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Original Research Article

Mobility and Vitality Lifestyle Program (MOVE UP): A Community Health Worker Intervention for Older Adults With Obesity to Improve Weight, Health, and Physical Function

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Abstract

Background and Objectives: Obesity rates in adults ≥65 years have increased more than other age groups in the last decade, elevating risk for chronic disease and poor physical function, particularly in underserved racial and ethnic minorities. Effective, sustainable lifestyle interventions are needed to help community-based older adults prevent or delay mobility disability. Design, baseline recruitment, and implementation features of the Mobility and Vitality Lifestyle Program (MOVE UP) study are reported.
Research Design and Methods: MOVE UP aimed to recruit 26 intervention sites in underserved areas around Allegheny County, Pennsylvania and train a similar number of community health workers to deliver a manualized intervention to groups of approximately 12 participants in each location. We adapted a 13-month healthy aging/weight management intervention aligned with several evidence-based lifestyle modification programs. A nonrandomized, pre–post design was used to measure intervention impact on physical function performance, the primary study endpoint. Secondary outcomes included weight, self-reported physical activity and dietary changes, exercise self-efficacy, health status, health-related quality of life, and accelerometry in a subsample.
Results: Of 58 community-based organizations approached, nearly half engaged with MOVE UP. Facilities included neighborhood community centers (25%), YMCAs (25%), senior service centers (20%), libraries (18%), senior living residences (6%), and churches (6%). Of 24 site-based cohorts with baseline data completed through November 2017, 21 community

health workers were recruited and trained to implement the standardized intervention, and 287 participants were enrolled (mean age 68 years, 89% female, 33% African American, other, or more than one race).
Discussion and Implications: The MOVE UP translational recruitment, training, and intervention approach is feasible and could be generalizable to diverse aging individuals with obesity and a variety of baseline medical conditions. Additional data regarding strategies for program sustainability considering program cost, organizational capacity, and other adaptations will inform public health dissemination efforts.

Translational Significance: Testing the effectiveness of a structured lifestyle weight management intervention for older obese adults in the community organizations serving them, rather than traditional university or medical center settings, provides an opportunity to evaluate how well the intervention approach will be adopted after the research project is completed.

Keywords: Exercise/physical activity, Function/mobility, Lifestyle, Nutrition, Obesity, Translational Research

Background and Objectives

Overweight and obesity is a growing problem that threatens the overall health, mobility and functional independence of aging adults in the United States (Brown & Flood, 2013; Ortman, Velkoff, & Hogan). In the past decade, obesity prevalence (body mass index or BMI ≥ 30 kg/m^2) has increased more in adults aged 65 and older, than in any other age category (Fakhouri, Ogden, Carroll, Kit, & Flegal, 2012). Obesity has a negative impact on muscle strength and physical function directly through biomechanical pathways and indirectly through multiple chronic conditions of aging such as arthritis, hypertension, diabetes, metabolic syndrome, and lipid disorders (Villareal, Apovian, Kushner, & Klein, 2005).

By 2050, it is anticipated that the number of older adults in the United States will more than double, increasing health care utilization and costs (Anderson, 2010) and amplifying the need for feasible, effective, and sustainable public health approaches to manage obesity and mitigate functional decline. Racial and ethnic minority groups are disproportionately burdened. The National Health and Nutrition Survey (NHANES; Ogden, Carroll, & Flegal, 2014) report that, among older U.S. adults, one third of Caucasians are obese compared to about 50% of African American and 40% of Hispanic individuals. Other data suggest obesity in older African American women is associated with higher rates of mobility disability compared to Caucasians (Koster et al., 2008). Given the magnitude of these problems, efforts are needed to increase the reach of weight management interventions beyond traditional health care settings and promote healthy physical function among diverse, community-dwelling older adults with obesity and a wide range of baseline risk factors and conditions.

Prior research from the CDC-funded Center for Aging and Population Health-Prevention Research Center (CAPH-PRC) at the University of Pittsburgh Graduate School of Public Health has demonstrated the effectiveness of community-implemented public health approaches tailored to older adults in underserved communities. This includes "10 Keys" to Healthy Aging, a behavior change program that targets screening and self-management for multiple chronic disease risk factors (Newman et al., 2010; Robare et al., 2011; Zgibor et al., 2016). However, safe and efficacious goal-based lifestyle interventions, which target modest weight loss through a reduced-calorie healthy eating pattern and increased physical activity, such as those derived from the Diabetes Prevention Program (DPP; Knowler et al., 2002, 2009; Venditti, 2016) and Look AHEAD trials (Look AHEAD Research Group, 2014; Rejeski et al., 2012; Unick et al., 2015; Wing, 2010), have also provided a strong foundation for translating structured lifestyle interventions into a wide variety of public health settings (Ackermann, Finch, Brizendine, Zhou, & Marrero, 2008; Ackermann et al., 2015; Delahanty, 2017; Ely et al., 2017; Katula et al., 2013, 2011; Kramer et al., 2009; Ma et al., 2013; Pi-Sunyer, 2014). Thus, the MOVE UP study sought to expand upon prior community-based healthy aging intervention efforts and examine the impact of a feasible weight management approach on the primary physical performance outcomes of interest.

Importantly, an increasing number of clinical trials are being conducted with overweight and obese adults aged 65 and older with various baseline cardiovascular and functional risk factors, to better understand the optimal dose and intensity of combined nutrition (typically caloric restriction), multimodal activity (aerobic, resistance, and balance training), and weight loss interventions to improve cardiometabolic and functional health. Programmatic research such as that conducted by Villareal and colleagues (2017, 2011), underscores the importance of including progressive resistance training activities, not only aerobic exercise to weight loss interventions to enhance strength and preserve lean muscle mass and bone density while addressing other age-related risk factors. A systematic review by Liu and Latham (2009) and work by Messier and colleagues (2013) are in accord with these findings and suggest that progressive resistance exercises or a combination of resistance and

aerobic exercises may attenuate unfavorable effects and optimize cardiac and physical function benefits in elders.

At the same time, studies also suggest that older adults with obesity may not receive the same benefits from physical activity training programs without caloric restriction in service of at least modest weight loss (e.g., 5–7%; Nicklas et al., 2015), and that prudent calorie reduction can improve metabolic, functional, and body composition outcomes with few documented risks (Normandin, Houston, & Nicklas, 2015). Look AHEAD participants, 40–74 years of age at baseline, assigned to the intensive lifestyle intervention were at significantly reduced risk for loss of mobility compared to a diabetes support and education condition (Rejeski et al., 2012) after 4 years of contact, an effect that was mediated by more favorable weight loss and physical fitness. However, concerns have been raised that positive weight and function outcomes are typically demonstrated during active intervention or immediately upon treatment cessation, leaving longer-term benefits in question. It is noteworthy that Look AHEAD data collected 11 years post randomization (Houston et al., 2017), also demonstrated that those in the intensive lifestyle program had better gait speed and lower extremity function on performance-based measures, and no differences in grip strength when compared to the support condition. For some measures, the beneficial effect was somewhat larger in older versus younger participants, suggesting the intervention helped but did not harm strength and function among aging adults.

Significant gaps remain in demonstrating the effectiveness of scalable approaches for diverse community-based older adult samples, with mixed baseline risk factors, and the use of community health workers to enhance reach and adoption of evidence-based or evidence-informed lifestyle programs focused on mobility outcomes. Indeed, the duration, frequency, and intensity of weight loss and activity interventions being studied in randomized efficacy trials are not likely to be replicated in most public health settings. The first Cooperative Lifestyle Intervention Program (CLIP; Rejeski et al., 2011) study examined lifestyle interventions administered by family and consumer sciences educators and compared a combination weight loss and physical activity program (progressive home-based walking with a goal of ≥150 min/week) to either activity intervention alone or a "successful aging" (control) program among 60- to 79-year-old adults with overweight/obesity, cardiometabolic disorders, and mobility limitations. Results showed that the combined program improved walk speed significantly more over an 18-month period than the other conditions and those with poorer mobility at baseline benefited most. The CLIP II study (Rejeski, Ambrosius, Burdette, Walkup, & Marsh, 2017), which compared interventions administered by YMCA staff, found that older high-risk adults achieved clinically meaningful weight loss and that their changes in body weight and improvements in mobility (walk time and knee extensor strength) were significantly enhanced when either progressive resistance training or aerobic training was combined with a dietary weight loss program over 18-months. These results suggest that there may be more than one way to help older adults enhance strength and mobility in structured lifestyle management interventions and that translational research must explore ways to leverage community-based infrastructure to support or amplify the impact of evidence-based programs.

University of Pittsburgh CAPH-PRC Background

Our Prevention Research Center aims to improve active life expectancy and health-related quality of life (HRQoL) in older adults through research on the primary and secondary prevention of late-life disease and disability in communities with known health disparities. The center includes an External Scientific Advisory Board, a Medical Advisory Board, and a Community Action Network of partner organizations reflecting public health, organizational and lay perspectives on behavioral and environmental risk factors for aging adults in Allegheny County, Pennsylvania and surrounding areas. The MOVE UP study design was conceived with these partners in response to a community needs assessment that highlighted the problem of obesity and poor functional health among aging individuals. Given the magnitude and diversity of community organizations being approached for this study, it was determined that a community health worker training and implementation model be adopted and evaluated as a potentially effective and sustainable means of program delivery.

Primary Aims of the Core Research Project

The MOVE UP study has three primary aims: (a) refine a community-based translational lifestyle program that combines elements of evidence-based healthy aging and weight management interventions to be implemented by trained and supported community health workers, (b) examine the impact of intervention on the primary endpoint of physical function performance and other secondary measures, including weight, in older participants with overweight and obesity, and (c) evaluate the potential for sustainability considering program cost, organizational capacity, and other adaptations to inform future healthy aging dissemination efforts. Herein, we report on the study design, methods, and baseline characteristics of the sample through November 2017 (92.5% of the total recruitment target).

Research Design and Methods

Study Design Overview

We employed a nonrandomized, pre–post, mixed methods study design to estimate the feasibility and effectiveness of a four-phase, 13-month, 32-session healthy aging

and behavioral weight management intervention among community-dwelling adults, aged 60–75 years. All eligible and consented participants with overweight and obesity were given the same intervention. The MOVE UP primary outcome was changed in physical function performance at 13 months. Secondary outcomes included weight change, accelerometer measurement in a proportion of the sample, self-reported physical activities, medical history, diet history, exercise self-efficacy, health status, and HRQoL. Qualitative data were also collected.

Recruitment Approach

The organizational structure and partnerships of the University of Pittsburgh CAPH-PRC (Zgibor et al., 2016) served as an umbrella for all recruitment activities. The approach used in the MOVE UP study had three components: (a) recruit a broad spectrum of program delivery sites in and around Allegheny County to maximize generalizability; (b) recruit a like number of community health workers to help engage participants and to serve as site interventionists; and (c) recruit and enroll eligible participants within each community delivery site to the largest extent possible.

Recruitment of Program Delivery Sites

The MOVE UP study conducted intervention groups and outcome assessments in community rather than medical center settings. An administrator or program director for each site was asked to sign a letter of authorization indicating willingness to host an intervention group at their facility. Research staff met first with organizational leadership to determine whether program delivery was feasible and aligned with their mission and priorities. Key determinants for site selection included space to conduct assessments and intervention group meetings, participant safety or access features (ramps, handrails, and restrooms to accommodate those with minor mobility impairment), and likelihood of recruiting or matching a community health worker to a given location. Some reasons given by sites for nonparticipation were scheduling constraints, perceptions that MOVE UP might not be a good fit for constituents of their center, inability to match a worker to the site or concerns about compensation (1 site).

Recruitment of Community Health Workers

Research staff worked with each site to recruit and match a community health worker, some of whom helped to recruit study participants. Recent national survey data has indicated that community health workers are perceived as trusted frontline health personnel when they either come from the communities they serve, help to bridge cultural and linguistic barriers, or otherwise seek to expand reach and access to health care in underserved settings (Ingram et al., 2012). For this study, the primary qualification for a candidate was enthusiasm and willingness to undergo the lifestyle training and make a 13-month commitment to the study. Candidates were required to have at least a high school diploma or the equivalent, an operational email address and telephone number. Group leaders were often recruited from within the community organization, some were already employees, and in a few cases, the site administrator was willing to utilize a community health worker hired for MOVE UP via a job posting through the University. Having previous experience with health promotion in the community or adult education services was considered an asset for the position, but not a requirement.

MOVE UP community health workers were essentially volunteers for the project who received a small stipend for their efforts, primarily to offset travel expenses. They were hired as temporary employees with the University of Pittsburgh and oriented accordingly. The stipend was not meant to set a precedent for low-wage payment of community health workers in delivering prevention services. Our study was designed only to show that interested and rigorously trained community-recruited personnel could deliver a multicomponent behavioral lifestyle intervention effectively. Sustaining a community health worker approach for prevention efforts beyond volunteers will likely require specific billing codes and reimbursement akin to those used with diabetes clinical educators (Medicare) and mental health workers (Medicaid).

Recruitment of Participants (Eligibility and Procedures)

Primary methods of recruitment included word of mouth and existing communication tools and networks (mass mailings, web-mail, printed posters and flyers, newsletters, bulletin boards, and other internal promotions facilitated by research staff). Community health workers and other stakeholders helped with the participant recruitment and engagement process at some sites. Stakeholders included leadership (executive directors, clergy) invested in launching health programs and staff workers assigned to promote or conduct MOVE UP as part of their jobs. Administrative support staff, marketing staff, healthy living or activity directors, and community outreach managers were also involved in recruitment efforts. A feature article in the city newspaper yielded screening and enrollment of about 60 study participants (20% of the total projected sample) from throughout the county; these individuals were matched by preference to geographic locations.

Inclusion criteria were designed to be relatively broad, given the community-engaged mandate of our Prevention Research Center and the need to be responsive to most older adults with obesity. Phone screening questions (following verbal consent) targeted primarily age and weight status, and recent medical history or weight interventions

that might preclude participation or impact study outcomes. The study screening, assessment and intervention activities, and procedures were described providing the start of the informed consent process for those who were potentially eligible. About 21% of those who called expressing initial interest declined to proceed after the phone screen.

Inclusion criteria included: 60–75 years of age by the start of intervention, documented BMI of 27–45 kg/m^2, ability to walk either with or without an assistive device (e.g., cane), ability to consent for data collection and intervention and obtain medical clearance to participate by Session 5 when the physical activity goals and progression were introduced. Exclusion criteria included: undergoing active treatment for cancer (other than nonmelanoma skin cancer), overnight hospitalization in the past 6 months, uncontrolled diabetes mellitus (fasting blood sugar > 300 and hemoglobin A1C > 11%), uncontrolled hypertension (systolic blood pressure > 180 or diastolic blood pressure > 110), history of bariatric surgery, and current use of weight loss medications. Other exclusionary factors reviewed by investigators, were those that might preclude participation in program activities (unless accommodations could be made), that is, significant cognitive or psychiatric impairment, visual or hearing loss, inability to read or communicate in English, inability to regularly attend intervention sessions, or concurrent enrollment in an organized weight program or research study likely to impact MOVE UP outcomes.

Informed Consent

The MOVE UP protocol and consent forms were approved by the University of Pittsburgh Institutional Review Board (IRB) before study initiation. All participants were required to provide informed consent for the research study in compliance with all institutional procedures. This included the community health workers who participated in qualitative research assessments following program delivery. Community stakeholders were not involved in development of the consent form, but forms and protocols were reviewed during site recruitment. The informed consent process was typically conducted in a group setting, at the community site, just before baseline assessment. Consent review and signing occurred one-on-one. It was the responsibility of the research staff to determine participant comprehension and ensure that questions were answered satisfactorily before proceeding to signature and documentation.

Community Health Worker Training/Support Schedule

Training, supervision, and observational monitoring of the community health workers was strategically aligned to parallel delivery of the MOVE UP lifestyle intervention protocol (Table 1). The training sessions were led by two behavioral weight management experts, typically a registered dietitian and an exercise specialist. Research staff also provided orientation and instruction. Community health workers were encouraged, but not required, to participate in monthly 30- to 60-min conference calls with their interventionist peers and study staff for discussion and support. They were also invited to attend monthly "Meet and Greet" events, held at various times of the day and in rotating community locations. These meetings, led by research project staff, provided informal information for potential new partners and community health workers and reinforced training for partners in ongoing programs.

MOVE UP Lifestyle Intervention Protocol

The intervention consisted of 32 group sessions implemented in four phases over a 13-month intervention period.

Phase 1 (Run-in/10 Keys to Healthy Aging)

A unique feature of the MOVE UP intervention was the integration of the 10 Keys to Healthy Aging (Newman et al., 2010) session material in the primary engagement phase (Month 1). Before initiating the manualized weight loss induction portion of the program, participants engaged in 4 weekly sessions that related to screening and self-management of multiple health risk factors considered markers for late-life disease, disability, and physical function decline. Participants were coached to focus on personally relevant risk reduction goals, communication with health care providers and other support persons to develop ways to overcome barriers in achieving their health care goals. Eight of 10 keys (two per session) were introduced, with the remaining two keys (physical activity and cholesterol management) incorporated into the Phase 2–4 weight management protocol.

Phase 2 (Behavioral Induction: Healthy Eating, Physical Activity, and Weight Loss)

During Months 2–5, participants continued to meet in weekly group sessions with the community health worker. In this phase, MOVE UP used structured, goal-based materials derived from the first-year curriculum used in the Diabetes Prevention Program (Diabetes Prevention Program Research Group, 2002), Look AHEAD studies (Wadden et al., 2009) and other elder-focused physical activity interventions with multimodal physical activity aims (Pahor et al., 2014). As in Phase 1, all sessions were implemented in a face-to-face, interactive group format and lasted about 60 min. A group session facilitation guide (referred to as a "Coaches Clipboard") was simplified from original efficacy trial group leader materials (i.e., reduced text, step-by-step instructions with specific examples of prompts to facilitate group interaction, written at an 8th-grade reading level). Otherwise, the sequence, content, number of sessions, and social cognitive-behavioral principles on which the MOVE UP intervention was based (e.g., goal setting, self-monitoring and feedback, managing environmental and social cues,

Table 1. MOVE UP Intervention/Community Health Worker Training and Support Schedule

Program phase	Frequency of contact	Session content	Training and support
Phase 1: 10 Keys to Healthy Aging	Month 1 (weekly)	1. MOVE UP introduction, 10 Keys: stop smoking, maintain social contact 2. 10 Keys: lower systolic blood pressure, regulate blood glucose 3. 10 Keys: participate in cancer screening, get immunized regularly 4. 10 Keys: maintain healthy bones, joints, and muscles	*Group training (7 hr)* Before Session 1: • Review: Coaches Clipboard, group facilitation skills, interventionist's role, confidentiality and ethics, weighing etiquette, 10 Keys 1–4, lifestyle 5–8, how to comment on participant lifestyle logs, weight and activity tracking forms Optional (monthly) • Support calls • Meet and greets
Phase 2: Behavioral Induction: Healthy Eating, Physical Activity, and Weight Loss	Months 2–5 (weekly)	5. Losing weight 6. Healthy eating 7. Eat fewer calories 8. Move those muscles 9. Plan a healthy diet 10. Tip the calorie balance 11. What's around you 12. Being active: a way of life 13. Problem solving 14. Keys to eating out 15. Negative thoughts 16. Slippery slope 17. Emotions and you 18. Social cues 19. Jump start your activity plan: (Go4Life strength, balance, flexibility training exercises introduced) 20. Stay motivated	*Group training (4 hr)* Before Session 9: • Review: lifestyle Sessions 9–20, group facilitation skills, sample comments for participant lifestyle logs, weight and activity tracking forms, strategies for participants at goal weight Between Sessions 6–9: • Conduct Touchpoint Feedback (session observation and implementation fidelity check) Optional (monthly) • Support calls • Meet and greets
Phase 3: Weight and Activity Maintenance	Months 6–9 (bi-weekly)	21. Weight loss expert 22. Maintain energy balance 23. Feel full/fewer calories 24. Mindful eating 25. Hunger vs craving 27. Keep moving 28. MOVE UP tune-up 1	*Group training (4 hr)* Before Session 21: • Review: lifestyle Sessions 21–32, group facilitation skills, strategies for participants at goal weight Optional (monthly) • Support calls • Meet and greets
Phase 4: Weight and Activity Maintenance	Months 10–13 (monthly)	29. MOVE UP tune-up 2 30. Healthy heart 31. Sleep 32. Graduation	Optional (monthly) • Support calls • Meet and greets

problem-solving, responding to self-defeating thoughts and lapses, seeking social support) were wholly consistent with well-established evidence-based behavioral interventions for obesity and disease prevention (Venditti, 2016; Venditti et al., 2014).

Phase 3–4 (Weight and Activity Maintenance)

Session frequency was twice per month during months 6–8 (Phase 3) and once per month during months 9–13 (Phase 4). The overarching focus in the latter 6 months of MOVE UP was reinforcing strategies for weight loss maintenance, healthy eating, and lifestyle physical activities. At the end of the program, participants were encouraged to seek ongoing support within the community setting for weight and activity self-management, but this was not organized or provided by the study.

Missed sessions, retention, and adherence monitoring

A tracking database was used to monitor participant attendance at sessions, adherence to self-monitoring for

calorie intake and physical activity, and the number of food and activity records returned. A standard protocol for missed sessions was followed. The community health worker encouraged participants to notify them directly or contact the main study office about planned absences and to make plans to receive missed material (typically by mail, sometimes by coming early to the next session for a brief review). However, research staff had primary responsibility for contacting those who missed sessions and, by protocol, three attempts were made for re-engagement in the MOVE UP intervention and/or major study assessments after which a letter was sent inviting the participant to contact or return to the program at any time. When phone contact was made, staff assessed whether the reasons for nonattendance were likely to be temporary or ongoing, and requested feedback about the participant's experience to date. Participants were also offered an opportunity to continue receiving materials by mail and attend major assessment visits at 5, 9, and 13 months, even if they did not plan to continue with intervention sessions.

Behavioral and Theoretical Orientation

Strategies for achieving and maintaining the recommended weight loss and activity program behaviors and goals were consistent with the DPP and Look AHEAD efficacy study approaches and also informed by translational lifestyle intervention programs that have been conducted exclusively with older adults in community settings (Beavers et al., 2014; Marsh et al., 2013; Rejeski et al., 2011). The MOVE UP intervention emphasized both personal (self-regulatory) and social (including community) agency for health behavior change, models subsumed within social-cognitive theory (Bandura, 1989, 2004). In the first 6 months, the rationale and instructions for self-monitoring body weight, eating, and activity were introduced. Body weight was measured by the community health worker at each group session and participants were encouraged to weigh at home as a key self-monitoring behavior critical for weight loss maintenance.

Participants were given weekly food and activity records ("Lifestyle Logs") to self-monitor their food intake, physical activities, and home-based weights. The community health worker training included instruction on best practices for providing written feedback and encouragement to participants that were consistent with the stage of the intervention and session material. The Coaches Clipboard included sample comments (e.g., emphasis on praising self-monitoring efforts, small behavior changes, meeting goals for calories and physical activity, or indications that a participant had applied principles learned in the program). The investigative team, including registered dietitians and an exercise specialist, was available to address questions about appropriate feedback and commentary. The community health worker was also trained to alert study staff if they identified safety concerns when reviewing logs.

Goal-based intervention

Participants were encouraged to achieve and maintain a 7% weight loss goal from baseline and 175 min of weekly physical activity like brisk walking. These were standard minimum goals (DPP Research Group, 2002; Look AHEAD Research Group, 2006) and participants could set personal weight loss and activity goals. Weight loss alerts were set up for (a) any participant nearing a BMI of 22, or (b) any participant who demonstrated more than 7% weight loss in a four-week period. Weight loss alerts resulted first in data verification checks. Community health workers were also instructed to consult with study staff about participant weight loss safety concerns, new medical issues, and ask for guidance.

Dietary recommendations

Participants were coached to reduce energy intake to 1,200–1800 kcal/day based on initial body weight (specifically <200 pounds = 1200 kcal/d; 200–250 pounds = 1500 kcal/d; >250 pounds = 1800 kcal/d) to achieve the 7% weight loss target within a 6-month window (as in DPP and Look AHEAD protocols). Similar calorie restriction goals have been utilized safely and effectively with older adults in other clinical trials (Normandin et al., 2015; Villareal et al., 2011). All healthy eating goals and guidelines were based on current USDA recommendations. The Lifestyle Logs described above were the means through which participants tracked their own daily calorie intake, receiving feedback and encouragement for small, positive changes from the community health worker. Extensive written feedback about diet was not the approach. Rather, much of the behavioral learning about ways to reduce calories or portion size (e.g., MyPlate, nutrition facts labels, principles of caloric density as in Rolls, Drewnowski, & Ledikwe, 2005), or increase protein and fiber, occurred during the Phase 2 nutrition-focused sessions through group sharing, planning and problem-solving. In addition to the reduced calorie focus for weight loss, there was also emphasis, per the latest USDA guidelines, on models of healthier eating patterns such as the Mediterranean Diet, DASH diet, and other plant-based menu ideas (U.S. Department of Health and Human Services, 2015)

Physical activity recommendations

The physical activity goals and guidelines were consistent with national public health recommendations and appropriate for older adults (Nelson et al., 2007). Studies have shown that most aging adults are not meeting national guidelines, particularly those residing in underserved communities (Keadle, McKinnon, Graubard, & Troiano, 2016). MOVE UP employed an exercise goal (and exercise progression) of 175 minutes of weekly moderate-intensity physical activity, as in the DPP/Look AHEAD protocols, (Look AHEAD Research Group, 2006) which emphasized physical activities that correspond to 50–70% of maximal heart rate. Participants were encouraged to pursue brisk walking and similar intensity activities that could be maintained for at least 10 min. The

physical activity component was unsupervised and designed to help participants build their preferred home-based exercise program, including reduction of sedentary behaviors. Participants were instructed to engage in planned moderate-intensity physical activity 5 days per week, beginning at 10 min per day and progressing to at least 35 min per day (increasing no more than 5 min/d in 4-week intervals) to maximize behavioral adherence and minimize the risk of musculoskeletal injuries. Resistance training activities were introduced in Phase 2 (Session 19). In this session, the Go4Life "Workout to Go" materials (http://go4life.nia.nih.gov/) were provided to emphasize multimodal physical activity training. The materials included pictures of older adults doing standing and seated strength, balance, and flexibility exercises. MOVE UP encouraged resistance training at least twice per week above and beyond the aerobic activity goal, following ACSM/AHA guidelines for older adults (Nelson et al., 2007).

Participant Safety Checks

In addition to the requirement for initial health care provider clearance for participation in the study, and monitoring excessive weight loss triggers as noted above, MOVE UP also utilized an interim safety check form at the 5- and 9-month assessment visit. This form was either self- or interviewer-administered and documented whether the participant had been hospitalized overnight (and for what condition) or treated for any type of cancer since the last visit. Medical re-clearance, at the discretion of the medical safety officer, was requested for continued participation in some cases (e.g., following an injury or hospitalization). The medical safety officer for the study reviewed the circumstances to determine if the participant was no longer eligible to continue or if more information was needed from the primary care provider.

Data Safety and Monitoring

A committee comprised of three individuals (including one physician) was convened. Reports were reviewed twice annually to discuss study enrollment targets, intervention adherence and tracking, participant adverse events, and serious adverse events. Investigator meetings were held quarterly to review the same reports. Study research staff meetings were held weekly. These three mechanisms were used to adjudicate any concerns identified by either the community health workers or research assessment staff about a participant's initial eligibility, continuing eligibility, or need for renewed medical clearance.

Implementation Fidelity Assurance

All community health workers were observed on one occasion between Sessions 6 and 9 by a research staff member (a registered dietitian) using a "Touchpoint Feedback" scale. Before session observation, the study dietitian reviewed participant Lifestyle Logs to evaluate the quality of the written comments provided by the community health worker. The observer also completed Likert ratings on the following items: (a) session organization and readiness, welcoming participants, safe and semi-private weighing procedures, (b) opening the session with discussion of the past week (barriers and successes) and eliciting group problem solving, (c) delivery of session content and materials using the Coaches Clipboard, (d) facilitation of group interaction, and (e) adhering to session length, closing the group meeting with summary statements, home assignments, and positive reinforcement of all participant efforts. The community health worker and observer met postsession immediately. Feedback and positive reinforcement were provided on the intervention skills observed; one or two goals were discussed as next steps for improving implementation and group facilitation skills.

Study Data Collection Schedule

Independent, trained research assessment staff collected primary and secondary outcome data at baseline, 5-month, 9-month, and 13-month visits for each cohort, at each intervention site. When the staff was unable to obtain objective physical assessment measures, attempts were made to collect all questionnaire measures by phone interview.

MOVE UP Study Outcome Measures (Quantitative)

Table 2 displays the primary and secondary study outcome measures. Demographic information was collected between the screening and baseline visits. Most measures were collected at each of the main assessment time points, except where indicated, and they are described briefly here:

Short Physical Performance Battery

The short physical performance battery (SPPB), a widely used assessment of lower extremity function in studies involving older adults, was the primary outcome measure and included tests of gait speed (4-m walk-test), standing balance, and chair-stand tests (Guralnik et al., 1994).

Weight, Height, and BMI

Weight and BMI were the main secondary and mediating outcome measures. Participants were assessed wearing light clothing and no shoes. Weight was measured using a calibrated digital scale. Height was measured to the nearest 0.25 cm using a portable stadiometer. Weight and height measures were used to calculate BMI (kg/m^2).

Health-Related Quality of Life

Participants completed the Medical Outcomes Study (MOS) SF-36, a generic quality of life measure with well-established psychometric properties (Ware, 2000;

Table 2. MOVE UP Schedule of Data Collection

Outcomes	Source	Screening	Assessment frequency (month)			
			Baseline	5	9	13
a. Quantitative measures						
Demographic Information: sex, age, race, education	Survey	×	×			
Short Physical Performance Battery (SPPB): 4-m walk, standing balance, five-chair stand)	Objective		×	×	×	×
Weight	Objective	×	×	×	×	×
Height	Objective	×	×			
Health-Related Quality of Life (HRQoL): MOS SF 36	Survey		×	×	×	×
Depression: CES-D	Survey		×	×	×	×
Medical History Screening Questionnaire: Stanford Chronic Disease Prevention Program	Survey		×	×	×	×
Self-Reported Physical Activity: CHAMPS Questionnaire	Survey		×	×	×	×
Diet: Rate your Plate-Heart 2010	Survey		×	×		×
Physical Activity Monitoring/Accelerometry: ActiGraph GT3x+, BodyMedia SenseWear Pro Armband (SWA)	Objective		×	×		×
Perceived Global Fatigue: Pittsburgh Fatigability Scale	Survey		×	×		×
Self-Efficacy for Weight Loss: WEL Questionnaire	Survey		×	×		×
Self-Efficacy for Physical Activity: Self-Efficacy for Exercise Scale	Survey		×	×		×
b. Qualitative measures						
Program evaluation (group participant)	Survey					×
Program evaluation (interventionist)	Survey					×
Program evaluation (site administrator)	Interview					×
Focus groups	Interview					×

Ware & Sherbourne, 1992), frequently used to assess response to healthy aging and weight management interventions. The Physical Component Summary (PCS) scale was the specific outcome of interest.

Center for Epidemiological Studies-Depression

The 20-item Center for Epidemiological Studies-Depression (CES-D; Radloff, 1977) self-report measure was used to document depressive symptoms. This measure is widely used in epidemiological research and as a covariate in behavioral interventions with older adults (Matthews et al., 2011).

Medical History

A self-report questionnaire derived from the Stanford Chronic Disease Prevention Program was used to assess whether participants had ever been "told by their health care provider" that they had any of several medical conditions, which spanned several major health domains (Lorig, 1996; Lorig et al., 1999).

Community Healthy Activities Model Program for Seniors Survey

Community Healthy Activities Model Program for Seniors Survey (CHAMPS) is a questionnaire designed to assess the weekly self-reports of frequency and duration of various types of physical activities common among older adults and often used to assess activity outcomes in chronic disease prevention programs (Falck, McDonald, Beets, Brazendale, & Liu-Ambrose, 2016). The MOVE UP study used CHAMPS to estimate the caloric expenditure per week for two summary outcome measures: (a) activities of at least moderate intensity (only those categorized at 2.5 METS and above); and (b) total physical activities, including those of light intensity (Stewart et al., 2001). The association of CHAMPS with physical function performance measures (Chale-Rush et al., 2010) and accelerometry assessments (Pruitt et al., 2008) has also been well-established for older adults in the community.

Dietary Questionnaire

We used Rate Your Plate-Heart 2010, a modified and updated version of a 23-item food frequency questionnaire (FFQ; Kulick et al., 2013) that assesses the degree to which eating patterns are consistent with heart-healthy dietary guidelines (Gans, Hixson, Eaton, & Lasater, 2000; Gans et al., 1993). The Rate your Plate (RYP) FFQ was originally designed to be easily self-administered in community-based screenings. A prior study of overweight adults with low socioeconomic status found that RYP scores were significantly correlated with the Willett semi-quantitative FFQ (Gans et al., 1993), particularly for foods high in saturated fat.

Accelerometry

Objective physical activity monitoring was conducted within the first 11 sites recruited (N = 127 participants at baseline, or roughly half of the total sample) as a pilot

study to assess the relationship of changes in physical activity and self-reported physical fatigue over the course of intervention period. The ActiGraph GT3x+accelerometer and BodyMedia SenseWear Pro Armband (SWA) were both worn on the nondominant wrist and left triceps, respectively, for 7 consecutive days at baseline, 5 months, and again between 9 and 13 months. Participants were instructed to wear the wrist ActiGraph always, while the SWA was removed during showering, bathing, or swimming. The ActiGraph collected raw accelerometry data along three orthogonal axes with the sampling frequency of 80 observations-per-second (80 Hz) and volume and pattern metrics will be examined using advanced analytics (Jefferis et al., 2015; Lyden, Keadle, Staudenmayer, & Freedson, 2014; Shiroma, Freedson, Trost, & Lee, 2013; Shiroma et al., 2016). The SWA measured total energy expenditure (kcal/min), active energy expenditure (kcal/min), and total number of steps using the manufacturer's proprietary software. Concurrent with the objective activity assessment, participants completed the Pittsburgh Fatigability Scale (PFS), a validated 10-item self-administered questionnaire which assesses perceptions of whole body fatigue in relation to intensity and duration of common activities performed by older adults (Glynn et al., 2015).

Weight Loss Efficacy Questionnaire

Self-efficacy and confidence for maintaining healthy eating and exercise behaviors in the face of challenging situations or difficult emotions was assessed using the original Weight Efficacy Lifestyle Questionnaire (WEL; Clark, Abrams, Niaura, Eaton, & Rossi, 1991). This theory-based measure has been widely employed to assess individuals' confidence in their ability to follow the weight management program and has consistently added explanatory value to studies of these behavioral interventions (Burke et al., 2015; Delahanty et al., 2013).

Self-Efficacy for Exercise Scale

This 13-item measure was originally developed to assess self-efficacy expectations for sedentary adults in the community participating in an outpatient exercise program (McAuley, 1993; McAuley, Lox, & Duncan, 1993). Other researchers utilizing some or all the items have established the psychometric utility of the scale, including for older adults (Resnick & Jenkins, 2000). These questions have frequently been used to understand the mediating and moderating role of self-efficacy for maintaining physical activity behaviors in lifestyle intervention trials (Delahanty et al., 2013).

Qualitative Study Design and Outcomes

The MOVE UP study will evaluate how a translational behavioral weight management intervention for older adults was conducted within specific settings and organizational networks (Brownson, Colditz, & Proctor, 2012). Fixsen's Implementation Model (Fixsen, Naoom, Blase, & Friedman, 2005) and RE-AIM (Belza, Toobert, & Glasgow, 2007) will both be used to track multiple levels of intervention delivery including the process of selecting community health workers, the provision of initial and ongoing training and support for intervention fidelity, program evaluations, facilitative and administrative supports, and other organizational level data collection. Each MOVE UP participant and each community health worker completes a program evaluation after intervention. In addition, individual interviews with a key informant at each community site and participant focus groups will be conducted until saturation is achieved. Scripted prompts address themes including helpful or unhelpful aspects of the session material or instructor, the health behavior change and physical activity strategies provided, and ideas for improvement. The prompts also address whether and how participants plan to continue with/use strategies learned. On-site focus groups of 90 min each were digitally recorded then transcribed with identifiable participant information deleted. A qualitative codebook using ATLAS.ti 7 (Friese, 2013) will be derived, and transcripts will be recoded for inter-rater reliability. The information obtained during qualitative data collection is intended to provide preliminary information regarding program refinements and the resources needed to sustain the program once the study is complete.

Sample Size Estimates, Planned Analysis and Power, Statistical Analyses

The primary outcome in MOVE UP is the SPPB, a widely used and validated physical function measure (Chale-Rush et al., 2010; Guralnik et al., 1994) in aging epidemiology research and intervention studies. All analyses will be by intent-to-treat, and sensitivity analyses will be conducted among those completing versus not-completing the intervention per protocol. Missing data will be accounted for using multiple imputation methods. Descriptive analyses of participant characteristics and outcome variables will be conducted first. A 0.5-point unit of change is considered clinically meaningful and is associated with risk of mobility impairment, loss of independence, and mortality (Gawel et al., 2012; Kwon et al., 2009; Perera, Mody, Woodman, & Studenski, 2006; Studenski et al., 2011). Based on the projected total recruitment of 26 intervention sites with an average of 12 participants per site completing baseline and final study assessments, we estimate that there will be 80% power to detect an improvement in SPPB of 0.44 SPPB units or greater. The main secondary and mediating outcome will be weight loss. We estimate that there will be 80% power to detect at least a 5% change in weight from baseline at both the 6- and 12-month assessments, based on comparable community-implemented translational weight loss studies

(Katula et al., 2011; Kramer et al., 2009). A supplemental secondary outcome will be self-reported physical function based on the physical component score (PCS) subscale from the MOS SF-36. We also anticipate that we will have 80% power to detect a 5.9-point improvement in the MOS SF36 PCS (0–100 points) consistent with previous research.

For primary and secondary outcomes, statistical tests will include comparisons between sites as well as completers and noncompleters using: mean, standard deviation, quartiles, minimum and maximum values, *t*-tests, Wilcoxon rank-sum tests, and box plots. Categorical outcomes will be estimated using proportions and chi-square tests. Baseline characteristics will be assessed for comparability between sites and to identify and account for site differences. Comparisons will be conducted at baseline and each time point, and as the change at each time point versus baseline. Weight loss will be evaluated in absolute units (kg) and as percent change from baseline. If improvement in SPPB scores and weight loss is established, mediation analyses will be conducted with weight loss added as an explanatory covariate. An attenuation of 10% or more in the amount of SPPB improvement will be used as evidence of mediation (Mallinckrodt, Abraham, Wei, & Russell, 2006). Linear mixed models will also be used to analyze changes in study outcomes at the three postintervention time-points (5, 9, and 13 months) from baseline. Hierarchical random effects will include sites and participants within sites.

Cost Analysis

Costs for MOVE UP implementation will be assessed from health care system and societal perspectives. From the health care perspective, costs will include direct medical costs and the costs of the intervention estimated if it were implemented in a nonresearch setting (i.e., costs of recruiting, training, and maintaining a community health worker's time). Societal perspective costs will include the costs above plus the value of participant time, and the nondirect medical costs that participants incur while seeking and receiving the intervention (e.g., parking and transportation). Productivity costs will not be included in the societal perspective analysis due to participant age and retirement status. Cost-effectiveness from the health care and societal perspective will be calculated as per participant cost, from each perspective, divided by the change in the primary outcome observed (Sanders et al., 2016).

Results (Baseline)

Sites

Of 58 community-based facilities approached from January 2015 through November 2017, nearly half (27 sites or 46.6%) agreed to implement the program (Figure 1). Of these, the types of facilities represented were neighborhood community centers (25%), YMCAs (25%), senior service centers (20%), libraries (18%), senior living residences (6%), and churches (6%). From June 2015 through November 2017 (Figure 1), 24 site-based intervention cohorts were launched at the rate of 3–4 per quarter, with an average of 12 participants enrolled per group.

Community Health Workers

Of the 21 community health workers recruited and hired to date, ages ranged from 24 to 82 years (average, 53.8 ± 16.6). All but one was female. Twelve (57.1%) were Caucasian, six (28.6%) were African American, and three (14.3%) reported that they were more than one race. Educational attainment was as follows: 4 community health workers (19.0%) had less than a college degree, 10 (47.6%) had an Associate's or Bachelor's degree, and 7 (33.3%) reported postbaccalaureate or professional training. Four workers delivered more than one group; one group had co-leaders.

Participants

Out of the 586 individuals phone-screened, N = 336 proceeded to a field screening (57.3%) to confirm study eligibility and N = 291 (49.6%) were consented and enrolled. Baseline data collection was completed for N = 287 (48.9%) by November 30, 2017, and the flow diagram is reported in Figure 2. At the time of phone screening, the main reasons participants did not qualify included BMI or age out of range (Figure 2). An equal proportion declined to participate after hearing more detail about the study. At the time of the field screen, a much smaller proportion was excluded for BMI, age, or disinterest.

Characteristics of the MOVE UP participant sample, reflecting data collected from January 2015 through November 2017 (N = 287), are shown in Table 3. Study recruitment and baseline assessment will be complete as of April 2018. Therefore, these data represent about 92.5% of the total expected sample. Those enrolled were primarily female and evenly distributed across the age range categories (60–65, 66–70, and 71+ years) and educational attainment levels; very few had less than a high school degree. Thirty percent of those enrolled were African American or mixed race. Participants were in the obese weight range (mean BMI, 34.8 ± 4.7) and had an average of 3.2 (1.8) health risk conditions upon entry to the study. Only 12% of the sample had zero or one medical condition at baseline, 79% reported two to five conditions (with the majority reporting arthritis and hypertension), and 9% reported five or more conditions.

Discussion and Implications

The MOVE UP study will provide data on the feasibility, effectiveness, and potential sustainability of a highly structured healthy aging and behavioral weight management intervention for older adults with obesity across numerous community-based sites and utilizing community health

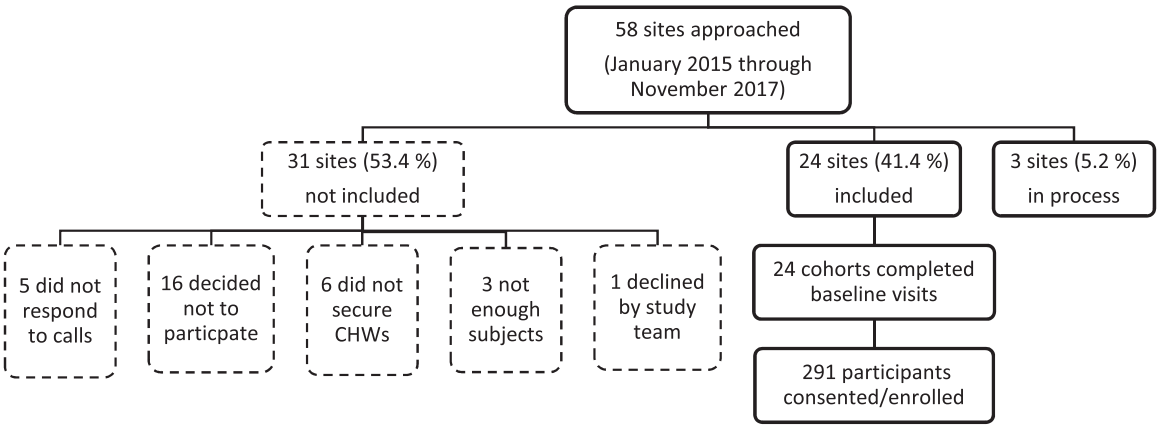

Figure 1. MOVE UP site/cohort recruitment.

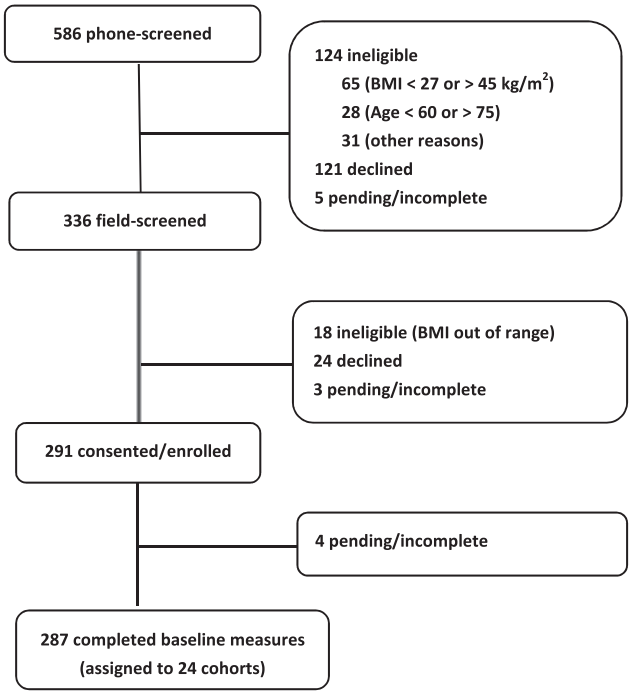

Figure 2. Participant flow (January 2015 through November 2017).

workers. Consistent with the mission of the CAPH-PRC to promote active life expectancy and functional independence among vulnerable older adults, MOVE UP will provide both quantitative and qualitative evidence for a robust three-pronged recruitment strategy that first targets and recruits program delivery sites with demonstrated need, then recruits, trains, and supports community health workers to serve as interventionists, and culminates with the enrollment and treatment of cohorts of eligible participants within each setting.

Randomized controlled clinical trials have set the stage by establishing efficacy for different components of high-intensity (often multiyear) lifestyle interventions that modify diet, physical activity, and weight, and providing beneficial impact on cardiometabolic risk parameters and physical function outcomes in middle and older aged adults (Houston et al., 2017; Knowler et al., 2002, 2009; Look AHEAD Research Group, 2014; Unick et al., 2015; Wing, 2010). Moreover, several tightly controlled but relatively short-term laboratory-based efficacy studies focusing exclusively on older adults (over the age of 60) have concluded that intensive weight loss interventions combined with various modes of intensive physical activity training are safe and superior to either weight loss alone or physical activity interventions alone on a variety of age-sensitive health outcomes (Beavers et al., 2014; Messier et al., 2013; Rejeski et al., 2011; Villareal et al., 2017, 2011). Furthermore, the cumulative findings from the Cooperative Lifestyle Intervention Program (CLIP) (Rejeski et al., 2011, 2017) studies support the notion that either aerobic or resistance activity guidelines and goals, when combined with weight management, can have a positive impact on older adult mobility and function. The 13-month MOVE UP results will demonstrate the feasibility and effect sizes of a highly structured but less intensive evidence-based behavioral lifestyle intervention implemented by community health workers who do not often have comprehensive weight management or exercise specialist expertise but are trained and guided by experts who do. By documenting SPPB, weight, self-reported physical activity, accelerometry, and other pertinent health and psychosocial outcomes that have been used in the previous clinical trials, we will be able to demonstrate the extent to which the MOVE UP approach is beneficial.

One prior study (West et al., 2011) provided data on the effectiveness of lay health educators, affiliated with 15 senior centers, delivering a translational DPP intervention to older African American adults with obesity in the rural South, however only 4-month results (indicating nearly 4% weight change) were provided. Belza and colleagues (2006) studied the impact of supervised community-based exercise classes offered three times weekly across multiple types of facilities (e.g., churches, senior centers, hospitals, fitness centers, public housing facilities) in the Pacific Northwest and

Table 3. MOVE UP Participant Baseline Characteristics

Variable	Total (n = 287)
Sex, no. (%)	
Female	255 (88.9)
Male	32 (11.1)
Age at screening visit[a]	
Mean (*SD*), years	68.0 (4.2)
Age, no. (%)	
60–65 years	106 (36.9)
66–70 years	103 (35.9)
71+ years	77 (26.8)
Missing	1 (0.3)
Highest education, no. (%)	
Less than high school diploma	8 (2.8)
High school graduate or GED	54 (18.8)
Some college or technical school	73 (25.4)
Associate or bachelor degree	88 (30.7)
Postcollege or professional degree	63 (22.0)
Missing	1 (0.4)
Weight, Mean (*SD*), kg	91.9 (14.8)
Weight, range, kg	59.1–137.3
BMI, Mean (*SD*), kg/m^2	34.8 (4.7)
BMI, range, kg/m^2	27.1–46.3
Race, no. (%)	
Non-Hispanic white	191 (66.6)
African American	85 (29.6)
Other race/more than one race	10 (3.5)
Missing	1 (0.3)
History of chronic conditions,[b] Mean (*SD*)	
Average no. conditions	3.2 (1.8)
Arthritis	225 (78.4)
Hypertension	191 (66.6)
Thyroid problems	85 (29.6)
Depression	70 (24.4)
Diabetes	61 (21.3)
Other chronic conditions	<20% of sample

[a]N = 286 (1 birthdate not documented).
[b]Skin cancers (nonmelanoma) excluded.

demonstrated significant positive 4- and 8-month physical performance changes from baseline, but weight management was not part of this approach. Similarly, Brach and colleagues studied the effectiveness of a 12-week group-administered activity program consisting of progressive stepping and walking pattern exercises, combined with strength and stretching activities aimed at timing and coordination, and compared it with a usual care program of seated strength, endurance, and flexibility for older adults at 32 independent living, senior housing, and senior community center facilities (Brach, Van Swearingen, Perera, Wert, & Studenski, 2013; Brach et al., 2016, 2017) Results showed that the timing and coordination intervention was more effective than usual care in improving gait speed and 6-min walk distance. Studies such as these and MOVE UP extend the evidence base for innovative, potentially sustainable interventions to support healthy aging in nonmedical settings.

There are limitations to the current study. It is a nonrandomized, prospective pre–post intervention design and threats to internal validity cannot be ruled out, such as selection bias or other potential confounders. The nutrition approach utilized in the current study stems directly from those outlined in DPP/Look AHEAD, with a primary emphasis on calorie restriction and evolving USDA guidelines for healthy eating and weight management. Other intensive nutritional approaches and/or adherence to specific dietary patterns could also be tested (Mozaffarian, 2016) and objectively measured using 24-hr dietary recall methodologies either alone or in combination with physical activity interventions to assess overall impact on older adult mobility and function. Other measures of adiposity besides BMI (i.e., waist circumference, objective measurement of body composition such as DEXA) could enhance understanding of the effectiveness of these community programs. The multimodal aspects of the physical activity intervention (i.e., resistance and balance training) could also have been emphasized earlier and more intensively in this aging cohort. Moreover, a 13-month program without community-based follow-up and support may not exert a sustained benefit. Increasing emphasis is being placed on 24-month prevention programs, and more research is needed on how to best implement continued contact but less intensive dietary and activity behavior changes within existing infrastructure and services for older adults. Therefore, MOVE UP outcomes will need to be viewed as preliminary and interpreted with caution. However, use of multiple community-based sites for recruitment, the rigorous assessment, training and delivery protocols and procedures, and the large sample size (of sites, interventionists, and participants) partially mitigate these concerns.

To date, the baseline characteristics of community sites, community health workers, and participants indicate that we have been successful in achieving our recruitment goals for the project. We have engaged multiple nonmedical, organizations already serving vulnerable older adults in some capacity and we have recruited interested, community health workers to undergo comprehensive training and serve as interventionists at these sites over several months. In addition, we have successfully recruited a community health worker and participant sample that is 30% African American, exceeding county demographic statistics for this group. If successful, our translational training and intervention approach should be generalizable to diverse individuals with obesity and a variety of baseline medical conditions. However, if there is to be sustainability of this approach, reimbursement models will require further development. Although there is data to suggest that community health workers can be powerful facilitators of participant engagement and behavior change (Katula et al., 2013) and provide a complementary means to extend the reach of effective, evidence-based weight management interventions for obesity beyond traditional health care professionals and specialists, more randomized comparative effectiveness and

cost-effectiveness studies are needed to promote this platform for widespread dissemination.

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Conflict of Interest

Dr John M. Jakicic is on the scientific advisory board for Weight Watchers. Dr Steven M. Albert serves as Deputy Editor of *Innovation on Aging* and recused himself from review of the manuscript. He also receives funding from the University of Pittsburgh Prevention Research Center, which completed this research.

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