Aging Gracefully in Place: An Evaluation of the Capability of the CAPABLE Approach

U.S. Department of Housing and Urban Development | Office of Policy Development and Research

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FOREWORD

Aging Gracefully in Place: An Evaluation of the Capability of the CAPABLE Approach

According to the most recent demographic estimates from the U.S. Census' Current Population Survey (2020), the number of adults aged 65 years or older is roughly 56 million. Based on projections from the Centers for Disease Control and Prevention, we can expect that number will reach 73 million by 2030 and 94 million by 2060. Given this reality, the challenge of providing quality, affordable housing options for an aging population will increasingly come into full view. Moreover, as people age, they are more likely to have or develop a mobility impairment, and more than 75 percent of adults aged 65 and older have difficulty with at least one physical function. These trends suggest that the costs and loss of independence associated with age and impaired function will rise dramatically unless interventions are formulated, validated, and widely implemented.

In 2009, researchers at Johns Hopkins University developed the Community Aging in Place—Advancing Better Living for Elders (CAPABLE) program which helps seniors and persons living with disabilities improve their ability to perform the activities of daily living and enables frail, low-income, older clients to age comfortably in safe homes. CAPABLE is a multidisciplinary intervention that involves an occupational therapist, registered nurse, and home repair professional. Previous studies of the program among low-income seniors in Baltimore have shown that it achieves high engagement from participants, improves participants' daily function and independence, and results in overall cost savings by reducing the use of a range of different in-patient, outpatient, and long-term services.

The main objective of this study was to validate the CAPABLE model in other community settings to determine if it is feasible, appropriate, and successful when implemented by different types of organizations, with different housing types, and with clients of varying backgrounds. The study found that it was feasible for small organizations in four micropolitan and urban locations to implement the program.

Most important, the study found that the program was effective at the time of the long-term follow-up of:

- Reducing falls from an average of 1.3 falls in the baseline year to 0.3 falls in the follow-up year.
- More than 20-percent increase in the percentage of study group clients who reported no difficulty with bathing, lower body dressing, getting in and out of beds and chairs, using the toilet, and walking across a small room.

The control group saw no or smaller changes between baseline and long-term follow-up on these measures.

These impacts were achieved with a modest implementation cost, ranging from roughly $300 to $12,000 and averaging $2,600 per client, with the higher costs for single-family homes.

The sample sizes for this research are small, but promising findings like these support further exploration of the CAPABLE model as a promising approach for addressing the urgent need for accessibility modifications for the rapidly growing population of American seniors.

Todd Richardson
General Deputy Assistant Secretary for Policy Development and Research
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1. Introduction

The number of people 65 years and older in the United States will grow from 49.2 million in 2016 to 73.1 million in 2030 and 94.7 million in 2060 (U.S. Census Bureau, 2017). Among Americans who were 65 years old in 2015, 62 percent of men and 71 percent of women can expect to live to 80 years old (ACL, 2017). Over 75 percent of adults 65 and older have at least one physical function difficulty (NCHS, 2018). These trends suggest that the impact of decreased function and associated costs and suffering will rise dramatically unless interventions are formulated, validated, and widely implemented. According to the National Aging in Place Council, a 70-year old with no functional impairments can expect to remain active and without impairment for about 9 more years, while those in poor health will remain active only 2 years before an impairment makes it difficult to live in their own home (NAIPC, n.d).

Nearly 90 percent of people over age 65 want to live in their own homes for as long as possible (AARP, 2018). However, for disadvantaged older adults living in poverty, aging in their homes is often not an option, despite the fact that aging-at-home intervention costs are far lower than skilled nursing facility (SNF) costs and can reduce both nursing home and hospital admissions. SNF costs are a burden on society. In 2018, 55 percent of the costs were paid by Medicaid, Medicare, and the Veterans Administration (CMS, 2020). In 2016, total long-term care spending—including public, out-of-pocket, and other private spending—was $366 billion (12.9 percent of all U.S. personal health care spending), almost two-thirds of which was paid by Medicaid and Medicare (CRS, 2018). In 2014, long-term care payments (totaling $152 billion) were almost one-third of all Medicaid spending, with $55 billion spent on nursing facility care alone (HHS, 2018). Acute-care costs, such as costs associated with short-term, immediate medical care for serious illnesses (e.g., heart attack, abdominal pain/spasms) or traumatic injuries (e.g., fall-related broken bones), are also burdensome. For example, as the Centers for Disease Control and Prevention (CDC) reports, about $50 billion is spent on nonfatal fall injuries each year—$29 billion paid by Medicare and $9 billion by Medicaid (CDC, 2020). Reducing the high psychological, emotional, and financial costs of frequent hospitalizations and SNF care through cost-effective interventions to reduce admissions is a public health priority. Researchers and policymakers have found that limitations in multiple Activities of Daily Living (ADLs)[1] or Instrumental Activities of Daily Living (IADLs)[2] are the leading modifiable predictors of nursing home admission (Gaugler et al., 2007; Salive et al., 1993).

In 2009, researchers at Johns Hopkins University (JHU) developed the Community Aging in Place-Advancing Better Living for Elders (CAPABLE) program to help reduce ADL disabilities and allow frail, low-income, older clients to age in place in safe homes. Until that time, most programs addressed either the individual's underlying impairment or environmental barriers, but not both (Szanton et al., 2011). CAPABLE offers a three-pronged, integrated approach: (1) the support of in-home occupational therapists (OTs); (2) the support of registered nurses (RNs); and (3) home modification services from handymen or home repair (HR)

[1] ADLs are defined as eight activities essential to daily self-care: walking across a small room, bathing, upper and lower body dressing, eating, using the toilet, transferring in and out of bed, and grooming.

[2] IADLs are defined as eight independent living skills: using a telephone, shopping, preparing food, light housekeeping, washing laundry, traveling independently, taking medications independently, and managing finances independently.

professionals[3] to address health and safety issues. These three interventionists work in tandem with each other and the client to individualize the fit between the client and his/her home. Because clients define their own goals, they are more likely to be engaged in the services and show greater function improvements.

In Baltimore, a team of professors, OTs, RNs, and other personnel from the JHU School of Nursing and the JHU School of Medicine, with grant funding, led the development and testing of the CAPABLE program. JHU's first pilot program was conducted about 10 years ago. In their Baltimore-based studies, JHU reported that CAPABLE yielded a 49 percent improvement in the number of ADL limitations, from a baseline average of 3.9 to a 5-month post-baseline average of 2.0. Participants also experienced improvements in IADLs and depression. All improvements were uniform across demographic groups (Szanton et al., 2016). Since then, the CAPABLE program is expanding across the country and is currently being utilized by healthcare organizations, Habitat for Humanity, area agencies on aging, housing organizations, and visiting nurse associations at 27 sites across the United States (Szanton et al., 2019).

The CAPABLE program must prove feasible, appropriate, and acceptable in various communities before it can be more widely implemented and brought to scale across more regions of the country (CDC, 2009). Building on the positive Baltimore results, in this study, the "Aging Gracefully in Place, An Evaluation of the Capability of the CAPABLE Approach" (Aging Gracefully), we evaluated whether CAPABLE could be successful through demonstrations in four diverse communities with different types of implementation organizations, housing stocks, and clients of varying backgrounds.

At the four sites, NCHH and its partners sought to increase older adult residents' control over their physical function and their housing conditions so they could age in their homes, become stronger, and be able to move more independently both inside and outside their homes, which should in turn decrease health care costs through improved quality of life and reduced social isolation. Often more concerned with their ability to function than with co-morbidities, clients who help set their own priorities for functional goals and home repairs are more motivated to follow through with action plans so they can remain independent (Szanton et al., 2014a). This person-directed approach to both the built environment and the individual is what guides CAPABLE and makes it unique (Petersson et al., 2007).

We conducted a randomized controlled evaluation of the CAPABLE program's impact on ADL and IADL limitations and other function-related parameters (see Section 2, Methods). Through this evaluation, NCHH and its partners sought to benefit enrolled individuals directly, prove the CAPABLE program's efficacy, and help promote implementation and more widespread adoption of similar approaches across the country.

2. Methods

Throughout this section, footnotes direct the reader to relevant sections of a separate brief, *"Aging Gracefully in Place: Important Considerations When Considering CAPABLE Program©*

[3] JHU uses the terms "home modification" and "home repair" to describe the types of tasks conducted for this third arm of the CAPABLE approach, and the terms "handyman" or "handy worker" to describe the person who performs these tasks.

Implementation," which discusses the policy and implementation implications of our research findings.

2.1. CAPABLE Program Methods

2.1.1. Identification of Aging Gracefully Partners

NCHH originally selected the four Aging Gracefully partners via a competitive process:

- Community Housing Solutions (CHS) of Guilford, Greensboro, North Carolina: Nonprofit organization providing safe and affordable housing to low-income households through home repair.
- Cathedral Square Corporation (CSC), South Burlington, Vermont: Provider and manager of affordable, service-enriched housing communities for older adults and people with special needs.
- The City of Bethlehem, Pennsylvania.
- The San Diego Department of the Environment.

Soon after NCHH obtained full funding for the project, both the Bethlehem and San Diego partners decided not to participate, citing insufficient capacity for the project. At the suggestion of the Weinberg Foundation, NCHH brought Catholic Social Services, Wilkes-Barre (CSSWB), Pennsylvania, on as a partner. Because another funder, Archstone Foundation, focuses on work in California, we recruited and contracted with the Family Health Centers of San Diego (FHCSD) (California), a Federally Qualified Health Center (FQHC), to replace the original San Diego partner.

2.1.2. Formation and Training of CAPABLE Teams in Each Region

Each partner assembled a team of Site Coordinators (SCs), OTs, RNs, and HR Specialists to meet the CAPABLE service requirements (exhibit 2-1).

Exhibit 2-1 Organizations Contributing Staff to Aging Gracefully Teams

Staff Type	NC	PA	VT	CA
OT	Cone Health	Allied Services	University of Vermont Medical Center	Per-Diem Contractors
SC	CHS	CSS, Wilkes-Barre	CSC	FHCSD
RN	Triad HealthCare Network	Allied Services	CSC	FHCSD
Home Repair	CHS	Local contractor	CSC maintenance	RT-San Diego
Recruiter	CHS	CSSWB, CSS-Scranton, AAA Luzerne County	CSC	FHCSD

AAA = Area Agency on Aging. CHS = Community Housing Solutions. CSC = Cathedral Square Corporation. CSSWB = Catholic Social Services, Wilkes-Barre. FHCSD = Family Health Centers of San Diego. OT = occupational therapists. RN = registered nurse. RT = Rebuilding Together. SC = site coordinator.

2.1.3. CAPABLE Service Provision

Before beginning any CAPABLE program work, JHU trained RNs and OTs from each partner site in CAPABLE methods.[4] JHU provided support to OTs and RNs throughout the Aging Gracefully project. Before beginning any project work, HR personnel from each partner site participated in a training webinar developed by NCHH and JHU to train these personnel in evaluation protocols and discipline-specific responsibilities. Due to staff turnover, on seven occasions over the course of the project, a total of 13 OTs and 9 RNs were CAPABLE-trained by JHU staff or through JHU online modules and local staff shadowing.[5]

The CAPABLE program is described in detail elsewhere (Szanton et al., 2014b, 2019). As JHU says on its CAPABLE website, the OT, RN, and HR collaborate,[6] working "in tandem with the older adult, as an interprofessional team" (JHU, n.d). The OT evaluates functional disability and home safety risks and works with the client to identify and reach functional goals. The RN works with the client on issues with pain, depression, medication management, communication with primary care providers, and strength and balance. They brainstorm with the client on the best ways to achieve the client's functional goals and develop an integrated plan to address those goals together with the home repair professional. This plan may include housing modifications, durable medical equipment, or everyday items and assistive equipment to support the goals. All OT, RN, and home modification services had to be provided during the CAPABLE service period, not during evaluation follow-up (post-CAPABLE) periods. Other than the parameters set by the Hopkins training and our research requirement that all enrolled adults had to meet the 12 criteria listed in section 3.2.1, partners were free to design and run CAPABLE programs in a manner that best fit their community.[7]

Our analyses included only those clients who had a baseline evaluation visit and either a short-term or long-term follow-up visit. We included only those clients judged by the partner CAPABLE teams to fully complete CAPABLE services and set a minimum of six total visits for inclusion in the analysis dataset.

2.2. Evaluation Methods

Advarra (formerly Chesapeake Research Review, Inc.), an Institutional Review Board (IRB), approved this study before any recruitment or data collection. Informed consent was obtained from all study participants. We collected self-reported health status data via interview at three points over the course of the project (baseline, short-term follow-up, and long-term follow-up). In addition, we conducted a visual assessment of each home, checking for safety hazards. NCHH trained evaluation field personnel in the approved protocols.

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[4] Implementation Brief Step 4 ("Train the CAPABLE Team) discusses policy implications of CAPABLE team training.

[5] Implementation Brief Steps 3 ("Assemble the CAPABLE Team) and 9 ("Retain Staff") discusses policy implications of staff hiring and turnover. In particular, Step 3 discusses the influence of regional OT shortages on CAPABLE implementation.

[6] Implementation Brief Steps 2 ("Determine the Lead Organization") and 3 ("Assemble the CAPABLE Team") discuss policy implications of CAPABLE team collaboration.

[7] Implementation Brief Step 7 ("Provide CAPABLE Services") discusses policy implications of CAPABLE service provision.

To maintain the confidentiality of enrolled individuals' private data collected during this project, and in compliance with the Health Insurance Portability and Accountability Act (HIPAA) regulations, personnel with responsibility for health data collection and/or data management completed the three modules of the U.S. Department of Health and Human Services (HHS) Office of Health Research Protections online Human Subject Assurance Training before initiating the project (HHS OHRP, n.d.).

2.2.1. Recruitment, Enrollment, and Randomization of Clients

Eligibility.[8] Potential participants had to meet the following eligibility criteria, adapted from those JHU used in their randomized controlled trial of CAPABLE (Szanton et al., 2014b):

1. At least 65 years of age.
2. Difficulties with at least one ADL *or* at least 2 IADLs.
3. Annual household income ≤80 percent of annual median income (AMI), with the majority having an annual income ≤50 percent AMI.
4. Cognitively intact based on the Short Portable Mental Status Questionnaire (SPMSQ) (Stanford, 2010).
5. Able to stand with or without assistance.
6. Not been hospitalized overnight four or more times in the past 12 months.
7. Not currently receiving in-home OT, RN, or physical therapy (PT) services.[9]
8. Not currently receiving outpatient PT services for balance or muscle-strengthening (PT for post-surgery recovery within past 3 months was ok).
9. Not currently receiving active cancer treatment.
10. Planning to stay in his/her current home in the next year.
11. Comfortable speaking English.
12. Not residing in an assisted living or other facility providing direct service medical care.

Residents were not required to own the home to be eligible for the project; however, one partner (North Carolina) required homeownership because their organization exclusively served homeowners.

Recruitment.[10] Recruitment methods varied by the partner and included:

- Referrals from housing and older adult aid organizations serving low-income households.
- Referrals from healthcare organizations.
- Fliers placed in and visits to low-income older-adult residential buildings, senior citizen community centers, libraries, and faith-based organizations.

Phone Screen. Partners used a phone screening tool to preliminarily determine a person's eligibility, asking about age, income, and whether the person lived in assisted living or other medical service facilities. If the person passed the phone screening, the SC set up an in-home visit to confirm full eligibility, enroll the person, and obtain informed consent.

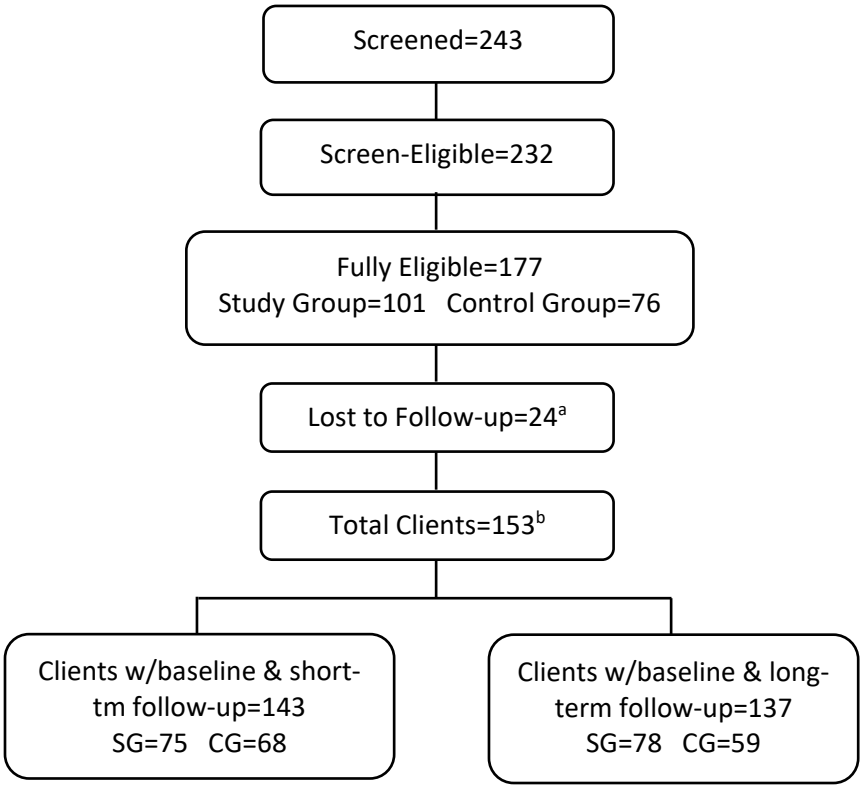
[8] Implementation Brief Step 5 ("Determine Enrollment Criteria") discusses policy implications of CAPABLE eligibility.

[9] This requirement was waived on a case-by-case basis if partners could not enroll without referrals from agencies providing such services. Participants needed to be newly signed up for, but not yet receiving, home services.

[10] Implementation Brief Step 6 ("Recruit CAPABLE Participants") discusses policy implications of client recruitment.

In-Home Eligibility Determination.[11] The SC conducted an in-home visit to make the final eligibility determination. If a person met all eligibility requirements, the SC obtained signed informed consent and then randomly assigned the client to either a Study Group or a Control Group (defined in section 3.5) according to a randomization list previously generated by the NCHH biostatistician for each partner. The four partners reached their enrollment goals while adhering to the randomization requirements; however, some of these clients were lost to follow-up before receiving CAPABLE services. Funders who paid for the CAPABLE service component of Aging Gracefully wanted up to 144 clients to participate in CAPABLE. To reach this goal, we replaced clients lost to follow-up before CAPABLE participation. North Carolina and Pennsylvania were able to assign each replacement client to the treatment group which had lost a client to follow-up; however, Vermont and California, who began the project months later than North Carolina and Pennsylvania, had to non-randomly assign replacement clients to the study group because insufficient time remained to assign them to the control group (i.e., and wait a year to gather 12-month post-baseline data and begin CAPABLE services). Exhibit 2-2 provides phone screening, home-visit eligibility, and attrition statistics.

Exhibit 2-2. Phone Screening, In-Home Eligibility, and Attrition Statistics



[a] Of the 24 clients lost to follow-up, 4 were unable to be contacted after repeated attempts; 4 moved into an assisted living or other facility offering medical services; 3 no longer wished to participate (one did not feel well enough, one's husband recently passed away, one reason unspecified); 2 passed away; 2 had mental health issues that prevented further progress; 2 became ill or injured in a manner which prevented their further participation in CAPABLE; and 7 finished services too late to be included in the dataset or did not complete either an EV2 or EV3.

[b] 153 Clients completed a baseline visit (EV1) and either short-term or long-term follow-up visits (EV2 or EV3, respectively).

[11] Implementation Brief Steps 5 ("Determine Enrollment Criteria") and 8 ("Retain Participants") discusses policy implications of CAPABLE eligibility and attrition.

2.2.2. Evaluation Data Collection

During the first in-home visit (see section 3.3), field staff conducted the baseline evaluation health interview after confirming eligibility and completing the treatment group assignment. Clients provided self-reported data for eight physical and mental health outcomes:

- Primary Outcome: ADL limitations (Katz et al., 1963).
- Secondary Outcomes:
  - IADL limitations (Lawton and Brody, 1969).
  - Quality of life (EuroQoL ED-5D™ [1998].
  - Falls efficacy 9 (Tinetti, Richman, and Powell, 1990).
  - Depression (Patient Health Questionnaire, PHQ-9; Spitzer et al., n.d.).
  - Life-space analysis (LSA; Peel et al., 2005; Baker, Bodner, and Allman, 2003). Measures mobility in terms of the spatial extent of a person's life (Peel et al., 2005). We used the University of Alabama's LSA instrument, a validated tool to assess the full range of mobility, ranging from (1) mobility dependent on assistance from another person and limited to the room where a person sleeps to daily to (2) independent travel out of the person's town.
  - Pain interference with normal, everyday activities (adapted from the "Brief Pain Inventory"; Cleeland and Ryan, 1994).
  - Number of falls in the past year (National Health Interview Survey Balance and Dizziness Supplement-Falls; CDC and NCHS, 2009). Data on the number of falls in the past year were collected only at baseline and long-term follow-up visits.

The health interview was repeated at two follow-up home evaluation visits. Study group clients received their short-term follow-up visit within about 1 month of completing CAPABLE. The median time between baseline and the short-term follow-up visit was 6 months for study group clients and 5 months for the control group clients. Both study and control group clients received the long-term follow-up visit approximately 12 months after the baseline visit (i.e., about 7 months post-CAPABLE for the study group). Each client received a $25 gift card after completing each of the three interviews ($75 total).

Control group clients received CAPABLE services after the long-term follow-up visits. At the baseline visit, partner field staff provided these clients with educational materials on home safety and fall prevention. In between evaluation visits, partner staff made periodic calls to control group clients to remind them of the project and the upcoming CAPABLE interventions.

During each of the three evaluation visits, field staff conducted a walk-through visual assessment of the general dwelling, interior floors, interior stairs and steps, kitchen, bathroom(s), and bedroom of each client's home, using a Home Safety Checklist adapted from CDC's 2015 brochure for older adult residents, "Check for Safety: A Home Fall Prevention Checklist for Older Adults" and the U.S. Consumer Products and Safety Commission's 2009 document, "Safety for Older Consumers-Home Checklist" (CDC, 2015; CPSC, 2009).

2.2.3. Data Entry and Management

This project utilized Vanderbilt University's Research Electronic Data Capture (REDCap) system, a secure, web-based, HIPAA-compliant environment for building and managing web-based projects. REDCap has security to protect the stored data as well as information on the identity and activity of REDCap end-users (Vanderbilt University, 2013). Vanderbilt

University's Data Coordinating Center securely hosted the evaluation website. Each REDCap user was trained by NCHH staff, had their own user account, and were permitted access to only those REDCap components that NCHH granted them. Each partner had access to their own but no other partner's data. NCHH exported REDCap data into SAS and Excel for periodic reporting and data analysis purposes.

Evaluation data stored in REDCap included the phone screen, the three evaluation interview forms, and the three home safety checklists. CAPABLE materials—used only by the OT, RN, and SC for CAPABLE service provision (not evaluation) purposes—were stored in a separate REDCap section.

2.2.4. Data Analysis

For all statistical analyses, we defined marginal significance as $0.05 \leq p < 0.1$ and significance as $p < 0.05$.

Some clients missed the short-term follow-up visit but completed the long-term follow-up visit, while others completed the short-term follow-up visit but were lost to follow-up before the long-term follow-up visit. For these reasons, we used two datasets in the analyses. The first included clients who completed both the baseline and the short-term follow-up visit. The second included clients who completed both the baseline and the long-term follow-up visit.

Interview. For dichotomous variables of yes/no, we used the Fisher's exact test to test that the percent yes was different between the two cohorts. We used the Cochran-Mantel-Haenszel (CMH) method of association to test the hypothesis that the percent yes changed from baseline to follow-up. We used weighted least squares methods to test that the change in the percent yes from baseline to follow-up was different for the study versus the control group.

For continuous or count variables, we used a paired t-test to determine a difference in the means or the mean changes between the study and control groups. For ordinal variables, we used the Cochran-Mantel-Haenszel mean score method to test that mean scores differed between the two cohorts.

Key Health Outcome Score Calculations. Six of the eight key health outcomes required a score calculation (exhibit 2-3). Scores for limitations in ADLs and IADLs, PHQ-9 (depression), quality of life, and falls efficacy were calculated following the methods Szanton et al. (2014b) described in their study rationale and design article. The life-space composite score (LSC) was calculated following the methods described by Sawyer et al. (Sawyer Baker, Bodner, and Allman, 2003).

Exhibit 2-3 Information on Scoring for Five Key Health Outcomes

Health Outcome	# Components	Score Methods	Score Range
ADL limitations	8 activities	0=no difficulty and needs no help; 1=difficulty but needs no help; 2=needs help regardless of difficulty	0=best 16=worst
IADL limitations	8 activities	0=no difficulty and needs no help; 1=difficulty but needs no help; 2=needs help regardless of difficulty	0=best 16=worst
Quality of Life	5 domains	1=no problem; 2=small problem; 3=large problem	5=best; 15=worst
Falls Efficacy	10 activities	0 to 10 confidence rating that person can do activity without falling	0=very confident

			10=not confident at all
PHQ-9 (Depression)	9 problems	In past 2 weeks, client has been bothered: 0=Not at all; 1=several days; 2=>half the days; 3=nearly every day	0=best 27=worst
Life-Space Composite Score (LSC)	5 locations	In past 4 weeks: • Did you go to the place (1=Yes, 0=No); • If so, how often (0=<1/wk; 1=1 to 3 times/wk; 2=4 to 6 times/wk); • Need help from another person=1; use equipment only=1.5 or neither=2	0=restricted to bed 120=totally unrestricted

ADL = activities of daily living. IADL = instrumental activities of daily living.

Modeling. Multivariable linear modeling was conducted to identify predictors of the reduction in the ADL limitations score from baseline to short-term follow-up for 70 study group participants with complete data. A stepwise forward regression procedure, with 0.1 significant level for variable entry into and with 0.15 significant level for removal, was conducted. The following variables were considered as potential predictors:

- Home (five variables): Type of home—Single-family versus apartment; Baseline home hazard score (see next paragraph for definition); Interaction between home hazard score and type of home; Year built—pre-1981 versus post-1980; Ownership—Rent versus own home.
- Client: Baseline ADL limitations score; age; race; gender; education; client lives alone—yes versus no; income < 30 percent AMI—yes versus no; number of baseline chronic conditions; baseline PHQ-9 score (depression).

Home Safety. To evaluate baseline versus follow-up home safety, we compiled 27 home safety checklist questions that applied to single-family and multifamily homes (exhibit 2-4). We used responses to these 27 questions to calculate a "home hazard score" for each home at each visit, with possible scores ranging from 0 (no home safety hazards) to 27 (maximum home safety hazards present). We used a paired t-test to determine if there was a mean change between visits within each treatment group and a two-sample t-test to determine if the mean change between visits was different for the study group versus the control group.

Exhibit 2-4 List of Home Safety Checklist Questions used to Calculate Home Hazard Score

Home Area	Question
General	How cluttered is the participant's home
General	Extent to which designated surfaces (for example, tables, kitchen counters) are covered
General	Emergency phone numbers posted in large print near the main phone the participant uses
General	Is a phone present in the main room where participant sleeps
Floors	When you walk through a room, do you have to walk around furniture
Floors	Are there throw rugs on the floor
Floors	Are papers, books, towels, shoes, magazines, boxes, blankets, or other objects on floor
Floors	Do you have to walk over or around wires or cords (like lamp, telephone, or extension cords
Floors	Is the flooring in need of repair
Kitchen	Are the things the participant often uses located on high shelves
Kitchen	If participant uses a stepstool, is it unsteady
Kitchen	If participant uses a stepstool, does it have a bar to hold onto?
Kitchen	Is the kitchen poorly lit
Kitchen	Is the microwave located too high for participant to access unless they use a stepstool

Bathroom	Does the tub or shower have a non-slip rubber mat or non-slip surface
Bathroom	Does the tub or shower have grab bars next to but just outside the tub/shower
Bathroom	Does the tub or shower have grab bars inside the tub/shower
Bathroom	Does the toilet have grab bars next to it
Bathroom	Does the toilet have a raised seat
Bathroom	Is the bathroom poorly lit
Bathroom	Does the bathroom have a shower chair
Bathroom	Does the shower have a flexible hose
Bedroom	Is the light near the bed hard to reach
Bedroom	Is the path from the bed to the bathroom dark
Bedroom	Does the path from the bed to the bathroom have a nightlight
Bedroom	Is there a flashlight within reach of the bed in case of power outage
Bedroom	Do ceiling light fixtures/ceiling fans have wall switches or chains participant can reach without stretching

CAPABLE Service Cost Compilation.[12] SCs periodically submitted to NCHH the cost of OT and RN visits for each client, as well as itemized costs for each type of home modification, durable medical equipment (DME), assistive equipment (AE), and home safety item, on a per-client basis. NCHH entered these cost data into partner-specific Excel spreadsheets, which were consolidated for data analysis. Partners paid OTs and RNs on a per-visit basis, regardless of how long each visit lasted. North Carolina, Pennsylvania, and California paid fixed fees for OT and RNs, regardless of the number of visits ultimately conducted. Home repairs, DME, AE, safety items, and everyday products were entered into an Excel spreadsheet and separated into seven home repair-related and 17 DME/AE-related categories.

Medical Event Cost Demonstration. The goal of the cost demonstration was to compare data on unplanned healthcare visits (for example, hospital, urgent care center, and emergency room) and their associated costs for the study group and the control group for the 1-year period before the baseline visit and the one-year period before the long-term follow-up visit. We used Medical Expenditure Panel Survey (MEPS) data converted to 2018 dollars (midpoint for the Aging Gracefully project) to extract mean inpatient hospitalization discharge expenditures per visit and ER expenditures[13] per visit for adults age 65 and older across the United States and in three pertinent U.S. regions (West for California, Northeast for Pennsylvania and Vermont, and South for North Carolina). MEPS data were not available in smaller regional categories. We subtracted hospital inpatient costs for admitted patients who did not spend a night (AHRQ, 2015). We based cost inflators on Center for Medicare and Medicaid estimates of yearly national health expenditure increases (4.3 percent in 2016, 3.9 percent in 2017, and 4.6 percent in 2018, for a total of 13.1 percent between 2015 and 2018; CMS, 2020).

We used these mean MEPS data to calculate mean total expenditures for three types of medical events: (1) emergency room (ER) visits, (2) ER visits leading to hospitalization, and (3) hospitalization only (for example, urgent care or doctor visits leading to hospitalization). We calculated cost rates for each medical event type for the study and control groups at baseline and long-term follow-up.

[12] Implementation Brief Step 1 ("Know the Costs of Initiating CAPABLE") discusses policy implications of CAPABLE program costs.

[13] Expenditures = funds that were actually transferred, not costs, which can be two to four times higher than expenditures.

3. Results

3.1. Demographic Data

Client demographics trended toward low-income, White, high-school-educated females living alone (exhibit 3-1) and were similar across partner sites, except that North Carolina enrolled more Black clients. California enrolled a higher percentage of Hispanic clients than the other partners. All client incomes were below 80 percent of the regional annual median income (AMI), and one-half had incomes less than or equal to 30 percent of AMI. Clients had lived in their homes a mean of 20 years (range less than 1 to 75 years), and 69 percent lived alone at baseline.

Overall, 51 percent of clients lived in apartments or condominiums in multi-unit buildings versus single-family homes. While Vermont had this same 50-50 housing split, in Pennsylvania, about two-thirds of clients (61 percent) lived in apartments. In California, this percentage was much higher at 98 percent, while North Carolina's was much lower at less than 5 percent. About one-fourth of clients had homes with interior issues based on visual assessment.[14] Again, however, the percentage varied between partners, from 0 percent for Pennsylvania clients to 42 percent for North Carolina. The mean year of home construction was in the 1961–80 range, both overall and for Vermont. Pennsylvania and North Carolina clients tended to live in slightly older homes (1941–60 range), while California homes were a bit newer (2001–2016 range). Study group demographics were statistically similar to those of the control group (exhibit 3-2).

Exhibit 3-1 Aging Gracefully Client Demographics Summary

Characteristic	NC (N=43)[a]	PA (N=28)[a]	VT (N=33)	CA (N=49)	ALL (N=153)[a]
# (%) Female	34 (79%)	21 (75%)	24 (73%)	33 (67%)	112 (73%)
Mean Age at Enrollment (SD)	76.6 (7.1)	82.3 (8.6)	81.6 (6.9)	72.3 (6.2)	77.3 (8.1)
Income:					
# (%) >50% AMI to ≤80% AMI:	18 (44%)	3 (11%)	7 (21%)	1 (2%)	29 (19%)
# (%) >30% to ≤50% AMI:	16 (39%)	9 (33%)	12 (36%)	8 (16%)	45 (30%)
# (%)≤30% AMI:	7 (17%)	15 (56%)	14 (42%)	40 (82%)	76 (51%)
Race/Ethnicity:					
# (%) White, non-Hispanic	10 (23%)	28 (100%)	33 (100%)	22 (45%)	93 (61%)
# (%) Black, non-Hispanic	33 (77%)	0	0	11 (23%)	44 (29%)
# (%) Hispanic, non-White, non-Black	0	0	0	7 (14%)	7 (4%)
# (%) White, Hispanic	0	0	0	5 (10%)	5 (3%)
# (%) Other[b]	0	0	0	4 (8%)[a]	4 (3%)[a]
Highest grade of school completed:					
# (%) 0 to <12 years	9 (21%)	4 (14%)	9 (27%)	13 (27%)	35 (23%)
# (%) High school degree or GED	19 (44%)	19 (68%)	16 (48%)	20 (41%)	74 (48%)
# (%) Associate degree and above	15 (35%)	5 (18%)	8 (25%)	16 (32%)	44 (29%)
Mean #Years in Current Home (SD)	31.9 (16.7)	24.1 (24.3)	19.6 (16.9)	6.2 (5.1)	19.5 (18.8)
% Who Live in Apt or Condo in Multi-Unit Building:	2 (4.7%)	17 (61%)	17 (52%)	48 (98%)	84 (55%)
# (%) Public Housing	0	11 (65%)	0	0	11 (13%)
# (%) Project-Based Section 8 housing	0	1 (6%)	2 (12%)	2 (4%)	5 (6%)
# (%) LIHTC	0	2 (12%)	8 (47%)	36 (75%)	46 (55%)
# (%) Section 202 housing	0	0	5 (29%)	0	5 (6%)
# (%) Condominium	2 (100%)	0	0	0	2 (2%)
# (%) Unknown housing type	0	3 (17%)	2 (12%)	10 (21%)	15 (18%)

[14] Interior issues = Peeling paint, visible evidence of pests, and/or broken furniture or lamps.

# (%) Clients Whose Homes Had Interior Issues	18 (42%)	0	2 (6%)	12 (24%)	32 (21%)
Year of Home Construction	1941-1960	1941-1960	1961-1980	2001-2016	1961-1980

AMI = area median income. GED = General Educational Development. LIHTC = low-income housing tax credit.

[a] Sample sizes are as shown in the column headers, except for the following: (1) Mean age at enrollment: North Carolina N=42, total N=152; (2) Income: North Carolina N=42, Pennsylvania N=27, Total N=151; and (3) Year of home construction: North Carolina N=35, Total N=145.

[b] Other reported race/ethnicities=White/Black/Hispanic, White/Pacific Islander/Other, White/Other, and White/American Indian/Alaskan Native.

Exhibit 3-2 Comparison of Study Group versus Control Group Demographic Data

Characteristic	Results		P
	Study Group (N=83)[a]	Control Group (N=70)	
% Female	72%	74%	0.855[b]
% White	69%	64%	0.608[b]
% Who Live Alone	65%	74%	0.291[b]
% in Moderate or Severe Pain	90%	89%	0.794[b]
% w/Household income >50% AMI but ≤80% AMI	24%	14%	0.154[b]
% Who Live in Apt or Condo in Multi-Unit Building	57%	53%	0.745[b]
Mean Age (SD)	78.2 yr (8.7)	76.4 yr (7.4)	0.168[c]
Mean # of ADL Limitations (SD)	3.7 (1.7)	3.6 (1.8)	0.725[c]
Mean # of IADL Limitations (SD)	3.7 (1.9)	3.7 (2.0)	0.810[c]
Mean # of Chronic Conditions (SD)	3.0 (1.2)	3.2 (1.2)	0.363[c]
Mean # of Years Lived in Current Home (SD)	21.0 (20.9)	17.8 (15.9)	0.274[c]
Highest Grade in School Completed	HS degree	HS degree	0.892[d]

AMI = area median income. HS = high school. SD = standard deviation.

[a] Study Group sample sizes are as shown in the column headers, except for the following: (1) % w/Household income >50% AMI but ≤80% AMI, N=80; Mean # of ADL Limitations, N=82; and (2) Mean # of Years Lived in Current Home, N=82

[b] Observed significance level from Fisher's exact test that the percentage of "yes" is different for the study and control groups

[c] Observed significance level from a two-sample t-test that the means are is different for the study and control groups

[d] Observed significance level from a CMH test that the mean educations are different for the study and control groups, where education is classified as 1=0-<12 years, 2=High school degree or GED, and 3=associates degree and above.

3.2. CAPABLE Service Delivery

Of the 153 clients who had baseline visits and either a short-term or long-term follow-up visit, 132 completed the CAPABLE program. Clients and partner teams needed a mean of 5 months to complete the suite of CAPABLE visits with each client. Overall, clients received a median of six OT visits and four RN visits (exhibit 3-3).

Most modifications and equipment focused on the goals of fall prevention, particularly in bathroom, and personal care (exhibit 3-4). Clients in single-family homes tended to get more home modifications than DME/AE, while clients in apartments or condominiums tended to get more DME/AE. Various reasons were anecdotally provided to explain this difference: Several apartments were already furnished with fall prevention items such as grab bars, while in other settings, landlords were reportedly reluctant to provide items in one apartment that were not feasible or needed in every apartment. Appendix A summarizes the tasks and items assigned to each of the 24 home modification and DME/AE categories shown in this table.

Exhibit 3-3 Summary of Number of Occupational Therapists and Registered Nurses CAPABLE Visits per Client[a]

Type of Visit	Number of CAPABLE Visits/Client (n=132)			
	Min	Mean	Median	Max
OT Visits	2	5.6	6	6
RN Visits	1	3.6	4	4
Total Clinician Visits	6	9.2	10	10

OT = occupational therapists. RN = registered nurse.

[a] A client had to have a minimum sum of six OT and two RN visits to be included in these data.

Exhibit 3-4 Summary of Home Modifications, DME, and AE Provided to Clients

Home Modification Category	% All Clients (n=125)	% SF clients (n=63)	% Clients in Apts (n=62)
General Fall Prevention, Grab bars	42	64	23
Misc. home repairs	34	64	6
Home Organization	27	10	42
Floor repairs	19	27	12
Home safety devices	18	30	6
Door repairs	18	36	2
Home Accessibility	12	22	3

Durable Medical Equipment/ Assistive Device Category	% All Clients (n=125)	% SF Clients (n=63)	% Clients in Apts (n=62)
General Fall Prevention, non-grab bar	75	80	71
Bathroom fall prevention, small	61	63	59
Personal Care Items	46	36	55
Sleep-Related Items	24	5	41
Bathroom fall prevention, large	23	39	9
Other IADL Aids	23	17	29
Pain Reduction Items	22	15	29
Safe Mobility/Transfer Equipment	21	15	26
Exercise items	15	12	18
Walkers	15	5	24
Cooking Aids	14	3	24
Nursing-related items	13	3	21
Vision Items	13	5	20
Home Cleaning Aids	12	7	16
Stress Reduction	12	5	18
Hearing Items	6	5	6
Walking Items, small	6	2	11

3.3. Changes in Home Safety Hazards

In exhibit 3-5, a negative change indicates a lower home hazard score and therefore, fewer home hazards. At both the 5-months and long-term follow-up, study group homes (both single-family homes and homes in multi-family buildings) showed significant reductions in home hazard scores, significantly greater than those in control-group homes. The primary hazard components showing the greatest improvements for the study group over the control group were:

- The presence of papers, books, towels, shoes, magazines, boxes, blankets, or other objects on the floor.
- Tubs and shower having no non-slip rubber mats or non-slip surfaces.
- Tubs and showers having no grab bars inside or outside the tub/shower.
- No raised toilet seat.

- No shower chair in bathroom.

Of the four partners, North Carolina and California had the highest baseline mean home hazard scores (12.7 and 13.3, respectively), as well as the greatest reductions in scores between baseline and short-term follow-up (-4.9 and -7.3, respectively; partner-specific data in appendix C). Pennsylvania and Vermont homes had baseline mean home hazard scores of 8.1 and 7.9, respectively. Pennsylvania's study group reduction, -1.5, was not significantly different from the control group, which had no change in mean score. Vermont's study group reduction (-2.8) was greater than Pennsylvania's and was marginally different from its control group mean reduction (-1.0).

Exhibit 3-5 Changes in Mean Home Hazard Score, Baseline to Short and Long-Term Follow-Up

Timeframe and Type of Home (sample size)	Study Group				Control Group				Study vs. Control
	Baseline	Follow-Up	Change	P [a]	Baseline	Follow-Up	Change	P [a]	P [b]
Baseline to short-term follow-up:									
Single-Family Homes (SG=36, CG=32)	11.6	7.4	– 4.3	**<0.001****	12.9	12.2	– 0.8	0.123	**<0.001****
Apartments/Condominiums (SG=39, CG=36)	10.1	5.6	– 4.4	**<0.001****	11.1	9.7	– 1.3	**0.023****	**<0.001****
All homes (SG=75, CG=68)	10.8	6.5	– 4.3	**<0.001****	12.0	10.9	–1.0	**0.006****	**<0.001****
Baseline to long-term follow-up:									
Single-Family Homes (SG=35, CG=29)	11.6	7.4	– 4.2	**<0.001****	12.5	11.0	– 1.5	**0.002****	**<0.001****
Apartments/Condominiums (SG=43, CG=30)	10.7	5.4	– 5.2	**<0.001****	10.6	8.8	– 1.8	**0.004****	**<0.001****
All homes (SG=78, CG=59)	11.1	6.3	– 4.8	**<0.001****	11.6	9.9	– 1.6	**<0.001****	**<0.001****

[a] Paired t-test was used to test the hypothesis that the mean changed from baseline to follow-up.

[b] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups.

**Significant at $p<0.05$; *marginally significant at $0.05 \leq p < 0.1$

3.4. Key Health Outcomes

When we designed the study, Hopkins was reporting that a full suite of 10 CAPABLE visits took about 4 months to complete (Szanton et al., 2014b). We therefore set the timing of the short-term follow-up visit at 5 months post-baseline, equivalent to about 1-month post-CAPABLE. On average, however, the clients and their CAPABLE teams required about 5 months to complete the program, which meant the study group received their short-term follow-up visits at about 6-months post-baseline (median 6.3 months), while the control group received theirs at 5-months post-baseline (median 5.3 months). The median times between the baseline and long-term follow-up visits for the study group (median 12.2 months) also differed from that of control group clients (12.0 months). The impact of these difference in follow-up visit timing is unknown.

3.4.1. Baseline to Short-Term Follow-Up

Short-term follow-up findings for the seven key health outcomes are summarized in exhibit 3-6. Apart from mean LSC, study group clients experienced significant improvements in all key health outcomes—ADLs, quality of life, falls efficacy, depression, and pain interference with normal activities. During the same time period, control group clients exhibited little if any change in these outcomes except ADLs, which improved, and the mean depression score, which worsened. Within approximately 1 month of completing CAPABLE, study group clients experienced significantly greater improvement in five of the seven key health outcomes: ADLs, quality of life, falls efficacy, depression, and pain interference.

IADL limitations score changes were less dramatic than ADLs. Although the study group experienced a significant decrease in IADL limitations scores, indicating a reduction in IADL difficulties, the control group had no change, and the difference between the study and control group mean changes was not significant.

Study group clients reduced their ADL limitations score by two points (44 percent) for the primary outcome, while the control group's mean score changed by less than one point (17 percent). A reduction by one point is considered clinically meaningful. Study group clients reported having difficulty with a mean of 3.7 ADLs at baseline versus 2.1 after CAPABLE ($p<0.001$), while the control group reduced difficulties with ADLs by only 0.5 (from 3.6 at baseline to 3.1 at follow-up, $p=0.013$). Study group improvement in ADLs was significantly greater than the control group's improvement ($p=0.001$). Between baseline and short-term follow-up, CAPABLE yielded a more than 20-percent increase in the percentage of study group clients who reported no difficulty with bathing, lower body dressing, getting in and out of beds and chairs, using the toilet (an almost 40-percent increase), and walking across a small room (data not shown).

For the primary outcome—changes in ADL limitations scores—California and North Carolina had substantially greater reductions for the study group than the control group (exhibit 3-7). For both the study group and the control group, California had the highest baseline ADL limitations scores. California's study group clients also showed greater short-term improvements than control group clients for four of the five secondary outcomes (mean quality of life, falls efficacy, IADL limitations score, and depression), while North Carolina's showed greater improvements for two (mean quality of life and depression). While Vermont's study group experienced a clinically significant improvement in the mean ADL limitations score, neither Pennsylvania nor Vermont had significant reductions in ADL limitations

scores for the study group versus the control group, possibly due to their relatively small sample sizes, particularly for their control groups. Partner data are presented in appendix B.[15]

Exhibit 3-6 Changes to Key Health Outcomes, Baseline to Short-Term Follow-Up

Outcome (range)	Study Group					Control Group					Study vs. Control
	N	Base-line	Short-Term Follow-Up	Change [a]	P [b]	N	Base-line	Short-Term Follow-Up	Change [a]	P [b]	P [c]
Mean ADL Limitations Score (0–16)	72	4.5	2.5	– 2.0	**<0.001****	67	4.2	3.5	– 0.7	**0.013****	**0.001****
Mean # of ADL Limitations (0–8)	72	3.7	2.1	– 1.6	**<0.001****	67	3.6	3.1	– 0.5	**0.025****	**0.001****
Mean Quality of Life (5–15)	75	9.0	8.2	– 0.8	**<0.001****	68	8.9	8.7	– 0.2	0.236	**0.024****
Mean Falls Efficacy (10–100)	75	32.9	23.7	– 9.2	**0.002****	68	34.1	32.0	– 2.1	0.203	**0.031****
Mean IADL Limitations Score (0–16)	75	5.7	4.9	– 0.8	**0.008****	68	5.2	5.1	– 0.1	0.810	0.148
Mean PHQ-Depression (0–27)	75	6.1	4.7	– 1.5	**0.001****	68	6.2	7.2	1.0	**0.049****	**<0.001****
Life-Space Composite Score (0–120)	75	46.7	47.8	1.1	0.536	68	46.3	48.3	2.0	0.348	0.752
Pain interference w/normal activities (0–10)	73	4.9	3.3	– 1.5	**<0.001****	68	4.7	4.5	– 0.3	0.436	**0.011****

[a] Except LSC, negative change = improvement and positive change = worsening. For LSC, negative change = worsening and positive change = improvement.
[b] A paired t-test was used to test the hypothesis that the mean changed from baseline to follow-up.
[c] A two-sample t-test was used to test the hypothesis that the mean changes were different in the study and control groups.
**Significant at p<0.05

Exhibit 3-7 Partner Comparison of Changes in Mean ADL Limitations Scores, Baseline to Short-Term Follow-Up

Site[a]	Study Group				Control Group			
	N	Baseline ADL Score	Short-Tm Follow-Up ADL Score	Change	N	Baseline ADL Score	Short-Tm Follow-Up ADL Score	Change
CA	19	6.1	2.5	-3.6	22	4.9	4.5	-0.5
NC	22	4.3	1.5	-2.8	21	3.3	1.8	-1.7
PA	16	4.0	3.9	-0.1	9	3.8	3.9	0.1
VT	15	3.3	2.3	-1.0	15	4.1	4.1	-0.1

[a] Detailed partner results are presented in appendix B.

[15] The separate implementation brief discusses partner successes and barriers that may have influenced these outcomes.

3.4.2. Modeling: Factors Influencing Changes in ADL Limitations Score, Baseline to Short-Term Follow-Up

Of the five home-related variables and nine client-related variables used in linear modeling, three were retained in the final model to predict the reduction in ADL limitations scores between baseline and short-term follow-up:

- Higher baseline ADL limitations scores were associated with greater reductions in ADL limitations score at short-term follow-up ($p<0.001$).
- The interaction between baseline home hazard score and type of home:
    - For apartments, higher baseline home hazard scores were associated with greater reductions in ADL limitations score ($p<0.001$).
    - For single-family homes, there is no association between baseline home hazard scores and ADL reductions ($p=0.865$).

Regression model parameter estimates are reported in exhibit 3-8.

Exhibit 3-8 Regression Model Parameter Estimates (R-squared=50.4%)

Parameter	Levels	Parameter Estimate (95% CI)	p-value
Baseline ADL limitations score	-	0.503 (0.304, 0.703)	**<0.001****
Type of Home	Single family	0.257 (-1.823, 2.337)	0. 806
	Apartment	– 3.693 (– 5.238, – 2.149)	**<0.001****
Type of Home x baseline home hazard score interaction	Single family	– 0.013 (– 0.162, 0.137)	0.865
	Apartment	0.318 (0.173, 0.464)	**<0.001****

ADL = activities for daily living.
** Significant at $p<0.05$

After the aforementioned procedure was finalized, we added a four-level site variable (California, North Carolina, Pennsylvania, Vermont) to the model. These four terms served as surrogates for site-specific influences not already included in the model (e.g., the intensity of home repairs/modifications). While controlling for the other variables in the model, the site was significant ($p=0.033$), and the R^2 increased to 57.8 percent. No model variables lost significance when site was added. This result indicates that there are site differences not being captured by other variables. There was no significant difference in the reductions among California, North Carolina, and Vermont ($p=0.509$). Pennsylvania had significantly lower reductions than North Carolina and Vermont but was not different from California ($p=0.003$, $p=0.024$, and $p=0.326$, respectively). Client and housing characteristics help but do not fully- explain the partner-specific differences in ADL limitations scores.

As Szanton et al. (2016) found in their Baltimore study, factors that commonly modify intervention success—age, race, gender, education, and income—did not affect the change in ADL limitations scores. Site was significant when added to our model, and modeling results indicate that the partner variability in ADL limitation score reductions is at least partially explained by partner differences in baseline ADL limitation scores (for example, California mean baseline ADL limitations score=6.1 versus Vermont=3.3), home type (for example, California homes=98 percent apartments versus North Carolina=4.7 percent), and baseline home hazard score (for example, California mean baseline home hazard score=13.8 versus Pennsylvania=8.1 and Vermont=7.9).

3.4.3. Baseline to Long-Term Follow-Up

At the long-term follow-up visit, study-group clients continued to experience significant improvements in the same six key health outcomes that were significant at the short-term follow-up visit (exhibit 3-9): ADL limitations score, quality of life, falls efficacy, IADL limitations score, depression, and pain interference with normal activities. In addition, for the study group, the number of falls in the past year decreased by an average of one fall ($p<0.001$). Control group clients exhibited little if any change in these outcomes, except that ADLs marginally improved, quality of life improved, and the mean depression score worsened. Between baseline and long-term follow-up, CAPABLE continued to yield a more than 20-percent increase in the percentage of study group clients who reported no difficulty with bathing, lower body dressing, getting in and out of beds and chairs, using the toilet, and walking across a small room (data not shown).

In general, of the four partners, North Carolina and California had study-group clients who experienced greater long-term improvements in most key health outcomes than control-group clients (exhibit 3-10). For the primary outcome—changes in ADL limitations scores—only in California were study-group ADL limitations score reductions significantly better than those of the control group. Vermont also showed significant changes in ADL limitations scores; however, the change was in the wrong direction (study-group ADL limitations score got worse while control-group limitations improved). As previously stated, both Vermont and Pennsylvania had smaller sample sizes than North Carolina and California, which makes it more difficult to discern changes. California's study group clients showed greater long-term improvements than control-group clients for five of the six secondary outcomes (mean quality of life, falls efficacy, IADLs, depression, and number of falls in the past year), while North Carolina's showed greater long-term improvements for four (mean falls efficacy, depression, pain interference, and number of falls in the past year).

Two parameters were evaluated only for the period between baseline and long-term follow-up: the number of falls in the past year and the percentage of hospitalized clients for at least one night in the past year (exhibit 3-9). Study group clients' change in the number of falls—one less fall over the follow-up year compared with the year before baseline—showed greater improvement than the control group. The study group showed a slight decrease in the percentage of clients who went to the ER and were subsequently hospitalized for at least one night, while the control group showed a slight increase; however, these changes were not significant. The percentage of clients who visited the ER at least once (but were not hospitalized overnight) decreased insignificantly for both the study and control groups.

3.5. Cost Evaluation

3.5.1. CAPABLE Program Costs in Aging Gracefully Project

Of the 132 clients who completed CAPABLE, CAPABLE program-cost data (OT, RN, home modification, and DME/AE cost/client) were available for 122 clients. Overall, the median CAPABLE program cost/client was $2,352, but partner medians were highly variable (exhibit 3-11). Vermont, which did not have to pay their staff RN to conduct CAPABLE RN visits separately, had the lowest median cost ($1,328).

In their Baltimore research, Szanton et al. reported that spending on CAPABLE home repairs and modifications ranged from $72 to $1,398 per participant (Szanton et al., 2016). Pennsylvania, Vermont, and California CAPABLE home repair costs were generally close to this range (with a few outliers contributing to the higher maximum costs for Pennsylvania and Vermont). North Carolina's maximum cost was almost an order of magnitude higher. Early in their planning, North Carolina strategically decided that they would add accessibility modifications such as access ramps or outdoor concrete step repair to the more "typical" lower-cost CAPABLE home modifications such as grab bars. North Carolina did both the "typical" CAPABLE home modifications and the accessibility modifications during the CAPABLE program. North Carolina deemed these accessibility modifications were necessary if these modifications fit the client goals of being able to move independently and safely from their home into their yards or communities. Due to the relatively high cost, JHU generally does not include accessibility modifications in CAPABLE.

Exhibit 3-9 Changes in Key Health Outcomes, Baseline to Long-Term Follow-Up

Outcome (range)	Study Group					Control Group					Study vs. Control
	N	Baseline	Long-Term Follow-Up	Change[a]	P [b]	N	Baseline	Long-Term Follow-Up	Change[a]	P [b]	P [c]
Mean ADL Limitations Score (0–16)	69	4.4	2.5	– 2.0	**<0.001****	57	4.3	3.6	– 0.7	**0.071***	**0.012****
Mean # of ADL Limitations (0–8)	69	3.6	2.0	– 1.6	**<0.001****	57	3.6	3.1	– 0.5	**0.084***	**0.009****
Mean Quality of Life (5–15)	70	8.9	8.2	– 0.8	**<0.001****	57	9.1	8.6	– 0.5	**0.009****	0.377
Mean Falls Efficacy (10–100)	70	31.5	22.6	– 8.9	**<0.001****	57	34.1	34.2	0.1	0.955	**0.012****
Mean IADL Limitations Score (0–16)	69	5.6	4.5	– 1.1	**0.002****	57	5.1	5.0	– 0.2	0.728	**0.093***
Mean PHQ-Depression (0–27)	70	5.9	4.6	– 1.3	**0.009****	57	6.2	6.6	0.4	0.484	**0.021****
Life-Space Composite Score (0–120)	70	47	48.2	1.2	0.574	57	47.5	46.3	– 1.2	0.543	0.408
Pain interference w/normal activities (0–10)	70	4.7	3.2	– 1.5	**<0.001****	57	5.0	5.2	0.3	0.537	**0.002****
# of Falls in past year	69	1.3	0.3	– 0.9	**<0.001****	57	1.2	0.7	– 0.4	**0.010****	**0.037****
% Clients who visited ER visit+≥ 1 night in hospital in past yr	76	23.7%	18.4%	– 5.3%	0.414	59	20.3%	23.7%	3.4%	0.593	0.337
% Clients who visited ER w/no hospitalization in past year	76	26.3%	17.1%	– 9.2%	0.108	59	22.0%	13.6%	– 8.4%	0.197	0.932
% Clients hospitalized overnight (no ER) in past year	76	0%	1.3%	1.3%	0.317	59	1.7%	0%	– 1.7%	0.317	0.158

[a] Except for LSC, negative change = improvement, positive change = worsening. For LSC, negative change = worsening and positive change = improvement.
[b] A paired t-test was used to test the hypothesis that the mean changed from baseline to long-term follow-up. For the percentages, a CMH test was used to test the hypothesis that the percent hospitalized changed from baseline to long-term follow-up.
[c] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups. For the percentages, weighted least squares methods were used to test that the change in percent "yes" from baseline to follow-up was different for the study versus the control group.
**Significant at $p<0.05$; *marginally significant at $0.05 \leq p < 0.1$

Exhibit 3-10 Partner Comparison of Changes in Key Health Outcomes, Baseline to Long-Term Follow-Up

Outcome (range)[a]	NC			VT			CA		
	Study P [b]	Control P [b]	Study vs Control P [c]	Study P [b]	Control P [b]	Study vs Control P [c]	Study P [b]	Control P [b]	Study vs Control P [c]
Mean ADL Limitations Score (0–16)	**<0.001****	0.160	**0.028****	0.272	**0.002****	0.161	**<0.001****	0.680	**<0.001****
Mean # of ADL Limitations (0–8)	**<0.001****	**0.078***	**0.006****	0.387	**0.005****	0.259	**<0.001****	0.764	**<0.001****
Mean Quality of Life (5–15)	**<0.001****	**0.001****	0.126	0.917	**<0.001****	**0.053***	**0.014****	0.872	**0.097***
Mean Falls Efficacy (10–100)	**<0.001****	0.419	**0.023****	0.174	0.749	0.242	**0.009****	0.339	**0.009****
Mean IADL Limitations Score (0–16)	**0.007****	0.552	0.108	0.367	**0.082***	0.577	**0.080***	0.396	**0.068***
Mean # of IADL Limitations (0–8)	**<0.001****	0.758	**0.016****	0.762	**0.028****	0.180	**0.076***	0.393	**0.069***
Mean PHQ-Depression (0–27)	**0.006****	0.475	**0.057***	0.252	0.148	**0.064***	0.443	**0.042****	**0.030****
Life-space composite score (0–120)	0.323	0.559	0.263	0.504	0.856	0.504	**0.030****	0.778	0.245
Pain interference w/normal activities (0–10)	**0.002****	0.943	**0.029****	0.155	0.896	0.295	0.529	0.101	0.162
# of Falls in past year	**0.010****	0.331	**0.086***	0.136	**0.057***	0.911	**0.003****	0.289	**0.032****

[a] Detailed partner results are presented in appendix B. Pennsylvania results are not shown because no significant study versus control changes were identified for any of the key health outcomes.
[b] A paired t-test was used to test the hypothesis that the mean changed from baseline to long-term follow-up.
[c] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups.
**Significant at $p<0.05$; *marginally significant at $0.05 \leq p < 0.1$

Exhibit 3-11 Summary of CAPABLE Program Costs per Client[a]

Partner	Discipline	Minimum ($)	Mean ($)	Median ($)	Maximum ($)
NC (N=37)	OT	900	900	900	900
	RN	600	600	600	600
	HR	492	2,686	2,255	10,678
	DME	0	63	57	192
	Total	2,043	4,249	**3,905**	12,323
PA (N=26)	OT	1,500	1,500	1,500	1,500
	RN	1,000	1,000	1,000	1,000
	HR	0	547	25	4,600
	DME	0	290	253	901
	Total	2,589	3,337	**2,894**	7,100
VT (N=29)	OT	300	750	900	900
	RN	0	0	0	0
	HR	0	563	353	3,860
	DME	19	160	179	388
	Total	323	1,472	**1,328**	4,987
CA (N=33)	OT	400	462	480	480
	RN	80	284	320	320
	HR	0	295	250	855
	DME	70	508	449	1,203
	Total	550	1,549	**1,500**	2,468
ALL (N=125)	OT	300	837	900	1,500
	RN	0	438	320	1,000
	HR	0	1,117	525	10,678
	DME	0	250	179	1,203
	Total	323	2,642	**2,352**	13,323

[a] Home repair costs included overhead and administrative costs paid to home repair personnel. DME costs include shipping and taxes.

3.5.2. Medical Event Cost Analysis

Both the study group and control group showed reductions in mean cost rates between 1-year pre-baseline and 1-year follow-up. The total 1-year follow-up mean cost rate for the study group ($2,434) was slightly less than that for the control group ($2,968); however, the control group's reduction (37 percent) exceeded that of the study group (24 percent) (exhibit 3-12).

Exhibit 3-12 Medical Event Costs, by Treatment Group

Type of Medical Event[a]	Visit	Mean Expenditure/ Event	Study Group (N=78)		Control Group (N=59)	
			# of Events[b]	Mean Cost Rate	# of Events[b]	Mean Cost Rate
ER	1 yr pre-baseline	$ 647	29	$ 241	17	$ 186
	1-yr follow-up	$ 647	13	$ 108	8	$ 88
ER + Hospitalization	1 yr pre-baseline	$12,139	19	$ 2,957	21	$4,321
	1-yr follow-up	$12,139	14	$ 2,179	14	$2,880
Hospitalization	1-yr pre-baseline	$11,492	0	$ 0	1	$ 195
	1-yr follow-up	$11,492	1	$ 147	0	$ 0
Total Baseline Cost	1-yr pre-baseline			$ 3,197		$4,702
Total 1-Yr Follow-Up Cost	1-yr follow-up			$2,434		$2,968
Cost (%) Difference[c]				-$764 (– 24%)		-$1,734 (– 37%)

[a] ER = ER visit without subsequent hospitalization. ER+hospitalization=ER visit w/hospital admission for ≥1 night. Hospitalization=urgent care or office visit with hospital admission for ≥1 night (added cost of urgent care or office visit assumed negligible compare w/hospitalization cost.

[b] Study group sample sizes for #Events=48 for one-year pre-baseline and 28 for 1-year follow-up. Control group sample sizes for #Events=39 for one-year pre-baseline and 22 for 1-year follow-up.

[c] Negative cost difference=lower cost during 1-year follow-up than in the year before baseline.

Sources: AHRQ (2015);

4. Discussion

4.1. Changes in ADL Limitations

For this primary outcome, study-group clients reported having difficulty with a mean of 3.7 ADLs at baseline versus 2.1 post-CAPABLE, while the control group reduced difficulties with ADLs by only 0.5 (from 3.6 at baseline to 3.1 at short-term follow-up). These statistically significant findings, with a study-group size of just 72 participants, support those of JHU, where 281 Baltimore participants reduced their mean number of ADL difficulties from a mean baseline of 3.9 to a 5-month post-baseline mean of 2.0 (Szanton et al., 2016). These Aging Gracefully findings prove the efficacy of CAPABLE implementation in other settings having different and small-scale organizational healthcare support systems.

Modeling results showing the influence of the baseline ADL limitations score on reducing this score from baseline to post-CAPABLE suggest that sites that target adults with more baseline ADL limitations will have a greater impact on ADL limitations scores. California, whose clients had a mean baseline ADL limitations score of 6.1, was able to reduce the mean ADL limitations score to 2.5 following CAPABLE. With its more intensive home repair work, North Carolina (mean baseline score=4.3) was able to reduce the ADL limitations scores even more to a post-CAPABLE mean of 1.5. As noted in section 3.4.2, our model did not include a variable for home repair intensity, so it is possible that the benefits of North Carolina's more intensive home modification work at least partially explain the site effect found in the model. (Other elements of North Carolina's program or other uncontrolled client or home factors may also contribute to the site effects.)

The model finding that apartments with higher baseline home hazard scores were associated with greater ADL reductions emphasizes the importance of CAPABLE's home modification arm to reduce home safety hazards. This finding also suggests that participants living in apartments with few baseline hazards (for example, Pennsylvania) are less likely to have home modifications and less likely to experience substantial changes in ADL limitations scores than clients living in apartments in "bad" baseline shape (such as California). When identifying communities in need of CAPABLE, organizations should identify target locations not simply based on client ADL limitations scores but also on baseline housing quality, particularly for those living in apartment buildings that may have universal design features that reduce the relevance of the home repair arm. Anecdotally, some partners reported landlord reluctance to accept grab bars and other physical changes to certain units, particularly when these units were otherwise in good shape. Gaining landlord "buy-in" may be an important element of a successful CAPABLE program. CAPABLE is most successful when conducted in communities where all three CAPABLE arms—OT, RN, and home modification services—are needed and delivered.

4.2. **CAPABLE Eligibility Criteria**

Several partners wished they could have had more flexibility in enrollment criteria, such as serving people who had lower physical function or were confined to wheelchairs, adults who were younger than 65 years of age, or even those with diminished mental capacity. We imposed these criteria to ensure our study population was similar to those studied by others; however, given the large numbers of older adults in need of programs like CAPABLE, its efficacy with other populations must be studied. In addition, our study population came from generally urban or micropolitan[16] areas. Research to determine CAPABLE's efficacy in rural locations is critical. People in the rural United States are older, on mean, than those in urban areas. More than one in five Americans live in rural areas, many in states where more than one-half of the older population lives in rural locations (U.S. Census Bureau, 2019).

The percentage of eligible female individuals, 73 percent, was higher than the national statistics for women 65 and older, 56 percent (ACL, 2018). This could be due in part to the project's income requirements. Over 80 percent of enrolled clients were very low or extremely low-income. Nearly 67 percent of U.S. older adults living in poverty are women, and women who live alone have higher rates of poverty than men living alone (Justice in Aging, 2018). The percentage of female individuals who were ineligible (65 percent) was lower than the percent of women who were eligible (73 percent), but we were unable to discern a specific reason for this difference. In general, ineligible women did not have different reasons for ineligibility than ineligible men. Partners did not report they had more difficulty recruiting men than women.

4.3. **Long-Term CAPABLE Effectiveness**

To our knowledge, this is one of the first studies to analyze the continued efficacy of CAPABLE over a long (approximately 7-month) period post-completion. Szanton et al.'s randomized clinical trial found a non-significant improvement in ADL limitations scores from baseline to 7 months post-CAPABLE for treatment versus control group, while our study found a significant improvement over this longer time period (Szanton et al., 2019). Given the time-limited nature of CAPABLE's interventions (about 5 months), it is promising to find that clients continue to experience physical and mental health improvements long after they finished the program. This

[16] The U.S. Census defines micropolitan areas as areas having at least one urban cluster of at least 10,000 but less than 50,000 population.

finding is in keeping with CAPABLE OT and RN training, which emphasizes that older adults can continue to apply the practices learned during the program (such as exercise, physician communication, safe use of grab bars and assistive equipment, and healthy decision-making) to future decision-making when faced with other functional challenges (Szanton, 2014b). Older people who have less difficulty conducting basic activities such as bathing themselves, using the toilet, and getting in and out of chairs over the long term are less likely to need to move to an assisted living or skilled nursing facility.

Continued post-CAPABLE contact with clients may help sustain benefits. The North Carolina site coordinator stayed in touch with several clients after CAPABLE services were completed, which may have contributed to the positive findings. A Michigan CAPABLE program maintains monthly telephone contact post-CAPABLE as part of Medicaid waiver services (Spoelstra et al., 2019). Hopkins suggests that a call or booster visit may be useful in promoting continued CAPABLE benefits (Szanton et al., 2019).

4.4. **Life-Space Analysis Outcomes**

In our analysis, neither the study-group nor control-group clients experienced a significant change in their life-space composite scores (LSCs), which remained around 40, a value which Eronen et al. (2016) defines as "restricted life space" (scores 0–59). Most articles finding significant improvements in LSC over time had much greater sample sizes (153 versus a range of 400 to over 1,000); therefore, we may have not had sufficient power to discern a change in this score. Further research to see whether CAPABLE can expand older adult range of mobility into the wider community would be beneficial, as it would undoubtedly impact other social determinants of health. Early in their planning, North Carolina strategically decided that accessibility modifications such as access ramps or outdoor concrete step repairs were necessary if these modifications fit the client goals of being able to move independently and safely from their home into their yards or communities. Our life-space analysis wasn't able to show that this decision had an impact on range of mobility, but perhaps additional research with a larger sample size could show the impact of this strategy.

4.5. **Layering Other Work with CAPABLE Program Work**

With separate funding, North Carolina conducted non-CAPABLE home repairs (not paid for with CAPABLE funding) when necessary. Examples include plumbing and heating repairs and weatherization work. In certain cases, some non-CAPABLE tasks were similar to CAPABLE work. For example, for one client who did not specify a goal of bathroom fall prevention, North Carolina installed a comfort height toilet as part of plumbing repairs, while for another client with bathroom-related CAPABLE goals, North Carolina installed a comfort height toilet as part of CAPABLE. The cost of North Carolina non-CAPABLE repairs in study-group homes ranged from $63 to $8,202 (median $1,243). The contribution of non-CAPABLE work to the health outcome findings is unknown. In general, a holistic approach generally works well for both the client and the service provider since home repairs and modifications are accomplished with less disruption to the client's home life.

About two-thirds of Vermont participants were involved in Cathedral Square Corporation's SASH program when they enrolled in CAPABLE. Some SASH services overlap with CAPABLE services (for example, in-home visits by wellness nurses, health and wellness assessments, and health coaching), which may help explain why Vermont's study group's change in mean ADL limitations scores was not as large as those of other partners. Some of the

dual SASH-CAPABLE participants were reportedly overwhelmed by the added CAPABLE visits. To alleviate these issues, Vermont shifted to enrolling people who were not yet in SASH.

4.6. **CAPABLE Cost Savings Through Prevention**

Our mean CAPABLE cost, $2,642, is close to the mean cost of $2,825 reported by Szanton et al (2016). The JHU mean cost included care coordination and supervision, which we were unable to include in our cost tabulation because partners contributed these tasks as part of their leverage. Had these costs been included, our mean would likely be higher than Hopkins. All four of our partners noted that team coordination and oversight were critically important to program success and well worth the time and effort required.

The JHU CAPABLE program holds great promise to help low-income older adults. As noted by the Bipartisan Policy Center's (BPC's) Senior Health and Housing Task Force, "Millions of older adults understand all too well that their health and well-being depend as much on their housing as they do on their health insurance and monthly Social Security check. The upside of a more integrated approach to senior health and housing is significant: *By more tightly linking the two, the United States has the potential to improve health outcomes for older adults, reduce costs borne by the health care system, and enable millions of Americans to "age in place" in their own homes and communities"* (BPC, 2016). The BPC report identifies the CAPABLE program as one of the important works being undertaken to prove the validity of this proposition. The Aging Gracefully study results add to the growing data showing great value in implementing CAPABLE in a variety of communities.

The Aging Gracefully study was too small to evaluate whether the CAPABLE services helped prevent entry into skilled nursing facilities; however, other research has shown this may be the case. Ruiz et al. estimated that CAPABLE reduced total Medicare expenditures by a mean of $2,764 per quarter ($11,000 per year for 2 years, or $22,000) for participants relative to comparison group, mostly due to reduced inpatient and outpatient expenditures (Ruiz et al., 2017). Ruiz et al. (2017) also found that CAPABLE was associated with reduced readmissions and observation stays. In a single-arm clinical trial, Szanton et al (2018) found that mean Medicaid spending per CAPABLE participant was $867 less per month than that of their matched comparison counterparts, with the largest expenditure reductions in inpatient care and long-term services and supports.

To qualify for a Medicaid nursing home bed, one must be impoverished.[17] Programs like CAPABLE aim to avoid enforced poverty by not only deferring or avoiding nursing home placement but also by providing supports to reduce avoidable out-of-pocket expenses. The physical function improvements and ability to walk in and around one's home enable the exercise necessary to reducing conditions often controlled through medication. Even a dosage reduction can reduce the financial medication burden on a low-income older adult. Housing is a keystone of economic independence and advancement. An older, functioning resident with a safe and healthy home can save money and focus his/her time and resources on other basic needs. Additionally, housing modifications and repairs improve the quality of client homes by addressing deferred maintenance and needed repairs. Indeed, with separate funding, North Carolina took CAPABLE a step further, performing these kinds of maintenance and repairs in participant homes.

[17] The Implementation Brief includes a section on the "*Influence of JHU Current Configuration and Medicare/Medicaid Plans on Future of CAPABLE*."

This project has the potential to leverage current healthcare spending in Medicaid waivers, ACOs, and other capitated systems to save the healthcare system costs as well as improving low-income older adults' ability to age at home with improved quality of life. Michigan researchers found fewer hospitalizations for older adults in Medicaid waiver programs (Spoelstra et al., 2019). Our findings in urban and micropolitan communities, with client demographics differing from those in JHU's CAPABLE studies, help build the case for widespread adoption of similar programs across the country.

5. CONCLUSIONS

The JHU CAPABLE program proved feasible for partner teams in four micropolitan and urban locations to implement. The program greatly improved both physical function and mental health outcomes, while also making homes safer for participants, even 7 months after they completed the program.

As a companion to this paper, we prepared an Implementation Brief (*Aging Gracefully in Place: Important Considerations When Considering CAPABLE Program Implementation)* which uses the lessons learned by the four partner organizations during this demonstration. The brief uses these lessons learned to outline nine steps to implementation and covers larger policy implications. Programs and policymakers considering implementing CAPABLE can learn from the challenges experienced by the Aging Gracefully partners. One or more of these organizations struggled with recruiting participants, retaining staff (especially OTs), providing timely services, and utilizing the home repair component. Except for hiring enough OTs, these issues were rarely experienced by all four organizations, and those experiencing various issues were able to come up with creative solutions. For example, sites used a variety of strategies, including partnerships with Area Agencies on Aging, enrollment in other preexisting programs, and recruitment fliers. Both California and North Carolina attempted to use physician referrals, but with more success in North Carolina. Several partners faced recruitment challenges specific to their populations, such as in California, where many people who may have otherwise been eligible were not comfortable speaking English, which was the only language that the CAPABLE materials were available in at the time. Ultimately, programs looking to implement CAPABLE have many factors to consider, which will be informed by the needs and quirks of their communities. Review of the Implementation Brief and networking with other CAPABLE sites can aid other organizations in assembling their own strategies for implementing CAPABLE.

Based on our evaluation results, we believe that more widespread or even national expansion of CAPABLE would yield strong societal benefits. CAPABLE has the potential to meet a growing need in serving underserved populations. All four partners were successful in enrolling extremely low-income clients, and California focused on older adults who had been formerly homeless and were less likely to otherwise access a health clinic. In another study, CAPABLE has been shown to provide cost savings through reduced nursing home costs and reduced Medicare and Medicaid costs. The Implementation Brief contains further details about these evaluations and JHU's ongoing work on getting Medicare and Medicaid reimbursement for CAPABLE. As the U.S. population continues to age, successful CAPABLE implementation in other communities would be particularly promising for similarly underserved or isolated populations.

Appendix A. Items in Home Modification, Durable Medical Equipment, and Assistive Equipment Categories

Aging Gracefully Study: Home Modification, Durable Medical Equipment, and Assistive Equipment Definitions		
Classification	**Category**	**Items**
Mix of Home Mod & DME/AE[a]	De-Clutter/Home Organization Items	Shelf/shelves, dresser, storage closet, clothing organizer, file cabinet, storage cabinet, bookcase, clothing rack, vanity, drawers, clothing rod, double-rod closet, end table, shoe organizer, over-door hangar, desk, desk organizer, table and chairs, storage hooks, trashcan
Home Mod	Door Repairs	Door handle, lower eyehole on door, install magnetic screen door, repair/replace door, repair door threshold, repair sliding glass door, repair/replace door locks, repair storm door, replace all handles/locks with levers, widen door and door openings
Home Mod	Floor Repairs	Repair/replace floor, repair floor tile, install/repair linoleum/vinyl flooring, remove throw rug, anti-fatigue comfort mats, remove and replace carpeting, remove carpet from front steps
Home Mod	General Fall Prevention, Grab Bars	Grab Bars (bathroom door, shower, bathtub, toilet, between rooms)
Home Mod	Home Accessibility	Install/replace access ramp, access platform, wedge at back door, stairglide
Home Mod	Home Safety devices	CO detector, combination smoke/CO detector, smoke alarm, GFCI outlet kitchen/bathroom, dryer hose, surge protector, outlet cover, electrical outlet repair, cable, fire extinguisher
Home Mod	Miscellaneous Home Repairs (not otherwise classified)	Replace shower head; replace spout; replace basement window; repair front porch; repair kitchen faucet; ridge vent; install/repair railing on outdoor steps and porches; install lights on accessible switches; replace/repair lightbulbs, repair lighting/fixtures; repair kitchen cabinet; repair sidewalk; lower racks in closet; move washer/dryer from basement to kitchen; repair back porch; install wall lights
Mix of Home Mod & DME/AE[b]	Bathroom Fall Prevention, Large	Tub/shower transfer bench/seat, raised toilet seat, handheld showerhead, bedside commode, detachable showerhead, comfort height toilet/commode
Mix of DME/AE[b]	Bathroom fall prevention, Small	Handheld shower holder, non-slip strips for tub/shower, non-skid bathmat
DME/AE	Cooking Aids	Timer, rolling knife w/curved blade, mixer, stovetop cover/cutting board, can/bottle opener, rolling cart, jar grip, baker's rack, blender, skillet, microwave oven, diet book, can opener, adapted cutting board, kitchen timer, large print measuring cups, dish rack, food storage containers, multi-use kitchen tool
DME/AE	Exercise items	Exercise bands, balls, pedometer, exercise pedaler, ankle weight, arm bike, dumb bell, hand grip strength trainer kit, hand stress balls, hand therapy kit, hand weights, yoga kit

DME/AE	General Fall Prevention, Non-Grab Bar	Reacher, grabber, stool, stepstool w/rails, light, floor lamp, elevated pet dish, carpet tape, lamp clapper, dog sweater, light pull chains, long-handle cat litter scoop, long-handle dog poop scooper, motion sensor light, nightlight, pet stroller, power strip behind furniture
DME/AE	Hearing-Related Items	Amplified cordless telephone, hearing amplifier, earplugs, doorbell for hearing impaired, amplified ringer with strobe, hearing aid-compatible phone, hearing-impaired smoke detector, noise-cancelling headphones
DME/AE	Home Cleaning Aids	Handheld cordless vacuum, mop, t-shirt folder, spin scrubber, long-handle dust pan and broom, long-handle duster, spray mop
DME/AE	Nursing-Related Items	Quit smoking aid, air purifier, blood pressure monitor, fan, hand therapy kit, humidifier, thermometer, medicine cabinet, wrist brace, bed pads, bed topper, ez dose pill crusher, pulse oximeter, foot bath, pill organizer, thermometer
DME/AE	Other IADL Aids	Laundry basket, folding grocery cart on wheels, ironing board, ironing board wall holder, signature guide, towel rack, walker basket, planner, bulletin board. Calendar, walker tray, walker pouch, kneeler, laundry bag, scooter basket, cart liner, phone grip and stand, weighted fork, weighted rocker knife, weighted tablespoon
DME/AE	Pain Reduction Items	Pain relief patches, massager, car seat cushion, heat therapy, heating pad, hot and cold reusable gel pack, muscle roller stick, pain relief gel, pain management system
DME/AE	Personal Care Items	Long-handle brush, long-handle comb, electric toothbrush, electric shaver, dressing aid stick, back scrubber, long-handled sponge/bath brush, bra, no-tie shoelaces, sock aid, portable bedside urinal, zipper pull, leg lifter, long-handle toilet aid, button hook, foot care kit, long-handle foot scrubber, stocking aid, compression socks, hand mirror, long-handle lotion applicator, long-handle shoehorn, one-handed denture brush
DME/AE	Safe Mobility/Transfer Equipment	Bed assist bar/handle, car assist/transfer handle, bed riser, lift chair, bed rail, elevated chair, seating system, bed frame, bed platform, econorail, chair lever extender, ez up stand assist
DME/AE	Sleep-Related Items	Bed, wedge pillow, body pillow, mattress, bed tray, topper, blackout blinds, weighted blanket, white noise machine
DME/AE	Stress Reduction	Aromatherapy, oil diffuser, chair protector, chair leg pad
DME/AE	Vision-Related Items	Magnifier, large print reading items, overlay, booklight and magnifier, low vision lamp, big button remote
DME/AE	Walking Aids, large	Walker, rollator, off-road wheels, glide caps, rollator replacement parts
DME/AE	Walking Aids, Small	Cane, folding cane seat, knee brace, quad cane

[a] Home organization category includes some items that required assembly and therefore were considered a combination of home modification and DME/AE.
[b] This category includes a combination of DME/AE and home modification items.

Appendix B. Changes in Key Health Outcomes, by Partner Site

Exhibit B-1. North Carolina: Changes in Key Health Outcomes, Baseline to Short-Term Follow-Up

Outcome (range)	Study Group					Control Group					Study vs. Control
	N	Base-line	Short-Term Follow-Up	Change [a]	P [b]	N	Base-line	Short-Term Follow-Up	Change [a]	P [b]	P [c]
Mean ADL Limitations Score (0–16)	22	4.3	1.5	– 2.8	**<0.001****	21	3.7	2.0	– 1.7	**<0.001****	**0.075***
Mean # of ADL Limitations (0–8)	22	3.5	1.3	– 2.2	**<0.001****	21	3.3	1.8	– 1.5	**<0.001****	**0.096***
Mean Quality of Life (5–15)	22	8.8	7.4	– 1.5	**<0.001****	21	8.5	8.1	– 0.4	0.176	**0.030****
Mean Falls Efficacy (10–100)	22	33.0	19.4	– 13.6	**0.043****	21	29.0	25.6	– 3.4	0.256	0.152
Mean IADL Limitations Score (0–16)	22	4.1	3.8	– 0.4	**0.470**	21	3.8	3.8	0.0	1.000	0.648
Mean # of IADL Limitations (0–8)	22	2.9	2.2	– 0.7	**0.035****	21	2.4	2.5	0.0	0.920	0.183
Mean PHQ-Depression (0–27)	22	7.8	4.8	– 3.0	**0.009****	21	6.6	6.8	0.1	0.870	**0.025****
Life-space composite score (0–120)	22	53.2	51.7	– 1.5	0.699	21	55.2	57.2	2.0	0.650	0.549
Pain interference w/normal activities (0–10)	22	4.1	2.0	– 2.1	**0.007****	21	4.2	3.4	– 0.8	0.184	0.168

[a] Except LSC, a negative change=improvement, and a positive change=worsening. For LSC, a negative change=worsening and positive change=improvement.

[b] A paired t-test was used to test the hypothesis that the mean changed from baseline to short-term follow-up.

[c] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups.

**Significant at $p<0.05$; *marginally significant at $0.05 \leq p < 0.1$

Exhibit B-2. North Carolina: Changes in Key Health Outcomes, Baseline to Long-Term Follow-Up

Outcome (range)	Study Group					Control Group					Study vs. Control
	N	Base-line	Long-Term Follow-Up	Change [a]	P [b]	N	Base-line	Long-Term Follow-Up	Change [a]	P [b]	P [c]
Mean ADL Limitations Score (0–16)	21	4.1	1.4	– 2.7	**<0.001****	18	3.9	3.0	– 0.9	0.160	**0.028****
Mean # of ADL Limitations (0–8)	21	3.5	1.1	– 2.4	**<0.001****	18	3.4	2.6	– 0.8	**0.078***	**0.006****
Mean Quality of Life (5–15)	21	8.9	7.3	– 1.5	**<0.001****	18	8.8	7.9	– 0.9	**0.001****	0.126
Mean Falls Efficacy (10–100)	21	31.0	14.0	– 17.0	**<0.001****	18	30.8	27.5	– 3.3	0.419	**0.023****
Mean IADL Limitations Score (0–16)	21	3.9	2.8	– 1.1	**0.007****	18	3.8	4.4	0.6	0.552	0.108
Mean # of IADL Limitations (0–8)	21	2.8	1.5	– 1.3	**<0.001****	18	2.5	2.7	0.2	0.758	**0.016****
Mean PHQ-Depression (0–27)	21	7.6	4.3	– 3.3	**0.006****	18	6.8	6.2	– 0.6	0.475	**0.057***
Life-space composite score (0–120)	21	54.6	58.3	3.6	0.323	18	55.6	53.5	– 2.2	0.559	0.263
Pain interference w/normal activities (0–10)	21	4.0	1.6	– 2.4	**0.002****	18	4.6	4.5	– 0.1	0.943	**0.029****
# of Falls in past year	21	1.2	0.3	– 0.9	**0.010****	18	0.9	0.7	– 0.2	0.331	**0.086***

[a] Except LSC, a negative change=improvement, and a positive change=worsening. For LSC, a negative change=worsening and positive change=improvement.
[b] A paired t-test was used to test the hypothesis that the mean changed from baseline to long-term follow-up.
[c] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups.
**significant at p<0.05; *marginally significant at 0.05≤p<0.1

Exhibit B-3. Pennsylvania: Changes in Key Health Outcomes, Baseline to Short-Term Follow-Up

Outcome (range)	Study Group					Control Group					Study vs. Control
	N	Base-line	Short-Term Follow-Up	Change [a]	P[b]	N	Base-line	Short-Term Follow-Up	Change [a]	P[b]	P[c]
Mean ADL Limitations Score (0–16)	16	4.0	3.9	– 0.1	0.896	9	3.8	3.9	0.1	0.928	0.894
Mean # of ADL Limitations (0–8)	16	2.9	2.9	– 0.1	0.889	9	2.7	3.0	0.3	0.724	0.703
Mean Quality of Life (5–15)	16	8.9	8.4	– 0.5	0.204	9	8.3	8.2	– 0.1	0.729	0.433
Mean Falls Efficacy (10–100)	16	29.6	18.4	– 11.2	**0.082***	9	30.0	28.3	– 1.7	0.583	0.168
Mean IADL Limitations Score (0–16)	16	7.7	7.7	0.0	1.000	9	5.1	4.8	– 0.3	0.608	0.666
Mean # of IADL Limitations (0–8)	16	4.3	4.4	0.1	0.817	9	3.3	2.7	– 0.7	0.169	0.179
Mean PHQ-Depression (0–27)	16	5.4	3.2	– 2.2	**0.036****	9	4.4	5.0	0.6	0.732	0.156
Life-space composite score (0–120)	16	49.1	42.4	– 6.7	**0.092***	9	51.1	56.3	5.2	0.546	0.213
Pain interference w/normal activities (0–10)	15	4.9	3.3	– 1.5	**0.052***	9	4.8	4.7	– 0.1	0.916	0.272

[a] Except LSC, a negative change = improvement, and a positive change = worsening. For LSC, a negative change = worsening and positive change = improvement.
[b] A paired t-test was used to test the hypothesis that the mean changed from baseline to short-term follow-up.
[c] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups.
**significant at p<0.05; *marginally significant at 0.05≤p<0.1

Exhibit B-4. Pennsylvania: Changes in Key Health Outcomes, Baseline to Long-Term Follow-Up

Outcome (range)	Study Group					Control Group					Study vs. Control
	N	Base-line	Long-Term Follow-Up	Change [a]	P[b]	N	Base-line	Long-Term Follow-Up	Change [a]	P[b]	P[c]
Mean ADL Limitations Score (0–16)	16	4.0	4.0	0.0	1.000	8	4.3	5.5	1.3	0.405	0.435
Mean # of ADL Limitations (0–8)	16	2.9	2.9	– 0.1	0.919	8	3.0	4.0	1.0	0.342	0.374
Mean Quality of Life (5–15)	16	8.9	8.4	– 0.5	0.150	8	8.4	9.0	0.6	0.388	0.166
Mean Falls Efficacy (10–100)	16	29.6	19.6	– 9.9	**0.060***	8	31.4	32.9	1.5	0.820	0.173
Mean IADL Limitations Score (0–16)	16	7.7	6.3	– 1.4	0.104	8	5.3	5.1	– 0.1	0.888	0.298
Mean # of IADL Limitations (0–8)	16	4.3	3.8	– 0.6	0.227	8	3.3	2.9	– 0.4	0.528	0.798
Mean PHQ-Depression (0–27)	16	5.4	3.4	– 1.9	0.104	8	4.5	7.1	2.6	0.219	**0.065***
Life-space composite score (0–120)	16	49.1	48.2	– 1.0	0.790	8	55.1	48.2	– 6.9	0.304	0.424

Outcome (range)	Study Group					Control Group					Study vs. Control
	N	Base-line	Long-Term Follow-Up	Change [a]	P[b]	N	Base-line	Long-Term Follow-Up	Change [a]	P[b]	P[c]
Pain interference w/normal activities (0–10)	16	4.8	3.1	– 1.5	**0.018****	8	5.0	4.6	– 0.4	0.768	0.423
# of Falls in past year	16	1.3	0.4	– 0.9	**0.014****	8	2.1	1.4	– 0.8	0.303	0.870

[a] Except LSC, a negative change = improvement, and a positive change = worsening. For LSC, a negative change = worsening and positive change = improvement.
[b] A paired t-test was used to test the hypothesis that the mean changed from baseline to long-term follow-up.
[c] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups.
**Significant at p<0.05; *marginally significant at 0.05≤p<0.1

Exhibit B-5. Vermont: Changes in Key Health Outcomes, Baseline to Short-Term Follow-Up

Outcome (range)	Study Group					Control Group					Study vs. Control
	N	Base-line	Short-Term Follow-Up	Change [a]	P	N	Base-line	Short-Term Follow-Up	Change [a]	P	P
Mean ADL Limitations Score (0–16)	15	3.3	2.3	– 1.0	**0.038****	15	4.1	4.1	– 0.1	0.902	0.185
Mean # of ADL Limitations (0–8)	15	2.7	1.9	– 0.8	**0.047****	15	3.4	3.5	0.1	0.876	0.132
Mean Quality of Life (5–15)	17	8.2	8.4	0.2	0.299	16	9.2	8.6	– 0.6	0.106	**0.054***
Mean Falls Efficacy (10–100)	17	20.5	23.2	2.7	0.599	16	31.3	29.3	– 1.9	0.637	0.477
Mean IADL Limitations Score (0–16)	17	5.8	4.4	– 1.4	0.1132	16	7.4	5.8	– 1.6	**0.050***	0.814
Mean # of IADL Limitations (0–8)	17	3.4	2.9	– 0.5	0.324	16	4.7	3.9	– 0.8	0.125	0.672
Mean PHQ-Depression (0–27)	17	3.9	4.4	0.5	0.355	16	7.4	9.5	2.1	0.140	0.279
Life-space composite score (0–120)	17	48.4	52.2	3.9	0.261	16	44.0	43.5	– 0.5	0.843	0.294
Pain interference w/normal activities (0–10)	17	5.0	3.6	– 1.4	0.104	16	5.3	5.5	0.3	0.749	0.148

[a] Except composite life score, a negative change = improvement, and a positive change = worsening. For LSC, a negative change = worsening ,and a positive change = improvement.
[b] A paired t-test was used to test the hypothesis that the mean changed from baseline to short-term follow-up.
[c] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups.
**Significant at p<0.05; *marginally significant at 0.05≤p<0.1

Exhibit B-6. Vermont: Changes in Key Health Outcomes, Baseline to Long-Term Follow-Up

Outcome (range)	Study Group					Control Group					Study vs. Control
	N	Base-line	Long-Term Follow-Up	Change [a]	P [b]	N	Base-line	Long-Term Follow-Up	Change [a]	P [b]	P [c]
Mean ADL Limitations Score (0–16)	17	3.2	2.5	– 0.8	0.272	14	3.9	1.9	– 2.0	**0.002****	0.161
Mean # of ADL Limitations (0–8)	17	2.6	2.1	– 0.5	0.387	14	3.1	1.8	– 1.4	**0.005****	0.259
Mean Quality of Life (5–15)	17	8.2	8.2	0.1	0.917	14	9.3	8.1	– 1.2	**<0.001****	**0.053***
Mean Falls Efficacy (10–100)	17	20.5	27.5	7.0	0.174	14	30.7	28.9	– 1.8	0.749	0.242
Mean IADL Limitations Score (0–16)	16	5.8	4.7	– 1.1	0.367	14	7.0	5.1	– 1.9	**0.082***	0.577
Mean # of IADL Limitations (0–8)	16	3.4	3.2	– 0.2	0.762	14	4.5	3.2	– 1.3	**0.028****	0.180
Mean PHQ-Depression (0–27)	17	4.1	4.9	0.8	0.252	14	7.6	6.1	– 1.5	0.148	**0.064***
Life-space composite score (0–120)	17	48.4	44.2	– 4.2	0.504	14	46.4	47.1	0.7	0.856	0.504
Pain interference w/normal activities (0–10)	17	5.0	3.6	– 1.4	0.155	14	5.4	5.6	0.1	0.896	0.295
# of Falls in past year	17	1.1	0.5	– 0.6	0.136	14	1.1	0.5	– 0.6	**0.057***	0.911

[a] Except LSC, a negative change = improvement, and a positive change = worsening. For LSC, a negative change = worsening, and a positive change = improvement.

[b] A paired t-test was used to test the hypothesis that the mean changed from baseline to long-term follow-up.

[c] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups.

**Significant at $p<0.05$; *marginally significant at $0.05 \leq p < 0.1$

Exhibit B-7. California: Changes in Key Health Outcomes, Baseline to Short-Term Follow-Up

Outcome (range)	Study Group					Control Group					Study vs. Control
	N	Base-line	Short-Term Follow-Up	Change [a]	P [b]	N	Base-line	Short-Term Follow-Up	Change [a]	P [b]	P [c]
Mean ADL Limitations Score (0–16)	19	6.1	2.5	– 3.6	**<0.001****	22	4.9	4.5	– 0.5	0.291	**<0.001****
Mean # of ADL Limitations (0–8)	19	5.2	2.4	– 2.7	**<0.001****	22	4.5	4.1	– 0.4	0.377	**<0.001****
Mean Quality of Life (5–15)	20	9.8	8.8	– 1.1	**0.002****	22	9.4	9.7	0.3	0.409	**0.004****
Mean Falls Efficacy (10–100)	20	46.1	33.0	– 13.1	**0.005****	22	42.7	41.5	– 1.2	0.692	**0.028****
Mean IADL Limitations Score (0–16)	20	5.7	4.4	– 1.3	**0.004****	22	5.0	6.0	1.0	0.140	**0.005****
Mean # of IADL Limitations (0–8)	20	4.4	3.6	– 0.9	**0.005****	22	4.1	4.7	0.6	0.179	**0.007****
Mean PHQ-Depression (0–27)	20	6.7	6.1	– 0.6	0.384	22	5.7	6.9	1.2	**0.059***	**0.050***
Life-space composite score (0–120)	20	36.3	44.2	7.9	**0.019****	22	37.65	40.2	2.5	0.503	0.273
Pain interference w/normal activities (0–10)	19	5.7	4.6	– 1.1	0.172	22	4.8	4.6	– 0.2	0.751	0.356

[a] Except LSC, a negative change = improvement, and a positive change = worsening. For LSC, a negative change = worsening, and a positive change = improvement.

[b] A paired t-test was used to test the hypothesis that the mean changed from baseline to short-term follow-up.

[c] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups.

**Significant at $p<0.05$; *marginally significant at $0.05 \leq p < 0.1$

Exhibit B-8. California: Changes in Key Health Outcomes, Baseline to Long-Term Follow-Up

Outcome (range)	Study Group					Control Group					Study vs. Control
	N	Base-line	Long-Term Follow-Up	Change [a]	P [b]	N	Base-line	Long-Term Follow-Up	Change [a]	P [b]	P [c]
Mean ADL Limitations Score (0-16)	15	6.6	2.3	– 4.3	**<0.001****	17	5.0	4.8	– 0.2	0.680	**<0.001****
Mean # of ADL Limitations (0-8)	15	5.5	2.1	– 3.3	**<0.001****	17	4.5	4.3	– 0.2	0.764	**<0.001****
Mean Quality of Life (5-15)	16	9.9	9.0	– 0.9	**0.014****	17	9.6	9.5	– 0.1	0.872	**0.097***
Mean Falls Efficacy (10-100)	16	45.8	31.8	– 14.0	**0.009****	17	41.6	46.4	4.8	0.339	**0.009****
Mean IADL Limitations Score (0-16)	16	5.8	4.8	– 1.0	**0.080***	17	4.9	5.5	0.5	0.396	**0.068***
Mean # of IADL Limitations (0-8)	16	4.4	3.8	– 0.6	**0.076***	17	4.1	4.4	0.4	0.393	**0.069***
Mean PHQ-Depression (0-27)	16	6.1	5.6	– 0.4	0.443	17	5.2	7.2	1.9	**0.042***	**0.030****
Life-space composite score (0-120)	16	33.5	39.3	5.8	**0.030****	17	36.1	27.1	0.9	0.778	0.245
Pain interference w/normal activities (0-10)	16	5.4	4.8	– 0.6	0.529	17	5.1	6.1	1.0	0.101	0.162
# of Falls in past year	15	1.5	0.2	– 1.3	**0.003****	17	0.9	0.6	– 0.3	0.289	**0.032****

[a] Except LSC, a negative change = improvement, and a positive change=worsening. For LSC, a negative change = worsening, and a positive change = improvement.

[b] A paired t-test was used to test the hypothesis that the mean changed from baseline to long-term follow-up.

[c] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups.

**Significant at $p<0.05$; *marginally significant at $0.05 \leq p < 0.1$

Appendix C. Changes in Home Hazard Scores, Baseline to Short-Term Follow-up, by Site

Timeframe & Type of Home (sample size)	Study Group				Control Group				Study vs. Control
	Base-line	Follow-Up	Change	P[a]	Base-line	Follow-Up	Change	P[a]	P[b]
NC:									
Single-Family Homes (SG=22, CG=19)	12.7	7.8	– 4.9	**<0.001****	14.9	14.2	– 0.8	0.262	**<0.001****
Apartments/Condominiums (SG=0, CG=2)	NA	NA	NA	NA	14.0	10.5	– 3.5	**0.09***	NA
All homes (SG=22, CG=21)	12.7	7.8	– 4.9	**<0.001****	14.9	13.8	– 1.0	0.118	**<0.001****
PA:									
Single-Family Homes (SG=7, CG=3)	10.0	6.4	– 3.6	**0.034****	6.0	4.7	– 1.3	0.184	0.166
Apartments/Condominiums (SG=9, CG=6)	6.7	6.8	0.1	0.873	5.5	4.8	– 0.7	0.638	0.618
All homes (SG=16, CG=9)	8.1	6.6	– 1.5	**0.084***	5.7	4.8	– 0.9	0.347	0.617
VT:									
Single-Family Homes (SG=7, CG=9)	9.7	6.9	– 2.9	0.123	10.9	10.1	– 0.8	0.385	0.278
Apartments/Condominiums (SG=10, CG=7)	6.6	3.9	– 2.7	**0.008****	9.4	8.1	– 1.3	0.306	0.331
All homes (SG=17, CG=16)	7.9	5.1	– 2.8	**0.003****	10.3	9.3	– 1.0	0.157	**0.095***
CA:									
Single-Family Homes (SG=0, CG=1)	NA	NA	NA	NA	13.0	15.0	2.0	NA	NA
Apartments/Condominiums (SG=20, CG=21)	13.3	6.0	– 7.3	**<0.001****	13.0	11.7	– 1.3	0.118	**<0.001****
All homes (SG=20, CG=22)	13.3	6.0	– 7.3	**<0.001****	13.0	11.9	– 1.1	0.152	**<0.001****

[a] A paired t-test was used to test the hypothesis that the mean changed from baseline to short-term follow-up.

[b] A two-sample t-test was used to test the hypothesis that mean changes were different in the study and control groups.

**Significant at $p<0.05$; *marginally significant at $0.05 \leq p < 0.1$

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