity (PA) has been shown to improve health outcomes, reduce functional limitations, and increase quality of life for older adults with multiple different chronic conditions (Langlois et al., 2013; ACSM, 2009; Cohen-Mansfield et al., 2010). Currently, lack of PA engagement is a significant problem as only
39% of older adults engage in regular PA (US Department of Health and Human Services, 2014).

Inactivity is more common in individuals with advanced age, disability, female gender, increased medication use, increased number of chronic conditions, and lower socioeconomic status (Cohen-Mansfield et al., 2010; Struck and Ross, 2006). Although frail older adults have low rates of PA engagement, substantial evidence documents the effectiveness of PA programs for this population (Langlois et al., 2013; Jette et al., 1996; Judge, 2003; Seguin and Nelson, 2003). Despite the fact that this population is in great need of and should benefit from the positive health effects of PA, homebound older adults are the least likely group to engage in these programs.

This is true because most evidence-based PA programs targeting older adults are typically offered in community settings (Park and Chodzko-Zajko, 2014). Frail, homebound older adults who could potentially benefit greatly from these interventions known to improve functioning are often unable to access these community-based programs due to mobility limitations. Therefore, a significant need exists to investigate effective strategies to engage frail, homebound older adults in PA in their own homes.

Currently, over 1.2 million older adults and/or persons with disabilities receive home and community based services (HCBS) through Medicaid waiver programs in the United States (Eiken and Lelchook, 2013). In Illinois, HCBS are offered to older adults with documented risk for nursing home placement through the Community Care Program (CCP). Community Care Program services include case management, HCAs, adult day services, and emergency response systems. The goal of the CCP is to assist clients to “age-in-place” by providing services, predominantly HCAs, to assist with ADL or IADL functions. The CCP
population is characteristically female, minority, with low socioeconomic status, and advanced age (Ward, 2013). Consistent with this demographic profile, this population has multiple risk factors for a sedentary lifestyle, reduced functional ability, and is highly likely to benefit from access to PA programming. One mechanism to reach this underserved population is to embed PA programming within existing CCP services.

Previous research has documented that HCAs feel a sense of mission and reward in their jobs and are dedicated to helping others (Eustis, Kane, and Fisher, 1993; Feldman, 1997; Ashley et al., 2010). Home care aides are in a unique position to access and assist this population of homebound older adults with health promotion activities because aides visit their clients regularly and have established relationships with clients on which to build. Therefore, the potential exists to expand the job role of these front line paraprofessionals to include the provision of PA programming for their clients.

Strong for Life is an evidence-based PA program originally designed for frail and/or functionally impaired older adults (Jette et al., 1996). It is a DVD-based strength-training program that has shown significant improvements in muscle strength, tandem gait, and functional ability, with high participation and adherence rates and no adverse events (Jette et al., 1996). Although SFL has demonstrated benefits in social functioning (Etkin et al., 2006), strength, gait, and disability in the broader community (Jette et al., 1999), it has not been tested with homebound persons in the CCP using HCAs as exercise trainers. This pilot study tested this new mode of implementing SFL with CCP clients using HCAs as exercise trainers for their clients. We hypothesized that it would be possible to train HCAs to implement SFL with their clients and that both clients and HCAs would report high levels of
satisfaction with the program. We also hypothesized that HCAs would be able to teach clients how to adapt exercises as appropriate to meet their needs.

C. **Methods**

1. **Design**

   This study used a randomized control trial with repeated measures to assess the feasibility of offering SFL within the CCP. Randomization sequences were determined by blocking the number of client service hours into five categories (4-10, 11-15, 16-20, 21-25, and 26 or greater hours) such that 50% of client subjects in each service category were assigned to both groups. Client service hours are allocated based on their Determination of Need score, a measure that assesses client ADL and IADL performance, with greater functional impairments correlated with greater number of allocated hours. We stratified based on allocated hours as a proxy for client functional impairment. We used a Matlab computer program that guaranteed a 50/50 split in each cell. However, group allocation was uneven between the randomization and the beginning of the intervention because five clients were determined to be ineligible since they no longer received CCP services or their HCA changed. Post randomization, two HCAs in the intervention group did not show up for training and were subsequently not enrolled in the study.

2. **Setting, participants, and recruitment**

   We recruited CCP participants for this pilot through the Cook County office of Community Care System, Incorporated. Community Care System, Inc. is a large home care vendor that has a contract to participate in the CCP program state-wide. Home care aides employed by this office were recruited through direct mailings and presentations at staff
in-services. All study methods, measures, and consent procedures were reviewed and approved by the Cook County office. This study protocol was approved by the University of Illinois at Chicago Institutional Review Board (2013-1152).

Home care aides participated in a telephone screen to determine their eligibility to participate in the study. Once a HCA was deemed eligible, all clients on the eligible HCA’s caseload were mailed study information. Research staff telephoned clients two weeks later to provide further information about the study. Interested clients participated in a telephone screening to assess inclusion criteria. Research staff met clients meeting telephone inclusion criteria in the client’s home to sign informed consent and participate in baseline measurement testing.

3. **Inclusion criteria**

Home care aides were considered eligible if they were employed by the CCSI Cook County office, had at least one client whom they visited two or more days per week, were English-speaking, and were willing to participate in measurement and intervention procedures.

Clients of enrolled HCAs were eligible for this study if they were primarily English-speaking, not currently participating in regular exercise (defined as more than 30 minutes, 3 or more days per week), had no other health problems that contraindicated participation in PA as determined by the EASY (Resnick, 2008), greater than 65 years of age, and willing to participate in measurement and intervention procedures. If a client screen indicated need for physician consent, a physician consent form was faxed to the primary care physician identified by the client.
4. **Training procedures of home care aides**

All participating HCAs (n=32) attended a half-day training. HCAs randomized to the intervention group (n=17) participated in SFL training led by a physical therapist, while HCAs randomized to the control group (n=15) participated in back safety training. Strong for Life training followed the manual developed by the Boston University Roybal Center. HCAs received the instruction manual and listened to presentations that reviewed the core components of the SFL program and benefits of exercise for older adults. They then watched the SFL DVD and participated in discussions regarding the benefits, potential modifications, and safe techniques for conducting each exercise in the program. Finally, HCAs demonstrated their competence in leading SFL by practicing leading the program with peers, problem solving challenging situations via role playing, and answering questions regarding safe modifications to SFL for their clients. These practical scenarios tested the ability of the HCA to modify and lead SFL and enabled the physical therapist trainer to observe HCA competency. The trainer taught HCAs to use the Borg Rating of Perceived Exertion (Borg, 1998) to monitor client exercise intensity in order to progress the level of Theraband used throughout the course of the program. We provided HCAs with a telephone hotline to contact research staff with any concerns over the course of the 12-week SFL intervention. All HCAs were compensated $80 for participating in the half-day training, and intervention HCAs were paid an additional $40 for leading SFL with their client. Home care aides in the control group were instructed to continue performing usual care with their clients.
5. **Intervention**

The SFL resistance exercise program consists of a 35-minute video routine that includes a warm up, 11 upper and lower extremity exercises using Therabands for resistance, and a cool down. Exercises are performed both seated and standing, and exercise modifications are shown as part of the routine. Home care aides were instructed to continue their usual care tasks and also lead SFL with their clients two times per week for the first two weeks with clients completing the third weekly session independently. During weeks 3-12 of the program, HCAs were instructed to motivate their clients and remind them to complete SFL at every usual care visit. They were also instructed to encourage clients to progressively increase the difficulty of the Theraband resistance bands used over the course of the 12-week program. All clients were provided with the SFL DVD, a user's manual, Theraband tubing including three levels of resistance, Theraband attachment handles to assist with grip, and instructions to perform the program three times per week for 12 weeks. Clients were compensated $10 for participation in baseline and follow-up measurements.

6. **Measures**

The primary outcomes of this feasibility study were client and HCA program satisfaction, HCA SFL training evaluations, and SFL fidelity rates. Satisfaction rates were calculated using a 10-point Likert scale to measure overall satisfaction with the program (Appendix C). Home care aides rated the SFL training on a five-point scale (from “poor” to “excellent”) (Appendix D). Strong for Life fidelity rates were calculated as a percentage of the exercises (out of 11) completed correctly during a site visit to the client’s home with qualitative information regarding the quality of SFL delivery (Appendix A). A secondary
outcome of this study was HCA job satisfaction as measured by the Job Descriptive Index (JDI). One of the most frequently used job satisfaction measures, the JDI has test-retest reliability above 75% and internal consistency of .81 (Van Sanne et al., 2003). Furthermore, the test has been used with similar populations of nursing staff working with older adults (Kiyak et al., 1997).

7. **Data collection**

Train research assistants (Master’s of Public Health students) blinded to group assessment conducted pre- and posttest measurement at baseline and at 12 weeks following a standardized testing protocol. At each time point, HCAs filled out the Job Description Index. Train research assistants (Master’s of Public Health students) who were not blinded to group assignment performed an in-home fidelity check during weeks three and four of the 12-week intervention. Research assistants observed both the HCA and the client performing SFL together. During each observation, research staff evaluated each exercise in the program using a fidelity checklist designed by the study principal investigator. Research assistants assessed client participation and noted any problems such as deviations from the exercise routine, equipment issues, or safety concerns. Any fidelity issues noted during the home visit were corrected by research assistants.

8. **Statistical analysis**

Answers to open-ended questions were analyzed through conventional content analysis using a spiral approach. Answers to survey questionnaire items were initially read, codes were developed based on the initial reading of the answers, and then answers were re-read and codes applied to each answer for categorization. Codes were analyzed for frequency to identify meaningful patterns. We used qualitative and
quantitative data in a sequential explanatory design to explore congruence between qualitative and quantitative findings.

D. Results

Home care aides (n=64) were screened for eligibility. Of these, 61 were initially determined eligible. However, 27 HCAs did not have any clients enroll in the program and were subsequently determined ineligible. The remaining HCAs (n=34) were randomized for training: 15 HCAs to the control group and 17 HCAs to the intervention group. Table X (Appendix F) shows baseline HCA characteristics. Home care aides had a mean age of 48.7 years, all were female, and a majority were ethnic minorities, including 72% who were African American. The majority had at least a high school education.

Clients (n=64) were screened for eligibility. Of those, 52 were determined eligible and 42 enrolled in the study. Table XI (Appendix G) shows baseline client characteristics. Overall, clients had a mean age of 75 years, 83% were female, and a majority were ethnic minorities, including 50% who were African American. The majority had at least a high school education. There were no significant differences between intervention and control group clients.

1. Study attrition

Of the initial 42 client participants, 35 (83%) remained at the completion of the 12-week study. Among those in the control group, 14 (78%) completed the study. Among those in the intervention group, 21 (88%) completed the study. We anticipated an attrition rate of 15% given the range of attrition rates reported in similarly structured exercise programs (6-25%) (Fairhall et al., 2012; McAuley, E. et al., 2013; Silveira, P. et al,
Clients left the study for the following reasons. Among the control group participants, one client died, and three refused to continue due to their placement in the control group. Among the intervention group participants, one client died, one client moved, and one client withdrew due to an illness that she said prevented her from doing the exercise program.

2. **Strong for Life training evaluation**

   Home care aides were overwhelmingly positive regarding the SFL training. One hundred percent of HCAs rated their overall reaction to SFL training, quality and usefulness of training and training materials, as well as the convenience of a Saturday morning training session as “excellent” or “good.” Ninety-three percent of HCAs felt the SFL trainer had “excellent” or “good” ability to communicate SFL content. At the conclusion of the program, 100% of HCAs reported that the SFL training session prepared them to train their clients appropriately.

3. **Strong for Life fidelity**

   Research staff conducted in-home fidelity checks on 19 of 24 (79%) clients in the intervention group. Reasons for not conducting a fidelity check were n=1 (deceased), n=2 (did not return phone calls), and n=2 (HCAs did not attend training). Overall, a high level of implementation fidelity was observed. Each exercise was coded as a dichotomous measure (yes/no) based on whether or not the client performed the exercise. All clients completed the following exercises: hip extension, hip abduction, ankle pumps, rowing, leg kicks, victory, hip rotation, and arm extension. One client was unable to perform heel raises and one client was unable to perform shoulder abduction. Four clients omitted the “get up and go” exercise due to reported difficulty.
Qualitative assessment using participant observation was used to examine SFL intervention receipt. Research assistants observed the completion of one SFL session and noted the quality of exercise participation and client comprehension, client perception of program difficulty, program safety, and client use of equipment. Research assistants also took field notes with qualitative descriptions of the interaction between the client and the HCA during the exercise session.

All clients had limitations with respect to exercise participation due either to limited range of motion or balance impairments. Clients and HCAs modified the SFL exercises to accommodate these deficits by reducing the range of motion through which exercises were completed or performing SFL while sitting. Overall, clients were able to perform SFL safely. Research assistants identified five of 19 clients (26%) who experienced safety issues. All five clients performed SFL on rolling desk chairs or unlocked wheelchairs. Research assistants instructed clients and HCAs to modify participation to use immovable chairs and all clients successfully made the recommended modification.

Clients reported mixed findings regarding the difficulty of SFL. The majority of clients reported that SFL provided an appropriate level of challenge (63%). Participants stated that SFL was “a challenge and I enjoy the workout” and “reasonably hard, but not impossible.” However, other clients (26%) noted some difficulty in performing SFL: “30 minutes of exercise is too long for someone my age” and “I do all the exercises sitting because of my balance.”

Participants used varying levels of resistance with one client performing SFL without Theraband, seven clients using yellow Theraband, five clients using red, one client
using green, and five clients varying the level of Theraband depending on the specific exercise.

Home care aides were involved in administering SFL. Staff observed most HCAs performing SFL exercises simultaneously with their client, providing encouragement, and supplying clarifications and explanations of exercises. Reasons for not performing SFL simultaneously with the client were that the client preferred to do SFL alone or that the client was competent in the program, and the aide observed from a distance. Overall, clients showed a range of SFL understanding. Over half of clients (n=11, 58%) required some degree of assistance from their HCA to correctly perform SFL. The amount of assistance varied from total assistance to move limbs to minor verbal cues to clarify exercise technique.

4. **Program evaluation**

All treatment group HCAs who received SFL training (n=17) and clients (n=15 of 24, 63%) completed program evaluations. Because two HCAs did not attend SFL training, their five clients did not receive and were not included in the evaluation. An additional four clients deferred participating in program evaluations due to personal reasons or family members reporting cognitive difficulties that limited answering open-ended questions.

Overall, both clients and HCAs were highly satisfied with SFL. Mean ratings on a ten-point Likert scale were 9.1 for HCAs (range: 6-10) and 8.3 for clients (range: 2-10). Qualitative analysis found that HCAs perceived the benefits of SFL for their clients as enhancing mobility, increasing strength, and providing motivation to be more active: “I'm
happy to say that this program made a big difference in their life. It made them feel very good and my clients looked forward to doing their exercises!"

Clients reported physical benefits to participation, as well as motivating effects of the DVD: “The CD [DVD] showed how active people are and what we can accomplish if we work at it on a day to day basis.”

Clients (11/15, 73%) overwhelmingly identified the most successful component of the SFL program as the DVD. Roughly half of the clients (8/15, 53%) identified areas of SFL that could be improved. The identified improvements included the need to present alternative modifications for those with limited mobility and a slower pace of the DVD program instruction. Roughly half of HCAs (9/17, 53%) also identified areas needed for improvement. Those improvements focused on two themes: reducing the challenge of certain exercises or adding more variety by including additional DVDs within the overall program.

Only two of 17 (12%) HCAs reported difficulty leading SFL with their clients. The reasons for difficulty included one client who needed more motivation and one client who was blind and required greater physical assistance from the HCA to help guide extremity movement. Only one of 15 clients (7%) reported difficulty performing SFL in the home due to not owning a chair. The HCA provided instruction to modify the program by having the client complete SFL while sitting on a cooler.

All HCAs recommended that SFL should be implemented with all CCP clients; however, HCAs stated that having varied difficulty levels of SFL for non-ambulatory or high-functioning clients would be helpful. All clients also recommended that SFL be instituted with all clients in the CCP: “If you’re just sitting there, this [SFL DVD] gives you
the ability to do it when there’s no one around. Especially for people like me who don’t drive and can’t get out”; “I was a couch potato. It [the SFL program] got me off of the couch and moving.”

Clients overwhelmingly were aware that physical activity is beneficial to older adults. The primary reason clients stated SFL should continue in the CCP is due to the importance of exercise: “I think it [SFL exercise] helps the body be more flexible and [my] disposition is better”; “When you exercise, you can notice a definite difference in the flexibility and mobility. Your hips and knees are looser and the freedom of motion is really elevated.”

5. **Home care aide job satisfaction**

Healthcare policy changes have contributed to HCA reports of intensified work responsibilities (Cloutier et al., 2008). Increased daily workload is theorized to affect job satisfaction by increasing job burden, decreasing time spent in relational activities with clients, and contributing to job stress and burnout (Cloutier et al., 2008; Piercy, 2000). We assessed job satisfaction using the Job in General and Work on Present Job scales from the Job Descriptive Index (JDI). Job Descriptive Index scores of 27 are indicative of a neutral point in job satisfaction (Balzer and Smith, 1990). Both the Job in General and Work on Present Job facets have maximum scores of 54.

At baseline, HCAs in the intervention group had significantly lower satisfaction with work on the present job compared with HCAs in the control group (Table IX). However, since all scores were well above the threshold of 27, these values indicate that HCAs in both group assignments had high levels of job satisfaction. Qualitatively, HCA job satisfaction
was positively influenced by administering SFL due to themes of achievement and recognition. Home care aides stated:

“[SFL] gave us something to do [together];

“I am so proud that my client is able to walk for longer periods of time [after SFL];

“[SFL] made her [the client] better—it made her legs stronger.”

<p>| TABLE IX |</p>
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<th>HOME CARE AIDE JOB DESCRIPTIVE INDEX SCORES</th>
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<td>Control Group Pre</td>
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<td>Job in General</td>
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*p <.05; Control Pre vs. Intervention Pre

E. Discussion

The goal of this study was to determine the feasibility of training to lead SFL with their homebound clients in the Community Care Program. Findings unequivocally support the hypothesis that HCAs can be trained to offer this 12-week resistance training intervention with clients and can implement the intervention successfully and safely. These findings are notable for several reasons. First, this study was able to engage frail, homebound older adults in a PA program without any reports of adverse events. Second, HCA job satisfaction did not appear to be adversely impacted by the increased workload of leading SFL. Although there was no significant improvement in job satisfaction, qualitative
findings reveal that HCAs had a sense of pride when leading SFL with their clients that contributed to feelings of achievement when they recognized their client’s functional improvements. Importantly, time was never identified as a barrier to completing SFL, indicating that HCAs can deliver SFL within the time constraints of CCP hours allotted for usual care tasks. Third, acceptability of the intervention was high. Both HCAs and clients had positive reactions to the intervention and voiced the opinion that SFL should continue to be offered throughout the CCP. Finally, HCAs were able to adapt the SFL intervention appropriately given clients’ individual physical or environmental challenges.

One other study, to our knowledge, has examined the home care aide delivery model for physical activity interventions (Park and Chodzko-Zajko, 2014). The authors implemented the Healthy Moves for Aging Well program with 13 CCP clients and six HCAs in southern Illinois. They found high program satisfaction rates with implementation of the three-exercise program, but did not test effects on HCA job satisfaction. Thus, this study is unique in utilizing a DVD-based format that enabled clients to participate on days their HCA does not visit, using resistance bands to increase exercise intensity to create strength improvements, and quantifying of HCA job satisfaction using an established and validated questionnaire.

These results are consistent with findings from previous studies that have tested DVD exercise interventions and demonstrated their capacity to reach populations that would typically not be able to exercise in community settings (McAuley et al., 2013). However, this study was novel in utilizing HCAs to individually modify the DVD program for their client’s specific mobility and balance impairments, as well as to accommodate
environmental constraints in the home. We believe that the low attrition rates among clients are, in part, due to the motivational reinforcement provided by the HCAs.

The finding that HCAs have high levels of job satisfaction is congruent with findings from the National Home Health Aide Survey (Bercovitz et al., 2007). These results support the conclusion that the additional work responsibilities of administering a physical activity program with clients do not adversely affect job satisfaction, thereby supporting the acceptability of this intervention model. The qualitative findings provide a more complete understanding of the high program satisfaction reported by HCAs. High levels of program satisfaction appear to be driven by HCAs’ desire to improve the activity levels, energy, and mobility of their clients. It could be that participation in SFL provides clients with improved functioning that is noted by the HCA, reinforcing the HCA’s sense of pride in work responsibilities and contributing to increased job satisfaction.

Lack of social support, an exercise partner, and exercise supervision have been reported as barriers to exercise participation for older adults (Picorelli et al., 2014; Allen and Morey, 2010). We believe that the social support, encouragement, and supervision provided by HCAs enabled the successful implementation of SFL within this population of frail, homebound older adults. Furthermore, it is likely that the social support provided by HCAs greatly contributed to the implementation success. Based on fidelity check findings, the majority of HCAs provided motivation and emotional support, supplied tangible instrumental help in modifying the program, and gave instructions and advice on the importance of exercise. In sum, both qualitative and quantitative findings show that HCAs are capable of expanding their job responsibilities beyond performing homemaker tasks to include the role of supportive exercise leader.
Several limitations of the study deserve attention. First, this study is based on a small sample that received services from a single provider. Therefore, the findings are not representative of the entire Community Care Program population, specifically with respect to rural populations. Second, this study did not assess client cognition. Varying levels of cognition may have impacted both baseline physical functioning, as well as the ability to remember to complete the exercise program without input from the HCA. Third, we have limited information regarding adherence to the prescribed dose of three times per week recommendation for participation. This limits our ability to understand the exercise dosage clients received, as well as our understanding of the dosage with which the program was implemented. Fourth, the short duration of the intervention limits our understanding of the ability of HCAs to promote long-term exercise maintenance with their clients. Finally, the study did not collect information regarding changes in the Theraband color use, which limits our ability to comment on the ability of HCAs to progress exercise intensity with their clients.

Despite these limitations, this study has important implications for both future research, as well as policy. For researchers, this study supports the utility of an implementation mechanism that requires further investigation on a larger scale. For policymakers, this research suggests an effective means of offering physical activity programming to an underserved population within an existing delivery framework. This study purposely used broad inclusion criteria in order to enroll participants representing the multiple levels of function seen across clients receiving HCA services. We did this to assess the feasibility of implementing the program across levels of physical and cognitive
functioning. The broad inclusion criteria demonstrates the feasibility of implementing SFL with a heterogeneous CCP population.

In sum, findings from this study indicate strongly that SFL can be successfully implemented within the CCP by training HCAs to lead the program. Home care aides are capable of being trained to implement SFL safely with their clients, and fidelity site visits are important means of reinforcing safe ways to conduct the program in the home. This pilot study demonstrates that SFL has the potential to be incorporated within existing care services in the CCP to provide access to structured PA that is badly needed by clients. Further research should involve testing SFL with a more representative sample of clients state wide and nationally.
VI. IMPACT OF STRONG FOR LIFE ON THE PHYSICAL FUNCTIONING AND HEALTH OF OLDER ADULTS RECEIVING HOME AND COMMUNITY BASED SERVICES

A. Abstract

1. Purpose

To test the effects of SFL on the physical performance and self-rated health of older adults receiving Home- and Community-Based Services (HCBS).

2. Design

Randomized, controlled, single blind pilot trial with pre-post measures.

3. Participants

Home care aides (HCAs, n=42) employed by an HCBS waiver program were randomly assigned to a SFL intervention group or to a usual care control group. Clients of treatment group HCAs received the SFL intervention (n=24) and clients of control group HCAs received usual care (n=18).

4. Intervention

Strong for Life is a 12-week DVD-based, resistance exercise program that was tested for the first time with HCBS clients.

5. Measures

Outcomes included strength measures (grip and quadriceps), mobility measures (Timed Up and Go and gait speed), and self-reported measures (Self-Efficacy for Exercise, pain, and the PROMIS-global health).

6. Results

Effect sizes were moderate for for grip strength ($d = .38$), pain ($d = .34$), and PROMIS-global health ($d = .27$). Small effect sizes were found for all other measures.
Although no statistically significant differences between study groups were seen on outcome measures, median quadriceps and TUG scores differentially improved among intervention participants versus controls. No adverse health events were reported. Prevalence of frailty in the control group increased between baseline and post-test while frailty prevalence in the intervention group decreased during the same time period.

7. **Conclusions**

Strong for life has the potential to improve the strength, mobility, health, and frailty status of older adults receiving HCBS. This study provides initial evidence of the impact of this intervention for homebound older adults. The lack of reported adverse events supports the safety of this progressive resistance exercise intervention for older adults receiving HCBS.

B. **Background**

Despite the benefits of physical activity (PA) for older adults, PA engagement rates remain low in this population (Healthy People 2020, 2014). Resistance exercise, in particular, shows lower participation rates compared with aerobic exercise (Hughes et al., 2005). Hughes et al. surveyed 652 community-based facilities nationwide providing PA programming for older adults (2005). Aerobic and flexibility exercise programs were the most commonly offered and well-attended exercise classes for older adults. Only 26% of facilities surveyed offered resistance exercise classes, representing 10% of total PA program offerings. Engagement in resistance-based programming was low with only 11% of the 69,634 older adults surveyed participating in these classes. These findings suggest that challenges exist with respect to engagement in and access to resistance PA
programming for older adults. Older adults completing the 2001 National Health Interview Survey also reported low rates of strength training engagement (Krueger, 2004). Among persons aged 65 to 74, only 12% participated in resistance exercise two or more days per week. Female older adults, as well as those with advanced age, lower levels of formal education, obesity, or self-reported fair or poor health were least likely to meet the recommendation of two or more days per week of resistance exercise.

Low levels of resistance exercise engagement among older adults are a concern given the loss of muscle mass that occurs with aging. Sarcopenia is associated with impaired physical functioning, decreased quality of life, and increased mortality (Marcell, 2003; Zamboni et al., 2008). Despite older adults’ low rates of engagement in resistance exercise, substantial evidence indicates that this mode of PA is effective in improving muscle mass and functional outcomes (Hanson et al., 2009; Gennuso et al., 2013; Fahlman et al., 2011; Liu and Latham, 2009; Hunter et al., 2004).

Despite the proven effectiveness of resistance exercise programs, frail, homebound older adults who may be able to benefit the most from them are often unable to access these programs when they are offered in the community. Alternative delivery models, such as home-based DVD programs, are a potentially low cost mechanism with broad reach that can be used to implement PA programs for this population. However, there is minimal literature documenting the safety and effectiveness of DVD-based PA programs for this population. An additional concern regarding resistance PA programming for this population is a report of adverse outcomes, specifically musculoskeletal complaints such as soreness or pain (Liu-Ambrose et al., 2004). Given the frail nature of the homebound population, implementing a resistance PA program through a DVD alone without any
instruction may be ineffective or harmful since participants are likely to need individualized instruction to modify training protocols to accommodate functional limitations, as well as initial musculoskeletal discomfort that may arise in response to initiating a training program.

The SFL progressive resistance exercise program was selected as the intervention for this study for several reasons. First, SFL is an evidence-based DVD resistance exercise program originally designed for frail and/or functionally impaired older adults (Jette et al., 1993). The DVD format that SFL uses is ideal for reaching frail, homebound older adults. Second, previous research has shown that older adults who participated in SFL had significant improvements in muscle strength, tandem gait, and functional ability, with high adherence and participation rates and no adverse events (Jette et al., 1996). Third, SFL focuses on progressive resistance exercise involving major muscle groups at a moderate intensity level which has been recommended to facilitate optimal strength improvements for older adult populations (ACSM, 2014); however the safety and effectiveness of SFL has not yet been tested with this target population.

In Illinois, older adults who are Medicaid eligible and who have a determined need for nursing home care are eligible to receive HCBS through the Community Care Program (CCP). The primary service offered through the CCP is HCA assistance with activities of daily living and home management. Physical activity programming is not offered within the CCP. In this study, HCAs were trained to serve as exercise leaders for the SFL evidence-based resistance PA program that is provided on a DVD to test the safety and effectiveness of implementing the program with homebound older adults. We hypothesized that the 12-week SFL intervention would enhance clients’ strength contributing to improved physical
performance measures and self-reported health outcomes. We also hypothesized that no serious adverse events would be reported. Thus, the purpose of this study was to test the effects of SFL, a DVD-delivered and HCA-assisted, resistance exercise program on physical function and health in older adults enrolled in the Community Care Program.

C. Methods

1. Design

This study employed a randomized controlled pilot trial with pre- and posttest measures to assess the effects of the 12-week SFL intervention on physical function and self-reported health. HCAs were randomized to receive SFL training with randomization sequences determined using a Matlab program designed to achieve balanced allocation of clients to intervention and control groups stratified by number of hours of weekly care received from the HCA. Outcomes were assessed at baseline and at the end of the 12-week intervention. Research staff involved in data collection were blinded to group assignment.

2. Participants and setting

Study participants were HCAs and their clients; community-dwelling older adults enrolled in the CCP who received HCA services through the Community Care Systems, Inc. Cook County office. Home care aides were recruited through flyers and presentations at in-service trainings. All study methods, measures, and consent procedures were approved by the University of Illinois at Chicago Institutional Review Board (Protocol #2013-1152). Strong for Life was delivered by HCAs to their clients during usual care visits in the client’s home.
3. **Inclusion criteria**

Inclusion criteria for HCAs were: employment by the Community Care Systems, Inc. Cook County office; having one or more clients who received care two or more days per week; English-speaking; able to attend a half-day training program; and willingness to lead SFL with their client. Inclusion criteria for clients were: enrolled in the CCP and receiving HCA services through the Community Care Systems, Inc. Cook County office; English-speaking; no current participation in regular exercise defined as 30 minutes three or more days per week; no other health problems that contraindicate participation in PA as determined by the EASY (Resnick, 2008); age > 65 years; and willingness to participate in measurement and intervention procedures. If results of the EASY indicated a need for physician consent, a consent form was faxed to the client's physician.

4. **Procedures**

Home care aides who were interested in assisting their clients to use the SFL resistance exercise program were recruited first. Home care aides were screened for eligibility using a telephone screen and if determined eligible, flyers describing the study were mailed to all clients in the eligible HCA's caseload. Interested clients participated in a separate telephone screening to determine their eligibility. If a client was determined to be eligible, an in-home appointment was made to complete the informed consent and baseline measurement testing.

Home care aide participants were randomized to the SFL intervention or to a usual care control group. Home care aide intervention group participants attended a half-day SFL training session and HCA control group participants attended a half-day back safety training session. Research staff performing measurement procedures were blinded to
group allocation. Client outcomes were assessed at baseline and at week 13 in the homes of participating clients.

5. **Control condition**

   Older adult clients in the control condition received usual care provided by their HCA which did not include PA. Home care aides and clients assigned to the control group participated in measurement procedures at baseline and following the intervention, but were not otherwise contacted by research staff during the study period.

6. **Intervention condition**

   Older adult clients whose HCAs were randomized to the intervention group completed the 12-week SFL intervention in their homes. Details regarding the SFL intervention have been previously described (Jette, et al., 1999). Home care aides completed SFL with their clients two times per week for the first two weeks of the program. Clients were encouraged by their HCAs to complete a third session independently. After the initial two-week period, HCAs provided their clients motivation at each usual care visit (two or three times per week) to perform SFL three times a week for an additional 10 weeks. Research staff who did not complete baseline or follow-up measurement attended one session in the client’s home for a fidelity check during weeks three and four to ensure that SFL was being performed appropriately.

D. **Measures**

   Figure 4 shows the theoretical framework of the hypothesized association between the SFL intervention and the outcomes assessed in this study. Strong for life targets both upper and lower extremity strength which we hypothesized would lead to improvements
in mobility and ADL performance. These functional improvements would contribute, in turn, to greater self-reported health and self-efficacy for exercise.

1. **Sociodemographic measures**

Demographic measures that were collected at baseline only for both clients and HCAs included age, gender, education, and ethnicity. Hours of caregiving services that clients were prescribed through the CCP were also obtained at baseline.

Figure 4. Theoretical framework

2. **Strength measures**

Older adult clients completed two trials of grip strength on each hand using a Jamar Hand Hydraulic Dynamometer testing following standardized procedures (Fess, 1992) with the greater value, regardless of hand dominance, used for analysis.
Clients also completed two trials of maximal isometric quadriceps muscle strength on both legs following the “make test” testing procedures (Bohannon, 1986) using a hand held dynamometer (Lafayette Manual Muscle Testing System – Model 01165). The average of the two trials for each side was calculated and the greater value used for analysis, regardless of side of the body.

3. **Mobility measures**

We used the Timed Up and Go (TUG) and gait speed to assess the impact of SFL on client mobility. Clients were instructed to complete the TUG at their normal, comfortable walking speed by standing from a chair, walking a 10-foot distance, turning around, and returning to sit. Gait speed was measured as the time required to complete a 10-foot walking distance with a five-foot acceleration and deceleration length. Participants were instructed to walk at their self-selected customary pace. Clients completed two trials of the TUG and gait speed with the average value in seconds and meters/second, respectively, used for analysis.

4. **Self-report measures**

We assessed self-efficacy for exercise using the Self-Efficacy for Exercise scale (Resnick and Jenkins, 2000). The SEE assesses persons’ beliefs in their ability to exercise in the face of barriers to exercise. This 11-item scale was designed for older adults, and its reliability and validity have been tested in a variety of elderly populations (Resnick et al., 2004). Participants were instructed to rate their level of confidence in their ability to exercise three times per week for 20 minutes from 0 (not confident) to 10 (very confident). We calculated the SEE score by summing the numeric ratings for all responses and dividing by the number of total responses.
Pain was assessed pain using the numeric pain rating scale (McCaffery et al., 1989). Client participants rated their pain on average over the last seven days using a 11-point Likert scale. For older adults, the numeric pain rating scale has excellent internal consistency and concurrent validity (Herr et al., 2004).

Clients also completed the PROMIS-global health measure (Hays et al., 2009). General, overall health scores are based on responses to items from the five PROMIS domains of physical function, fatigue, pain, emotional distress, and social health (Hays et al., 2009). We calculated an overall score, as well as separate physical and mental health summary scores, adhering to customary scoring guidelines for the tool (Hays et al., 2009).

E. **Analyses**

The analyses used R software version 3.2.0 using intention-to treat analysis. We ran descriptive statistics and examined group differences at baseline. Attrition from posttest measurement, as well as frequencies of adverse event reporting, were also examined. Wilcoxon-rank sum models were run on change scores between baseline and posttest measurement for each outcome variable. The Wilcoxon-rank sum test was used as the non-parametric version of the paired samples t-test due to non-normal distribution in the data in several of the outcome measures. We used median change scores to investigate the magnitude of difference in client performance from pretest to posttest by group assignment. Cohen's $d$ effect sizes were also calculated to determine the strength of the association between study arm and outcome measure. We also asked clients to complete a SFL program evaluation. We analyzed open-ended responses to the program evaluation survey using content analysis. Client responses were initially read, codes were developed,
and then answers were re-read with codes applied. Code frequency was analyzed to identify meaningful patterns.

F. **Results**

Figure 3 (Appendix E) shows the flow of the clients through the recruitment and intervention process and reports the number of clients in each group who participated in measurement at baseline and at the end of the intervention. There was approximately a one-month lag between telephone screening and study start date, during which participants were lost for a variety of reasons. Primary care physicians did not provide medical clearance for client participation in the intervention group (n=2); one of whom had a recent fracture and the other of whom had unstable cardiovascular health. Upon arrival at the participant’s home to obtain informed consent, research staff found that some participants were ineligible because English was not their primary language and they were unable to understand study procedures and provide informed consent (n=4). Seven additional participants deemed eligible during the telephone screening also declined to enroll in the study due to loss of interest in the study. We were was unable to reach eligible participants (n=2) after the telephone screening to schedule a time to sign the informed consent and conduct baseline measurement, despite multiple attempts at contact. Finally, one participant was unable to enroll in the study due to a hospitalization that occurred between telephone screening and baseline measurement period (n=1). In total, 34 HCAs were contacted, enrolled, and randomized to the intervention or control conditions. Although 19 HCAs were assigned to the intervention group, 2 aides did not come to the
scheduled SFL training. Therefore, the final baseline sample consisted of 32 HCAs (17 in the intervention group and 15 in the control group) and their 42 clients.

At baseline (Table X, Appendix F), there were no significant differences in HCA demographics between intervention and control groups. However, there was a trend towards a significant difference in educational attainment between control and intervention group HCAs with intervention group HCAs having less formal education than control group HCAs. As shown in Table XI (Appendix G), there were no significant differences in client demographic characteristics or baseline measures of outcomes between intervention and control groups. However, there was a trend towards a significant difference in PROMIS-mental health between control and intervention group clients with intervention group clients having a higher score. Overall, clients had a mean age of 74.8 years, the majority were female (83%), and 50% were African-American, 43% White, 5% Hispanic and 2% other.

Client baseline performance measures showed substantial within-group variability. Using a weak grip threshold score of 20 kg for females and 30 kg for males, 25 out of 35 females (71.4%) were characterized as having weak grip strength and six out of seven (86%) male participants were characterized as having weak grip strength. Quadriceps strength had a high standard deviation with a range of 0 kg to 38.7 kg of force generated by clients. Slow gait speed was prevalent throughout the sample. Only one client could ambulate more than the 1.0 meters/second and 64% of clients were unable to ambulate more than 0.6 meters/second. Overall, TUG scores ranged from 5.49 seconds to 2 minutes and 27 seconds with three clients unable to complete the test due to the inability to
ambulate. Based on TUG performance, 57% of clients were classified as at risk for falls given their TUG performance greater than 15 seconds.

1. **Adverse events/attrition**

   Clients and HCAs were instructed to contact research staff regarding any problems with SFL implementation or adverse health events. Research staff received no contact from participants over the course of the intervention reporting any adverse events, except for notification that one client had died in each of the intervention and control groups. These events were determined not to be related to the SFL intervention; rather both deaths were determined to be a result of the client's existing chronic medical conditions.

   Of the 42 client participants enrolled in the study, 35 clients completed the 12-week posttest measurement for a 83% retention rate. Of clients in the intervention group, 21 out of 24 (87.5%) completed the posttest compared to 14 out of 18 (77.8%) in the control group. Overall reasons for loss to follow-up in the intervention group included one client death, one client unable to be contacted due to a disconnected telephone, and one client who refused posttest measurement. Overall reasons for loss to follow-up in the control group included one client death and three clients who refused posttest measurement because of either disappointment about being assigned to the control conditions (n=1) or feeling ill (n=2).

   Analysis of variance as used to test for differential attrition by study group. There were no statistically significant differences in group means on baseline outcome variables, except for gait speed (p=.007) with control group clients who withdrew having significantly slower gait speed. The TUG trended towards significance (p=.096), again with
control group non-completers having significantly slower times. Descriptively, clients who did not complete posttest measurement were also older in both study arms (Table XII).

**TABLE XII**
DESCRIPTIVE STATISTICS FOR BASELINE PERFORMANCE MEASURES BETWEEN STUDY COMPLETERS AND NON-COMPLETERS

<table>
<thead>
<tr>
<th>Measure</th>
<th>Control Group Completers n=14 (Means and SD)</th>
<th>Control Group Non-completers n = 4 (Means and SD)</th>
<th>Intervention Group Completers n = 21 (Means and SD)</th>
<th>Intervention Group Non-completers N = 3 (Means and SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>73.14 (7.63)</td>
<td>84.23 (13.05)</td>
<td>73.57 (14.97)</td>
<td>78.00 (12.77)</td>
</tr>
<tr>
<td>Weekly hours of care</td>
<td>11.71 (6.41)</td>
<td>13.00 (5.03)</td>
<td>14.98 (6.26)</td>
<td>12.67 (7.02)</td>
</tr>
<tr>
<td>Grip strength</td>
<td>18.21 (6.45)</td>
<td>13.88 (6.52)</td>
<td>17.79 (5.71)</td>
<td>13.67 (5.48)</td>
</tr>
<tr>
<td>Quadriceps strength</td>
<td>23.95 (12.16)</td>
<td>15.30 (11.06)</td>
<td>24.84 (8.00)</td>
<td>24.98 (2.34)</td>
</tr>
<tr>
<td>Gait speed</td>
<td>0.58 (0.31)</td>
<td>0.09 (0.13)</td>
<td>0.47 (0.24)</td>
<td>0.76 (0.31)</td>
</tr>
<tr>
<td>TUG</td>
<td>14.45 (8.68)</td>
<td>47.49 (69.64)</td>
<td>25.40 (15.28)</td>
<td>16.99 (9.37)</td>
</tr>
<tr>
<td>Pain</td>
<td>5.93 (2.68)</td>
<td>3.50 (3.11)</td>
<td>4.67 (3.34)</td>
<td>5.00 (2.00)</td>
</tr>
<tr>
<td>Self-Efficacy for Exercise</td>
<td>7.39 (2.06)</td>
<td>5.68 (1.03)</td>
<td>6.75 (2.22)</td>
<td>6.70 (1.72)</td>
</tr>
<tr>
<td>PROMIS-global health</td>
<td>29.50 (6.45)</td>
<td>26.00 (7.79)</td>
<td>31.52 (6.15)</td>
<td>30.00 (9.17)</td>
</tr>
<tr>
<td>PROMIS-physical</td>
<td>11.64 (2.73)</td>
<td>10.00 (3.56)</td>
<td>11.76 (2.98)</td>
<td>11.67 (3.06)</td>
</tr>
<tr>
<td>PROMIS-mental</td>
<td>12.21 (3.47)</td>
<td>9.75 (2.99)</td>
<td>13.48 (2.48)</td>
<td>13.00 (4.00)</td>
</tr>
</tbody>
</table>

2. **Total sample outcomes over time**

Table XIII presents results of change scores in primary study outcomes between pretest and posttest. We used a Wilcoxon rank sum test to test differences in median change scores between pretest and posttest in the control and intervention groups.
The Wilcoxon analysis found no significant differences between control and intervention groups in change scores between baseline and posttest for any physical performance or self-report measures; however, intervention group participants showed trends towards improvements for the TUG, grip strength, quadriceps strength, PROMIS-global health, and PROMIS-mental health Effect sizes were medium for grip strength ($d = .38$), pain ($d = .34$), and PROMIS-global health ($d = .27$). Small effect sizes were found for all other outcomes.

### TABLE XIII
CLIENT PHYSICAL PERFORMANCE AND SELF-REPORT CHANGE SCORES BETWEEN BASELINE AND POSTTEST

<table>
<thead>
<tr>
<th></th>
<th>Control Group Median [IQR]</th>
<th>Intervention Group Median [IQR]</th>
<th>P value</th>
<th>Cohen's $d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadriceps strength</td>
<td>0.15 [-1.15, 8.20]</td>
<td>4.55 [-0.35, 6.81]</td>
<td>0.83</td>
<td>0.11</td>
</tr>
<tr>
<td>Grip strength</td>
<td>-0.25 [-2.38, 0.88]</td>
<td>0.00 [-1.50, 3.50]</td>
<td>0.24</td>
<td>0.38</td>
</tr>
<tr>
<td>Gait speed</td>
<td>-0.01 [-0.16, 0.02]</td>
<td>-0.02 [-0.15, 0.02]</td>
<td>0.80</td>
<td>-0.10</td>
</tr>
<tr>
<td>TUG</td>
<td>0.51 [-1.44, 2.37]</td>
<td>-0.19 [-2.05, 5.33]</td>
<td>1.00</td>
<td>-0.20</td>
</tr>
<tr>
<td>Pain</td>
<td>0.00 [-1.75, 1.00]</td>
<td>0.00 [-2.00, 1.00]</td>
<td>0.69</td>
<td>0.34</td>
</tr>
<tr>
<td>Self-Efficacy for Exercise</td>
<td>-0.46 [-2.32, 0.98]</td>
<td>-1.09 [-2.64, 0.09]</td>
<td>0.56</td>
<td>0.22</td>
</tr>
<tr>
<td>PROMIS-global health</td>
<td>0.50 [-3.75, 2.75]</td>
<td>1.00 [-2.00, 4.50]</td>
<td>0.43</td>
<td>0.27</td>
</tr>
<tr>
<td>PROMIS-physical</td>
<td>0.00 [-1.00, 1.00]</td>
<td>0.00 [-1.00, 2.00]</td>
<td>0.54</td>
<td>0.15</td>
</tr>
<tr>
<td>PROMIS-mental</td>
<td>-1.00 [-1.75, 0.00]</td>
<td>1.00 [-1.00, 1.00]</td>
<td>0.22</td>
<td>0.20</td>
</tr>
</tbody>
</table>

3. **Qualitative response to Strong for Life intervention**

Two health-related themes were identified: motivation and improved physical health benefits. The intervention was viewed positively by clients. For many, the DVD format provided motivation and raised awareness of client’s own inactivity. Clients reported that watching the DVD “made me recognize that I have to do something” and that
the DVD “got me thinking more about exercise” and “it got me exercising because I wasn’t exercising.” Clients attributed health benefits to the intervention, including improved functioning, arm strength, flexibility, and balance. One client noted that after doing SFL, she was “improved on going up the stairs.” Another client noted that SFL provided “help on my arms and balance.”

4. **Impact of Strong for Life on frailty**

Based on the baseline physical performance of clients on criteria in Fried’s frailty classification (unintentional weight loss greater than 10 pounds, low physical activity, weak grip strength, slow gait speed, and self-reported fatigue), 72% of clients (n=30) are frail given their grip weakness, slow gait speed, and self-reported low physical activity levels. We examined changes in frailty status between baseline and follow-up for those clients who completed both measurement points (Figure 5). At baseline, 5 clients in the usual care group were considered frail. At the 13 week follow-up, 7 clients’ functioning rendered them frail. At baseline, 9 clients in the intervention group were considered frail. But 3 months later, only 8 were still in the frailty classification.

G. **Discussion**

This study for the first time examined outcomes of the 12-week SFL intervention for a small sample (n=42) of older adult clients receiving HCBS. Median performance on TUG, grip strength, quadriceps strength, PROMIS-global health, and PROMIS-mental health improved more for intervention participants than controls, but between-group differences were not statistically significant. Despite a small sample size that was not adequately powered to detect statistically significant between group differences, Cohen’s $d$ effect sizes
show a medium effect for SFL on grip strength, pain, and PROMIS-global health. Furthermore, frailty prevalence increased over time in the control group compared with a decrease in the intervention group. These findings provide initial support that SFL has the potential to improve physical functioning and improve pain and self-rated health in older adults enrolled in the Community Care Program with instruction and motivation from their HCAs.

Figure 5. Client frailty criteria by group at baseline and follow-up
Other studies have examined the effects of SFL on older adult participants (Jette et al., 1996; Jette et al., 1999; Etkin et al., 2006). All found beneficial effects of SFL on participant outcomes but did not test the intervention with frail, homebound older adults receiving home- and community-based services. Thus, this study is unique in assessing the impact of a resistance PA intervention for this subpopulation of vulnerable adults who are currently very limited in their ability to access evidence-based resistance PA programming.

Previous reports in the literature have raised concerns over implementing strength-based PA programs for frail elderly due to the risk of musculoskeletal complaints or other adverse events (Liu and Fielding, 2011; Latham et al., 2004). Importantly, there were no reports of intervention-related adverse events in this study. Research staff visited clients in their homes during weeks three and four of the program to determine SFL fidelity and assess client safety. During these in-person visits, no clients or HCAs reported any musculoskeletal complaints with SFL. We would expect that if musculoskeletal issues emerged, they would occur at the initiation of an exercise program in response to the new stimulus of training. Thus, the finding of no adverse response to SFL provides encouraging evidence that resistance PA interventions for this population can be delivered safely. It is also important to note that the program tested is evidence-based with instructor training protocols and uses a DVD to enhance fidelity of treatment delivery.

This study is not without limitations. First, study participants were limited to one Community Care Program agency and one geographic office location. While participants in the study were of varied ethnic backgrounds, only 5% of participants were Hispanic older adults. Furthermore, this study focused on an urban HCBS population and did not include
rural older adults. Future studies should include a more diverse sample of older adults in order to test the generalizability of results across a broader HCBS population.

Second, we did not capture information on cognitive function on clients at baseline. Future studies would be strengthened by collecting cognitive status data at baseline in order to explore the relationship between cognition and resistance exercise training, as well as to examine SFL impact by level of cognition. Third, adherence to SFL was not determined. Home care aides and clients were instructed to log each completed session of SFL on a calendar; however, only eight of 24 clients (33%) provided completed logs at the end of the study. Therefore, our understanding is limited with respect to dosage and how adherence impacted client outcomes. Fourth, it was not possible to blind clients regarding receipt of the SFL intervention. It is possible that some of the self-report measures may reflect respondent bias. Future studies should examine the impact of SFL dose on exercise outcomes, as well as explore the effects of a longer intervention.

Despite these limitations, these results provide initial evidence that SFL has the potential to improve the strength, mobility, and self-rated health of frail, homebound older adults receiving HCBS. Given the growth of the older adult population and public health challenge of delaying costly nursing home placement, this study presents a novel solution by describing the impact of an evidence-based resistance exercise program on strength, mobility, and self-rated health in older adults. These findings are important in enabling us to understand and develop strategies to help older adults maintain their functioning to support aging-in-place in the future.
VII. CONCLUSION

A. Discussion

The purpose of this dissertation was to implement a pilot study to test the feasibility of implementing SFL, an evidence-based resistance exercise program with older adult clients receiving HCA assistance through HCBS. This study examined both client and HCA outcomes using quantitative and qualitative measures. In summary, results demonstrate that older adults in this sample who received HCBS have substantial levels of frailty and are at significant risk for hospitalization, falls, and mortality. However, HCAs were able to successfully implement SFL with these persons. Importantly, this study found that the implementation of SFL in the CCP was acceptable to both clients and HCAs who reported high levels of satisfaction with the intervention. No clients reported adverse reactions to SFL providing initial evidence of the overall safety of its use for this population. Since this study was designed as a pilot study, the number of clients enrolled was insufficient for efficacy tests for the impact of SFL on physical performance, self-reported health, and frailty levels. However, we now have baseline estimates of the variance in these measures in this understudied high risk population and trends show medium effect sizes for grip strength, pain, and PROMMIS-global health. Furthermore, the overall number of frail clients in the intervention group decreased between baseline and post-test compared with an increase in the number of frail clients over time in the control group.

Currently, no PA programming is offered within the CCP line of HCBS services. Initially, 64 HCAs out of approximately 125 (51%) employed by the Cook County office of CCSI expressed interest in participating in this study suggesting a high demand for PA programming among HCAs. Client recruitment was more challenging. Of the approximately
150 clients served by the 64 HCAs, only 52 clients expressed interest in SFL (35%). This rate is consistent with data documenting older adults’ reluctance to participate in PA programs (Coffman, 2004). While initial client interest in participation was low, clients who completed SFL reported positive benefits from participation and 100% stated that SFL should be offered to all clients in the CCP.

Fidelity checks in the homes of participating intervention clients found SFL was delivered to clients with good adherence to the original training instructions. HCAs were skilled in modifying and adapting SFL to accommodate clients’ physical limitations. Information from program evaluation data showed that HCAs did not encounter time limitations in implementing SFL, supporting the practicality of this intervention within usual care.

The primary purpose of this study was to determine feasibility of implementing SFL within a new population. Since this was a pilot study, it did not have sufficient statistical power to detect a significant difference in client outcomes between control and intervention groups between baseline and posttest. Despite a lack of statistically significant differences in baseline and posttest outcomes, trends were observed towards improved strength, mobility, and self-rated health in the intervention group compared with the control group.

There are a number of other reasons that might also explain why statistically significant differences were not seen in this feasibility study. Maturation would likely not contribute to differences in client outcomes given the relatively short time frame of the 12-week intervention. However, since random assignment occurred at the level of the HCA rather than the client, client maturation may have impacted client outcomes. Since this
population of older adult clients has multiple chronic conditions and high overall prevalence of frailty, it is possible that fluctuations in health status by group impacted individual client performance on outcome measures, confounding study results.

Despite standardized SFL training, variations in individual HCAs could have contributed to selection threats to internal validity in this study. Personality and communication styles, as well as the nature of the individual HCA-client relationship may have influenced SFL uptake and subsequent outcomes. I attempted to investigate the nature of the HCA-client relationship as a moderator variable using the Social Support for Exercise Scale. However, the majority of the clients were unable to complete the scale due to difficulties understanding the measure, thus, the data was unusable indicating a need to develop or use some other measures that are more user-friendly for this population.

Generalizability of study findings is challenged by selection bias. The present study recruited HCAs and clients who were interested in participating in a physical activity intervention. If SFL is adopted into the standard package of usual care for all clients receiving HCBS state wide, the feasibility of the intervention with populations who do not self-select into a study will be important to assess.

While fidelity checks showed clients received the intervention with good adherence to the original evidence-based program, I was unable to control for specific factors associated with delivery, such as enthusiasm and support provided by the HCA or the specific HCA instructions regarding dosage and intensity which may have impacted adherence and outcomes. In training, we instructed HCAs and clients to track their adherence to the intervention by filling out an exercise calendar on the days that they completed SFL. Unfortunately, only eight of the 19 clients (42%) in the intervention group
completed this calendar. Therefore, I was unable to determine the extent to which clients adhered to the recommendation of three times per week participation, as well as understand the potential role of treatment dosage on client outcomes.

I had also initially planned to use pedometers to capture client ambulatory activity to investigate the impact of SFL on reducing sedentary behavior. However, pedometer data could not be used as daily step counts because the overwhelming majority of clients had illogical numbers (10 out of 42; 24%) or had more than three days of missing data during the seven-day observation period (14 out of 42; 33%). Since overall mean gait speed in the sample was extremely slow, it is highly likely that the pedometers were unable to capture step counts because the slow velocity did not provide enough displacement to record movement as a step. This finding again indicates an important need to identify and test other valid ways of assessing ambulatory activity in this unique population and setting.

I used the Job Descriptive Index to assess HCA job satisfaction at baseline and the end of the 12-week intervention. At baseline, job satisfaction scores were high for both control and intervention HCAs. Thus, this measure did not provide substantial information regarding the impact of the intervention on job satisfaction due to apparent ceiling effects with this specific population of HCAs. Furthermore, HCA literacy levels may have contributed to difficulties in completing the measure accurately. During measurement, a number of aides asked for help completing the questionnaire because they could not understand the words used in the tool. This finding again indicates an important need to develop a more sensitive measure of job satisfaction and/or the need for research staff to administer the measure in the future with this group of workers.
B. **Future Research**

This study provides strong initial evidence that SFL can be implemented by HCAs for clients receiving HCBS. Future research studies should be fully powered to test the effectiveness of SFL for clients and should investigate whether SFL works for the heterogeneous population of older adults served by HCBS before SFL can be adopted into standard practice. Evidence-based programs to improve the health of older adults receiving HCBS are urgently needed to provide optimal care for the expanding number of older adults receiving these services.

The ability to collect information on HCA support for exercise was limited because clients had difficulties using the Social Support for Exercise Scale. Future research should involve the development of tools appropriate for HCBS clients to quantify the amount and type of support for physical activity that HCAs provide. This information is needed to determine the optimal type and amount of support necessary to encourage physical activity participation in this population, as well as to investigate the relationship between support and adherence.

Future studies must determine the effectiveness of SFL with older adult clients receiving HCBS. These studies will need to address the following issues considering the diversity of home- and community-based care clients by ethnicity, geographic location, functional performance, and cognition:

- Is there demand for SFL across the varied populations receiving HCBS?
- Can SFL be implemented with the heterogeneous populations receiving HCBS?
- Is SFL more effective in improving client outcomes than existing usual care services?
- Is SFL a cost-effective intervention?
• Is SFL sustainable?

• What are the long-term effects of SFL?

Finally, SFL is a single-component, resistance exercise program. There is some evidence that multi-component programs that target strength, balance, and aerobic domains are more effective at improving function than single-component programs (Daniels, 2008). Future research should determine the most effective components of programs, their optimal combinations, and ideal dosage for implementation into public health programming nationwide for this population.

C. **Summary**

The results of this feasibility study show that SFL can be implemented by HCAs faithfully and appropriately within the CCP. They also show that SFL, when implemented, SFL benefited both care partners. The study had insufficient statistical power to determine whether SFL changed client disability levels or functioning; however, there were trends were observed with respect to improved strength and mobility for intervention group clients. Finally, this study is novel in its identification of a feasible implementation mechanism to disseminate evidence-based physical activity programming to older adults receiving HCBS; a significantly underserved population.
CITED LITERATURE


**Journals of Gerontology Series A: Biological Sciences and Medical Sciences** 64(1);76-82:2009.


Piercy, K.: “When it is more than a job”: Close relationships between home health aides and older clients. J. Aging Health 12(3);362-87:2000.


Sallinen, J., Stenholm, S., Koster, A., Rantanen, T., Sainio, P., Heliovaara, M., Koskinen, S.: Association between obesity, history, and hand grip strength in older adults--exploring the roles of inflammation and insulin resistance as mediating factors. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences 66(3);341-48:2011.


Shumway-Cook, A., Brauer, S., Woollacoot, M.: Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go Test. Physical Therapy 80(9);896-903:2000.


APPENDICES
APPENDIX A. FIDELITY CHECKLIST

Client number: ____________________________________________

HCA number: ____________________________________________

Reviewer: ________________________________________________

Week #: _________________________________________________

Session #: ______________________________________________

Any complaints or issues?

Program Components:

1. Did the warm up? Yes No

Describe adaptations:

2. Performance of strengthening exercises:
## APPENDIX A (continued)

Performed exercises:

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Yes</th>
<th>No</th>
<th>Adaptations / Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip extension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip abduction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ankle pumps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rowing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heel raises</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leg kicks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulder abduction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victory exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip rotation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Get up and go</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Arm extension</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments on resistance exercise:

- Quality of exercise participation:
- Client safety:
- Client perception of difficulty of program:
- Client understanding/confusion of program:
- Client use of equipment:

Completed calendar adherence log? Yes No
APPENDIX B. CLIENT STRONG FOR LIFE EVALUATION FORM

Instructions: We greatly value your opinions regarding the Strong for Life exercise program. We are interested in your honest opinions. Please provide information about your experience with the Strong for Life Program.

1) Please rate your level of satisfaction with the program:

   1  2  3  4  5  6  7  8  9  10
   Strongly Unsatisfied
   Somewhat
   Extremely Satisfied

2) What were the benefits of the Strong for Life exercise program for you?

3) What are areas of improvement in the Strong for Life exercise program?
APPENDIX B (continued)

4) Did you have difficulty implementing the Strong for Life program in your home?

   Yes                  No

   If yes, please describe the problem and how you solved the problem:

5) Did your Home Care Aide assist you with the Strong for Life exercise program?

   Yes                  No

   If yes, in what way(s) did your Home Care Aide assist you?

6) Is the implementation of Strong for Life for the Community Care Program clients a good idea?

   Yes                  No

   If no, why not?
APPENDIX B (continued)

7) What aspects of the Strong for Life Program worked for you?

8) What aspects of the Strong for Life Program did not work for you?

9) What are your suggestions for improving this program?
APPENDIX C. HOME CARE AIDE STRONG FOR LIFE PROGRAM EVALUATION (TO BE COMPLETED AT END OF STRONG FOR LIFE PROGRAM)

Instructions: We greatly value your opinions regarding the Strong for Life exercise program. We are interested in your honest opinions. Please provide information about your experience with the Strong for Life Program.

1) Please rate your level of satisfaction with the program:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Unsatisfied</td>
<td>Somewhat Satisfied</td>
<td>Extremely Satisfied</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) What were the benefits of Strong for Life exercise for your client?

3) What are areas to improve the Strong for Life exercise program for your client?
APPENDIX C (continued)

4) Did you have difficulty implementing the Strong for Life program in your client’s home?
   Yes  No

   If yes, please describe the problem and how you solved the problem:

5) Did the Strong for Life training session prepare you to train your client appropriately?
   Yes  No

   If no, how does the training need to be improved?

6) Is the implementation of Strong for Life for the Community Care Program clients a good idea?
   Yes  No

   If no, why not?
APPENDIX C (continued)

7) What aspects of the Strong for Life Program worked for you and your clients?

8) What aspects of the Strong for Life Program did not work for you and your clients?

9) Was space and equipment adequate for your clients to perform Strong for Life in the home?

10) What are your suggestions for improving this program?
APPENDIX D. HOME CARE AIDE STRONG FOR LIFE TRAINING EVALUATION

Instructions: We greatly value your opinions regarding the Strong for Life exercise training session. We are interested in your honest opinions. Please provide information about your experience with the Strong for Life Program training:

Please circle the word that best describes your feelings to each line:

1. How well did the training session meet your expectations?
   Poor  Fair  Satisfactory  Good  Excellent

2. How would you rate the quality of the Strong for Life training content?
   Poor  Fair  Satisfactory  Good  Excellent

3. How useful were the training handouts?
   Poor  Fair  Satisfactory  Good  Excellent

4. What was the ability of the presenter to communicate content?
   Poor  Fair  Satisfactory  Good  Excellent

5. How was the area in which the program was held?
   Poor  Fair  Satisfactory  Good  Excellent
APPENDIX D (continued)

6. How was the convenience of the program day and time?

| Poor | Fair | Satisfactory | Good | Excellent |

7. Overall, how would you rate this Strong for Life training program?

| Poor | Fair | Satisfactory | Good | Excellent |

What were the best aspects of this training?

What would you change about this training?
APPENDIX E

Figure 3. Clinical flow diagram

Assessed for eligibility (HCA n=64) (clients n=64)

HCA Excluded (n=30)
- Not meeting inclusion criteria (n=3)
- No clients enrolled (n=27)

Clients Excluded (n=22)
- Not meeting inclusion criteria (n=12)
- Declined to participate (n=7)
- Unable to reach (n=2)
- Hospitalized (n=1)

HCAs Randomized (n=34) serving (n=42) clients

Allocated to 12 week SFL intervention (n=19 HCA and n=24 clients)
- Received SFL training (n=17)
- Did not receive SFL training (n=2) – did not show up for training
- Clients receiving SFL materials (n=21)

Allocated to 12 week usual care control (n=15 HCA and n=18 clients)
- Received control (n=15)
- Clients receiving usual care (n=18)

Lost to follow-up (n=3)
- Death (n=1)
- Unable to contact (n=1)
- Refused post-test measurement (n=1)

Lost to follow-up (n=4)
- Death (n=1)
- Refused post-test measurement (n=3)

Analyzed (n=17 HCA and n=21 clients)

Analyzed (n=15 HCA and n=18 clients)
### APPENDIX F

**TABLE X**  
HOME CARE AIDE PARTICIPANT BASELINE DEMOGRAPHICS BY GROUP

<table>
<thead>
<tr>
<th></th>
<th>Total participants n=32</th>
<th>Total n=32 % or mean (SD)</th>
<th>Control Group n= 15 % or mean (SD)</th>
<th>Intervention Group n= 17 % or mean (SD)</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.99</td>
</tr>
<tr>
<td>Age in years</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>48.7 (11.79)</td>
<td>.28</td>
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<tr>
<td>Race</td>
<td>47.3 (11.65)</td>
<td>49.9 (12.14)</td>
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<td>.28</td>
<td></td>
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<td>African American</td>
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<td>67</td>
<td>76</td>
<td>.27</td>
<td></td>
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<tr>
<td>White</td>
<td>6</td>
<td>0</td>
<td>12</td>
<td></td>
<td></td>
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<tr>
<td>Hispanic</td>
<td>22</td>
<td>33</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest Education</td>
<td>47</td>
<td>33.3</td>
<td>63.6</td>
<td>.08</td>
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<tr>
<td>Achieved</td>
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<td></td>
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<td></td>
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<tr>
<td>High School or less</td>
<td>44</td>
<td>61.1</td>
<td>27.3</td>
<td></td>
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<tr>
<td>Some College</td>
<td>9</td>
<td>5.6</td>
<td>9.1</td>
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<tr>
<td>College and above</td>
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<td></td>
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</tbody>
</table>
### APPENDIX G

## Table XI

CLIENT PARTICIPANT BASELINE DEMOGRAPHICS BY GROUP

<table>
<thead>
<tr>
<th></th>
<th>Total participants n = 42</th>
<th>Control Group n = 18</th>
<th>Intervention Group n = 24</th>
<th>p-value* (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Female</td>
<td>83 (SD)</td>
<td>83 (SD)</td>
<td>83 (SD)</td>
<td>.99</td>
</tr>
<tr>
<td>Age in years</td>
<td>74.8 (SD)</td>
<td>75.6 (SD)</td>
<td>74.1 (SD)</td>
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<td>Weekly Hours of Care</td>
<td>13.5 (SD)</td>
<td>12.0 (SD)</td>
<td>14.2 (SD)</td>
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</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td>.39</td>
</tr>
<tr>
<td>African American</td>
<td>50 (SD)</td>
<td>50 (SD)</td>
<td>50 (SD)</td>
<td>.50</td>
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<tr>
<td>White</td>
<td>43 (SD)</td>
<td>39 (SD)</td>
<td>46 (SD)</td>
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<tr>
<td>Hispanic</td>
<td>5 (SD)</td>
<td>6 (SD)</td>
<td>4 (SD)</td>
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<tr>
<td>Highest Education Achieved</td>
<td></td>
<td></td>
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<tr>
<td>Some Grade School</td>
<td>2 (SD)</td>
<td>0 (SD)</td>
<td>4 (SD)</td>
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<tr>
<td>Grade School</td>
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<td>22 (SD)</td>
<td>13 (SD)</td>
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<td>Some High School</td>
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<td>11 (SD)</td>
<td>29 (SD)</td>
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</tr>
<tr>
<td>High School</td>
<td>26 (SD)</td>
<td>28 (SD)</td>
<td>25 (SD)</td>
<td></td>
</tr>
<tr>
<td>Some College</td>
<td>26 (SD)</td>
<td>28 (SD)</td>
<td>25 (SD)</td>
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<tr>
<td>College</td>
<td>7 (SD)</td>
<td>11 (SD)</td>
<td>4 (SD)</td>
<td></td>
</tr>
<tr>
<td>Grip Strength (kg)</td>
<td>17.3 (6.54)</td>
<td>17.3 (6.36)</td>
<td>17.3 (5.74)</td>
<td>.99</td>
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<td>Quadriceps Strength (N)</td>
<td>23.7 (10.18)</td>
<td>22.0 (11.84)</td>
<td>24.9 (7.50)</td>
<td>.39</td>
</tr>
<tr>
<td>Gait Speed (m/sec)</td>
<td>0.5 (0.31)</td>
<td>0.5 (0.33)</td>
<td>0.5 (0.26)</td>
<td>.70</td>
</tr>
<tr>
<td>Timed Up and Go (sec)</td>
<td>22.5 (23.65)</td>
<td>21.8 (32.43)</td>
<td>24.4 (14.79)</td>
<td>.76</td>
</tr>
<tr>
<td>Pain</td>
<td>5.0 (2.98)</td>
<td>5.4 (2.89)</td>
<td>4.7 (3.17)</td>
<td>.31</td>
</tr>
<tr>
<td>Self-Efficacy for Exercise Scale</td>
<td>6.9 (2.38)</td>
<td>7.0 (1.94)</td>
<td>6.8 (2.13)</td>
<td>.69</td>
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<td>PROMIS-Global Health</td>
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<td>28.7 (6.50)</td>
<td>30.4 (5.24)</td>
<td>.39</td>
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<tr>
<td>PROMIS-physical subscale</td>
<td>11.5 (3.11)</td>
<td>11.3 (2.82)</td>
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<td>PROMIS-mental subscale</td>
<td>12.7 (3.32)</td>
<td>11.7 (3.35)</td>
<td>13.4 (2.56)</td>
<td>.08</td>
</tr>
</tbody>
</table>
VITA

NAME: Margaret Katherine Danilovich

EDUCATION: B.A., Exercise Science, Concordia University, River Forest, Illinois, 2005

D.P.T., Doctor of Physical Therapy, Northwestern University, Chicago, Illinois, 2007

Ph.D., Public Health Sciences, University of Illinois at Chicago, Chicago, IL 2015

LICENSURE: Licensed as a Physical Therapist in Illinois, 070-016292

FACULTY APPOINTMENTS: Instructor, Department of Physical Therapy and Human Movement Sciences, Northwestern University, Feinberg School of Medicine, Chicago, IL, 2014-present

Clinical Instructor, Department of Physical Therapy, University of Illinois at Chicago, Chicago, IL 2012-2014

PROFESSIONAL MEMBERSHIPS: American Physical Therapy Association, 2004-present

American Society in Aging, 2015-present