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Community Aging in Place, Advancing Better Living for Elders (CAPABLE): A Bio-Behavioral-Environmental Intervention to Improve Function and Health-Related Quality of Life in Disabled, Older Adults

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Abstract

Objectives—To determine effect size and acceptability of a multi-component behavior and home repair intervention with low-income, disabled older adults

Design—Prospective randomized controlled pilot trial

Setting—Participants' homes

Participants—40 low income older adults with difficulties in at least 1 Activity of Daily Living (ADL) or 2 Instrumental Activities of Daily Living (IADL).

Intervention—Coordinated occupational therapy (OT), nursing (RN), and handyman (HM) visits compared to attention-control visits. The intervention consisted of up to 6 visits with an OT, up to 4 visits with an RN and an average of \$1,300 in HM repairs and modifications. Each intervention participant received all components of the intervention clinically tailored to risk profile and goals. Each attention-control participant received the same number of visits as the intervention participants, involving sedentary activities of their choice.

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Author Contributions:

SLS, RJT, EKT, JKA, JMG and LNG were involved in all aspects of the study from inception including concept and design, analysis and interpretation of data and preparation of the manuscript. CB was involved with the medication management and PCP communications aspects of the intervention and preparation of the manuscript. BL, EA, CLS, and CW participated in the design of the study, interpretation of the data and preparation of the manuscript. QLX participated in interpretation of the data and preparation of the manuscript.

Measurement—Primary Outcome: difficulty in performing ADL and IADLs. Secondary outcomes: Health related quality of life and falls–efficacy.

Results—Thirty five of 40 adults (87%) completed the 6-month trial and 93% and 100% of the control and intervention group, respectively, stated the study benefited them. The intervention group improved on all outcomes. When comparing the mean change in the intervention group compared to the mean change in the control group from baseline to follow up, the CAPABLE intervention had an effect size of 0.63 for reducing difficulty in ADLs, 0.62 for reducing difficulty in IADLs, 0.89 for Quality of Life, and 0.55 for Falls-efficacy.

Conclusion—The multi-component CAPABLE intervention was acceptable to participants, feasible to provide, and showed promising results, suggesting that this multi-component intervention to reduce disability should be evaluated in a larger trial.

Keywords

disability; intervention; home-based

INTRODUCTION

Thirteen million U.S. adults aged 65 and older experience some type of disability. This is almost 40 percent of community-dwelling older adults.¹ This number is expected to increase, as both the current older population and the baby-boom cohort ages. While late-life disability rates have been declining,² other factors portend increases, such as the increasing number of middle-aged adults reporting difficulty with physical function.³ Because disability is one of the strongest predictors of nursing home admission,⁴ the increase in our aging population's disability burden puts society at risk of ever growing expenditures for long term care services.⁵ Prevention of disability is a research priority.

Disability is defined as the gap between an individual's abilities and the environment in which that person functions.⁶ This definition, as well as the conceptual model by Lawton and Nahemow⁷ describing the complex relationship between an older adult and his or her environment, suggest that the most effective interventions will be those that increase the capacity of the individual **and** decrease the demands of the environment. Although a growing body of research has tested interventions designed to reduce functional limitations,^{8–12} with few exceptions, these interventions have focused on either the individual's underlying impairment or environmental barriers.

Low-income and African-American older adults have a particular need for interventions that address both intrinsic and extrinsic factors, because they have higher rates of disability,^{13,14} chronic disease, pain,¹⁵ depression¹⁶ and less access to primary care¹⁷ (all intrinsic factors) than their higher-income or white counterparts. They are also more likely to live in deteriorated housing¹⁸ and to lack the resources necessary to modify it (both extrinsic factors) to compensate for their declining capabilities.

The purpose of this study was to pilot test the feasibility, acceptability and effect size of the Community Aging in Place, Advancing Better Living for Elders (CAPABLE) intervention targeting both individual (intrinsic) and environmental (extrinsic) disability factors in a population of low-income, disabled, predominantly African-American older adults compared to an attention-control condition over the course of six months.

METHODS

Recruitment and Randomization

Individuals were recruited from the lists of three government and non-profit organization of low-income older adults awaiting home-based services in Baltimore City. Persons were contacted first by letter and then a follow-up phone call to explain the study, determine interest and screen for eligibility. Eligible participants had to be at least 65 years old, demonstrate cognitive function with a score of 24 or higher on the Mini-Mental State exam¹⁹ 3), report difficulty with at least one Activity of Daily Living (ADL)²⁰ or at least two Instrumental Activities of Daily Living²¹, be considered low income (household income equaling or less than 199% of Federal Poverty Level), and be able to stand with or without assistance. For this study, we define disability as having difficulties performing at least 1 ADL or 2 IADLs. With these inclusion criteria, we enrolled a sample with a wide range of disability. Individuals were excluded if they had been hospitalized more than 3 times in the previous year, were currently receiving in-home rehabilitation (nursing, physical therapy or occupational therapy), had a terminal diagnosis with less than one year expected survival as determined by their physician or receiving active cancer treatment, had plans to move in less than one year, or not competent to provide informed consent. Recruited persons who provided informed consent were assessed at baseline by trained evaluators and then randomized to either the intervention or an attention-control group. All participants were reassessed at 6 months by evaluators masked to study assignment. This pilot study was approved by the Johns Hopkins Medical Institutions Internal Review Board.

The Community Aging in Place, Advancing Better Living for Elders (CAPABLE) intervention

Overview of the intervention—CAPABLE is informed by theory and evidence-based practices⁸ (Table 1). It involves up to 10 in-home sessions, each of 60 minutes duration, over a 6-month period. It draws upon best practices to enhance uptake and adoption of intervention strategies such as patient-centered care and motivational interviewing by interventionists.^{22, 23} All participants in the intervention received each component of the intervention (assessment, education, interactive identification of barriers to function with joint discussion of possible retraining and solutions) but interventionists tailored components to each participant's risk profile and goals.

Intervention Delivery Characteristics: The delivery characteristics of the CAPABLE intervention consisted of an assessment-driven, individually tailored package of interventions delivered by an occupational therapist (OT) (up to 6 home visits for an hour each), an RN (up to 4 home visits for an hour each) and a handyman (HM) team. Appointments for each intervention service were spaced across weeks so that participants had opportunities to practice new strategies or activities with the health professional and then on their own. Examples of each intervention component are in Table 1.

CAPABLE Protocol OT—In the 1st and 2nd OT sessions, the OT met with each participant and conducted a semi-structured clinical interview using the Client-Clinician Assessment Protocol (C-CAP) which has been tested for its psychometric properties for use in home-based and home modification programs.²⁴ The C-CAP provides a systematic approach from which to identify and prioritize performance areas that are problematic to participants. For each identified area, the OT observed the participant's performance to evaluate safety, efficiency, difficulty, and environmental barriers and supports. The C-CAP combines both self-report and observation in collaboration between the client and occupational therapist on 22 functional items as well as an assessment of environmental features that may pose problems for mobility or performance of ADLs and IADLs.²⁴

Common safety and mobility risks our team identified included holes in floors, uneven carpeting, and non-existent railings or banisters. The participant and OT decided together on environmental modifications. The OT then securely emailed a list of agreed upon assistive devices and housing repairs to the HM coordinator. In **OT sessions 3–5**, the OT engaged the participant in identifying behavioral and environmental contributors to performance difficulties and strategies for attaining functional goals. The OT trained participants to use specific strategies such as energy conservation, task and environment simplification and assistive device use. Also, the OT taught balance and fall recovery techniques to decrease fear of falling. In each session, the OT reinforced strategy use, reviewed patient-identified solutions, refined strategies, and provided education and resources to address future needs. The installation of home modification devices (e.g., grab bars, rails, raised toilet seats) was coordinated with the HM to ensure that they were provided in a timely manner to meet the needs of the participant. The OT provided individual training for use of each type of home modification a participant received. In the **final (6th) OT session**, the OT reviewed all techniques, strategies and devices, and helped the participant generalize the approach to other daily situations.

CAPABLE protocol RN—The RN met with each intervention participant for up to 4 visits during the same six months of the OT visits. **The first RN session** occurred within 10 days of the first OT session. During this visit, the RN assessed the participant using the C-CAP RN developed specifically for CAPABLE in which the RN focused on how and whether pain, depression, strength and balance, medication management and communication with a Primary Care Provider (PCP) impact daily function. Although communication with a PCP seems more remotely related to function, many participants did not know how to call their PCP if they had questions about medications that impact function such as diuretics that make them hurry to the bathroom or insulin that makes them dizzy from hypoglycemia. In this first assessment, the RN and the participant identified and prioritized goals, and used motivational interviewing to construct behavioral plans. In **RN visits 2 and 3**, the RN and the participant worked on the goals identified through the C-CAP RN. Similar to the OT visits, during each session, the RN reinforced strategy use, refined strategies (e.g. Tai Chi or pain management), and provided education and resources to address future needs (e.g. pill box for medication management). In the **final (4th) session**, the RN reviewed the participants' strategies and helped to generalize them to other possible challenges.

CAPABLE protocol HM—The HM portion was contracted with Civic Works, a local non-profit AmeriCorps site. The HM coordinated the ordering of the assistive devices as well as the repair and modification supplies. The HM made as many home visits as required to provide the renovations/modifications that the OT orders. The average budget allocated for this work was \$1300 per household.

Attention/Education Control: Comparable to classic fall-prevention research, an attention-control group that mirrored the amount of time spent on social attention and engagement provided to the intervention group by the OT and RN interventionists was provided to the control group.²⁵ Participants received up to ten 60 minute sessions with a trained research assistant (RA), who was not an OT or RN. The attention-control RA engaged participants in reminiscence²⁶ and sedentary activities of their choice such as making scrapbooks or family cookbooks together. Time with the attention-control RA was documented on a tracking sheet for each visit and signed by the participant. Bi-weekly supervisory sessions between the PI and the RA tracked content of the attention-control visits.

Measures: Single blind assessments were obtained at baseline (T0) and after pilot trial completion six months later (T1). Baseline assessment included demographic, psychosocial

and physical disability measures. These measures were selected based on the following criteria: 1) known reliability and validity with low-income samples; 2) sensitive to change; and 3) clinical relevance to quality of life.²⁷ The primary outcome was the reduction in ADL and IADL difficulty; a secondary focus was health-related quality of life, and falls efficacy. Finally, participants were also asked questions about being part of the study to determine acceptability.

Primary end-point—Activities of Daily Living²⁰ Self-report information about whether the participant had difficulty in performing one or more of five essential activities of daily living (ADLs): bathing, dressing, eating, using the toilet, and transferring in and out of bed.²⁰ For each task, a respondent reported whether they had difficulty with each task or not. These responses were summed to create an index ranging from 0–5, with higher scores representing poorer functioning.

Instrumental Activities of Daily Living²¹ is derived from self-report information on independent living skills. The items assessed were telephone use, shopping, preparing food, light housekeeping, taking medications independently, and managing finances independently. These responses were summed to create an index ranging from 0–6, with higher scores representing poorer functioning.

Secondary outcomes—Health-related Quality of Life was measured with the EQ-5D or Euroqol. The EQ5D has two components – a five item multi-attribute utility scale and a single-item visual analog scale. The EQ-5D has been used extensively to model quality of life changes in intervention trials.²⁸

Falls Efficacy was measured by asking each participant to rate from 0–10 their confidence in doing each of the following 10 activities without falling: cleaning house, getting dressed and undressed, preparing simple meals, bathing, shopping, getting into or out of a chair, going up and down stairs, walking in their neighborhood, reaching into cabinets or closets, and hurrying to answer the phone. This measure has been shown to have a strong relationship to function.²⁹

Statistical Analysis

Statistical analysis was performed on a modified intention to treat basis. All individuals in the study and available for follow up were included in the analyses regardless of level of participation. However, individuals who were not available for follow-up were not included and their data was not imputed. Baseline comparisons between CAPABLE and control were carried out with Students t-test for independent samples for continuous data and chi square for categorical data. The primary outcome was reduction in the number of ADLs for which participants reported difficulty between baseline and 6 months and was analyzed for Cohen's D effect size by subtracting the mean of the control group from the mean of the intervention group and dividing by the pooled standard deviation. Acceptability was determined by examining percentages of people who stayed in each arm of the study and also who answered positively to the questions regarding the benefits of the study. All analysis was performed using STATA 10 software (College Station, TX).

RESULTS

The study sample consisted of 40 adults (38 women and 2 men). The mean age was 78 (+SD of 7.8) and 79% of the overall group was African-American. Table 2 lists baseline characteristics of the study sample. Both groups were similar in age, gender, education, ADL difficulty, IADL difficulty, quality of life, cognition, and falls efficacy.

By design, the sample reported difficulty in performing ADLs. Forty four per cent (18 / 41) reported 3 or more ADLs for which they reported difficulty at baseline. At baseline, 57% of the sample reported bathing difficulty, 45% reported difficulty dressing, 71% reported difficulty getting into or out of bed, 31% reported difficulty getting on or off the toilet, 19% reported difficulty eating. Thirty eight per cent reported difficulty preparing meals, 71% reported difficulty doing light housework, 67% reported difficulty going shopping, 2% reported difficulty using the telephone, 15% reported difficulty taking their medications, 26% reported difficulty managing their money.

The handyman portion cost a mean of \$1285 per house with a range of \$149 to \$2185. The most expensive houses had unsafe electrical work that required a separate contractor. Some of the common repairs the HM provided were tightening or adding railings or banisters, gluing floor tiles to make floors flush, installing secure grab bars, repairing front stairs, and tightening carpeting. The most serious deficits fixed were replacing gas stoves with significant carbon monoxide leaks, replacing a “live” wire, repairing a shower leak that dripped onto the laminate living room floor below, and replacing a front door that could not close completely. The PI authorized repairs hypothesized to increase participant safety and mobility.

Overall, both the control and the intervention group reported that their participation in the CAPABLE study was positive. One hundred per cent of the intervention group and 93% of the control group said that participation benefited them. Eighty seven percent (35 of 40) of randomized participants completed final data collection. Of those who did not complete, 2 were recovering from surgery, one was in a nursing home, one had gone into adult day care and was difficult to reach, and one had an illness in the family (5 in intervention group and 1 in control group).

This study demonstrated moderate to strong effect sizes for the differences in the mean change between the intervention and the control group from baseline to follow-up (Table 3). Additionally, while 94% of the intervention group said that participation in CAPABLE made their life easier, only 53% of the control endorsed the same.

DISCUSSION

To our knowledge, this pilot study is among the first that targeted modifiable factors at both the individual and environmental level among low income and minority older adults with difficulty in performing ADLs and IADLs. Guided by theory, the intervention was designed to decrease functional difficulty by intervening on both intrinsic and extrinsic factors. The findings from this study suggest the potential power of a multi-component intervention that integrates home repair, nursing, and occupational therapy to improve daily function and well-being. As this intervention has potential to reduce functional limitations, future research is warranted to understand whether there is improvement for the outcomes preliminarily investigated here, as well as potential effects on downstream outcomes such as nursing home admission and other health care transitions.

The study has several strengths. First, the participants were randomly assigned. Second, the intervention addresses both intrinsic and extrinsic factors relating to disability. Third, this pilot represents a rigorous clinical pilot trial in the home.

Several limitations deserve mention. First, the study design and size prohibit determination of the relative value of each individual component. Second, in selecting from waiting lists for available services, participants may have been selected who differed in important ways from individuals with the same needs but who are absent from such lists.

The CAPABLE intervention was both feasible and acceptable. Participants enjoyed the intervention and reported that they would help us recruit participants for another study. In summary, a bio-behavioral-environmental intervention such as CAPABLE may be a promising approach to improving difficulty in performing disability limitation and quality of life with low-income disabled older adults.

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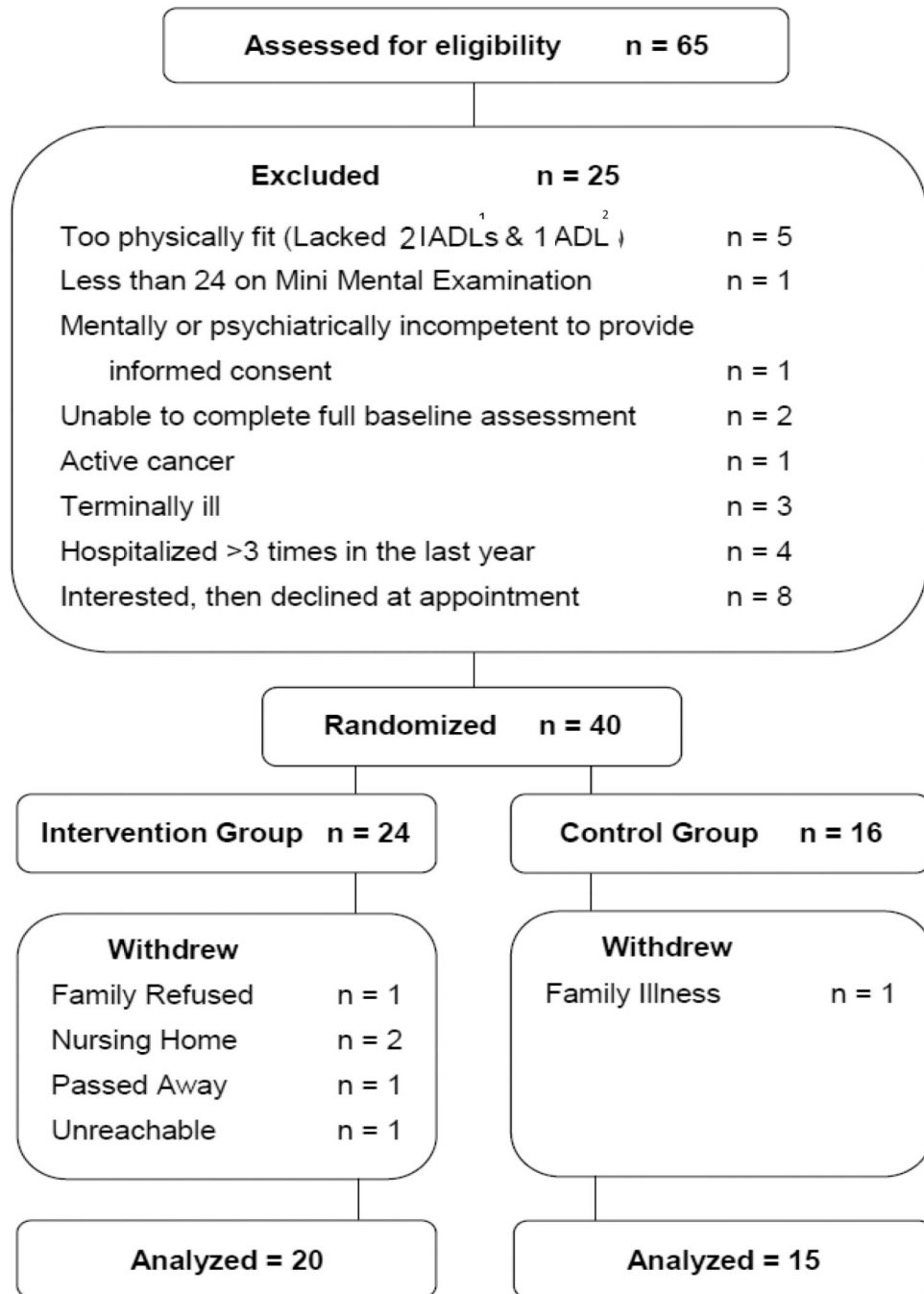


Figure 1.
Flow of participants in the CAPABLE trial
¹IADL = Instrumental Activities of Daily Living.
²ADL= Activity of Daily Living.

Table 1

CAPABLE Targeted Areas, Goals, and Treatment Approaches by Intrinsic and Extrinsic Dimensions

Dimension	Target area : goal	Treatment Approach
Extrinsic:	Housing safety: Modify and repair built environment to decrease fall risk and increase mobility	1) OT assesses house for safety risks. Creates prioritized list for HM examples of which are: fill in holes in floors, stabilize shaky banisters, caulk holes, control pests, lower microwave to reachable height, install tailored bathroom safety equipment.
Intrinsic: Individual Factors	Self-care: ↑ ability to independently conduct ADLs and IADLs	1) For each participant-identified area of concern, the OT a. observes performance; b. with participant, identifies solutions for priority concerns, c. orders, installs, and trains participant in the use of the adaptive devices. 2) The HM installs adaptive devices such as raised toilet seats and shower chairs.
	Communication with PCP: Enhance patient activation to facilitate safe management	1) RN provides Health passport; 2) medication simplification; 3) letters from RN to PCP on medication issues; 4) RN refers participants to new PCP if have none or Housecalls PCP if unable/unwilling to leave home; 5) Patient activation training by RN
	Medication Management: ↑ ability to adhere to medication regime	RN helps participant identify medication management problems and solutions such as 1) patient education on medication need; 2) dose timing; 3) physical reminders; 4) medications with fall implications
Intrinsic: Physiologic factors	Strength/balance: ↑ ability to stand, balance, and recover from falls, near-falls	1) RN implements NIA exercise with participant; 2) RN assesses interest in DVD's of TaiChi and tailored home visits from Tai Chi instructors; 3) RN assesses interest in exercise bands; 4) OT trains in fall recovery; 5) OT and RN reinforce strength and balance strategies at each visit.
	Depression: Enhance skills for mood management	RN implements an evidence-based depression intervention if necessary. 1) The participant identifies problems such as social isolation, health care needs, and housing-related issues that feel overwhelming; 2) participant and RN generate multiple solutions, evaluate and compare solutions; 3) participant implements the chosen solution; 4) participant and RN evaluate the outcome.
	Pain: To decrease pain to facilitate function	1) RN does thorough pain assessment 2) RN advocates on behalf of participant with PCP re pain medication 3) RN educates participant on timing and dosing of pain medication; 4) RN provides other pain management techniques such as topical NSAIDs, distraction, mobility, heat

OT = Occupational Therapist

RN = Registered Nurse

HM = Handyman

PCP = Primary Care Provider

ADL = Activity of Daily Living

IADL = Instrumental Activity of Daily Living

NIA = National Institute on Aging

DVD = Digital Video Disk

NSAIDs = Non-steroidal anti-inflammatory medications

Table 2

Baseline characteristics of participants according to group assignment

	CAPABLE group	Control	p
	N=24	N=16	
Age in years, mean (SD)	79 (8.2)	77 (7.1)	0.25
% female	96%	94%	0.76
%African-American	77%	81%	0.69
Education in years, mean (SD)	11.8(3.3)	11.9 (2.4)	0.88
ADL ¹ difficulties (0–5 scale)	2.1 (0.2)	2.6 (0.4)	0.24
IADL ² difficulties (0–5 scale)	2.3 (1.4)	2.0 (1.1)	0.47
Health related Quality of Life ³ (0–100)	57.9 (18.7)	63.1 (19.1)	0.39
MiniMental Score (24–30 by design)	26.0 (1.3)	27.3 (0.7)	0.38
Falls Efficacy ⁴ (10–65)	33.8 (3.3)	30.7 (4.4)	0.57

¹ADL= Activity of Daily Living. Includes bathing, dressing, eating, using the toilet, and transferring in and out of bed. Lower numbers indicate fewer difficulties

²IADL = Instrumental Activities of Daily Living. Includes telephone use, shopping, preparing food, light housekeeping, taking medications independently, and managing finances independently. Lower numbers indicate fewer difficulties

³Health Related Quality of Life. Higher numbers indicate higher health-related quality of life.

⁴Lower scores indicate more efficacy.

Table 3

Comparison of baseline and 24 week outcome measures for CAPABLE Intervention group and the Attention-Control Group

Outcome Measure	Group^a	Baseline Mean (SD)	24 week Mean (SD)	Effect size^b
<i>Disability</i>				
ADL difficulties ^c	CAPABLE	2.1 (1.2)	0.7(0.8)	0.63
	Control	2.6 (1.4)	2.1 (2.3)	
IADL difficulties ^c	CAPABLE	2.3 (1.4)	1.2(1.3)	0.62
	Control	2.0 (1.1)	1.8 (1.9)	
<i>Quality of Life</i>				
EuroQOL	CAPABLE	57.9(18.7)	75.8 (15.04)	0.89
	Control	63.1 (19.1)	62.5(24.9)	
EQ5D:	CAPABLE	3.8 (1.2)	2.9 (1.6)	0.48
	Control	3.8(1.7)	3.8 (2.2)	
Falls –Efficacy ^c	CAPABLE	33.8 (15.5)	28.8 (14.1)	0.55
	Control	30.7 (17.1)	36.1(27.6)	

^aCAPABLE: N = 24, control N= 16

^bd = mean of change in intervention group from baseline to follow up minus mean of control group from baseline to follow up / divided by pooled standard deviation

^clower scores indicate improvement