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Intervention Research

# Weight Loss through Lifestyle Intervention Improves Mobility in Older Adults

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## Abstract

**Background and Objectives:** The high prevalence of overweight or obesity in older adults is a public health concern because obesity affects health, including the risk of mobility disability.
**Research Design and Methods:** The Mobility and Vitality Lifestyle Program, delivered by community health workers (CHWs), enrolled 303 community-dwelling adults to assess the impact of a 32-session behavioral weight management intervention. Participants completed the program at 26 sites led by 22 CHWs. Participation was limited to people aged 60–75 who had a body mass index (BMI) of 27–45 kg/m$^2$. The primary outcome was the performance on the Short Physical Performance Battery (SPPB) over 12 months.
**Results:** Participants were aged 67.7 (*SD* 4.1) and mostly female (87%); 22.7% were racial minorities. The mean (*SD*) BMI at baseline was 34.7 (4.7). Participants attended a median of 24 of 32 sessions; 240 (80.3%) completed the 9- or 13-month outcome assessment. Median weight loss in the sample was 5% of baseline body weight. SPPB total scores improved by +0.31 units ($p < .006$), gait speed by +0.04 m/s ($p < .0001$), and time to complete chair stands by −0.95 s ($p < .0001$). Weight loss of at least 5% was associated with a gain of +0.73 in SPPB scores. Increases in activity (by self-report or device) were not independently associated with SPPB outcomes but did reduce the effect of weight loss.
**Discussion and Implications:** Promoting weight management in a community group setting may be an effective strategy for reducing the risk of disability in older adults.

**Keywords:** Community health workers, Lifestyle intervention, Lower extremity strength, Physical activity, Weight management

The prevalence of overweight or obesity in older adults is a public health concern because obesity is associated with higher rates of mobility disability, especially in women and minorities (Hales et al., 2020; Koster et al., 2008). Obesity is associated with multiple chronic conditions (hypertension, hyperlipidemia, diabetes, sleep apnea, osteoarthritis, and cancer) and increases the risk of premature disability and death (Flegal et al., 2005; Xu et al., 2018). Older men and women who are overweight or obese at age 65 accordingly have higher health care expenditures over their remaining lifetime (Yang & Hall, 2008). In 2011, the Centers for Medicare and Medicaid Services recognized the need to address overweight and obesity in old age with a Medicare benefit for obesity counseling (Batsis et al., 2015) and approved a National Diabetes Prevention weight management program; however, it is narrowly limited to individuals with prediabetes, and Medicare has not approved any weight loss programs for general use in an older adult population (Burd et al., 2020). Developing community-based weight management programs may be useful for addressing health risks associated with overweight and obesity in old age.

The Look AHEAD trial, designed to study the effects of weight loss on cardiovascular disease in middle-aged adults with diabetes, found that an intensive multiyear lifestyle intervention lowered the risk of mobility loss (Look AHEAD Research Group, 2014; Rejeski et al., 2011). Over 11 years of follow-up, Look AHEAD participants in the intensive lifestyle program continued to show faster gait speed and better lower extremity function (Houston et al., 2018). Shorter-duration lifestyle interventions that promote modest weight loss through a reduced-calorie healthy diet and increased physical activity have also shown benefit (Ackermann et al., 2015; Delahanty, 2017; Ely et al., 2017; Venditti, 2016; Venditti et al., 2021). However, few studies have evaluated the effects of weight management on mobility for older adults (Rejeski et al., 2017; Venditti et al., 2018).

The Mobility and Vitality Lifestyle Program (MOVE UP) assessed the effect of a weight management lifestyle intervention for improving mobility among older adults using a community-partnered approach. The program was offered at community sites and led by community health workers (CHWs). Development and adaptation of the lifestyle intervention, training and support of CHWs, recruitment experience, and baseline characteristics of the research cohort have been reported (Venditti et al., 2018). Here we examine the impact of the intervention on the primary endpoint of performance-based lower extremity function and determine if weight loss and changes in physical activity were associated with improvement.

## Method

MOVE UP employed a nonrandomized design to estimate the effectiveness of a 13-month, 32-session healthy aging and behavioral weight management intervention among community-dwelling adults. The primary outcome was a change in lower extremity performance. Secondary outcomes included weight change, physical activity, exercise and diet self-efficacy, health-related quality of life, and depressive symptoms. Objectively measured physical activity was available for a subsample. The MOVE UP protocol was approved by the University of Pittsburgh Human Research Protections Office and registered at clinicaltrials.gov (NCT02657239).

### Participants, Interventionists, and Sites

Inclusion criteria were age 60–75, body mass index (BMI) 27–45 kg/m$^2$, ability to walk (with or without an assistive device), ability to provide informed consent, and personal physician clearance to participate. Exclusion criteria were 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. The investigator team reviewed additional potential exclusions that might preclude effective participation (e.g., cognitive impairment or hearing loss). Participants did not receive compensation.

CHWs were selected for their interest in health promotion, willingness to interact with local community members, and ability to deliver the structured lifestyle protocol. Twenty-two CHWs led 26 participant cohorts. All but one was female and 40% were non-White. Their median age was 56. About half had prior experience leading fitness classes or weight management programs. Two thirds had a prior association with the site hosting the program. CHWs were compensated as temporary hourly employees with the exception of those who led MOVE UP programs as part of their regular employment or who volunteered ($n$ = 6). CHWs received clinical guidance from the study team, which included a registered dietitian and exercise specialist (Venditti et al., 2018).

We contacted a variety of organizations as potential MOVE UP sites. These included 10 (38.5%) community centers, four (15.4%) senior centers, four (15.4%) Young Men's Christian Associations (YMCAs), three (11.5%) churches, three (11.5%) libraries, and two (7.7%) residential sites in or neighboring Pittsburgh, PA. Sites were partners in prior studies or recommended by the MOVE UP community advisory board.

### Intervention

The intervention consisted of 32 group sessions implemented in four phases (Figure 1). All sessions involved face-to-face interactive groups and lasted about 60 min. In Phase 1 (Month 1), participants engaged in four weekly meetings introducing them to risk factors for late-life disease and disability and strategies for screening and self-management (Newman et al., 2010). In Phase 2 (Months 2–5), the weekly meeting shifted to a focus on behavioral induction of healthy eating, physical activity, and weight loss (Katula et al., 2011; Pahor et al., 2014; Santanasto et al., 2011;


**Figure 1.** MOVE UP: Intervention timeline. MOVE UP = the Mobility and Vitality Lifestyle Program.

Wadden et al., 2009). Phase 3 (Months 6–9) supported the maintenance of weight loss and activity by reinforcing strategies from earlier sessions with biweekly meetings. In Phase 4 (Months 10–13), groups met once per month and focused on personal goals for long-term maintenance.

The MOVE UP intervention was based on social–cognitive behavioral principles consistent with evidence-based interventions for obesity and disease prevention (Venditti et al., 2014; Venditti, 2016). The intervention protocol included self-monitoring using weekly food and activity records ("Lifestyle Logs") and in-person weigh-ins. Participants used the weekly Lifestyle Logs to record daily calorie intake, physical activity, and home-based weigh-ins. CHWs provided brief, nonprescriptive feedback on most logs collected, mainly encouraging small, positive behavior changes consistent with program goals.

Weight loss alerts were set up for any participant nearing a BMI of 22 or any participant who demonstrated more than 7% weight loss in a 4-week period. In these cases, the research team followed up to determine reasons for weight loss and if a referral to medical care was appropriate. CHWs were encouraged to alert study staff if they were concerned about participant safety.

To achieve weight loss goals of 5%–7% of body weight, participants were coached to reduce energy intake to 1,200–1,800 kcal/day based on initial body weight (specifically <200 pounds = 1,200 kcal/day; 200–250 pounds = 1,500 kcal/day; >250 pounds = 1,800 kcal/day; Look AHEAD Research Group, 2014). Physical activity goals included an exercise goal of 175 min of weekly moderate-intensity physical activity, which is consistent with the Look AHEAD protocol and emphasizes moderate-to-vigorous physical activities (similar to brisk walking; Look AHEAD Research Group, 2006; Nelson et al., 2007; U.S. Department of Health and Human Services, 2018). Participants were instructed to engage in physical activity 5 days per week, beginning at 10 min/day and progressing to at least 35 min (increasing no more than 5 min/day in 4-week intervals) to maximize behavioral adherence and minimize the risk of musculoskeletal injuries.

To ensure fidelity, all CHWs were observed on one occasion by training staff using a "Touchpoint Feedback" scale. The observer also reviewed participant Lifestyle Logs to evaluate the quality of the written comments and completed ratings on session organization, weighing procedures, group problem solving, delivery of session content, and session length. Positive feedback was offered after the session, with suggestions for improving implementation skills.

## Measures

### Primary

Trained research staff not involved in the intervention collected primary and secondary outcome data at baseline, 5, 9, and 13 months. The primary outcome was the performance on the Short Physical Performance Battery (SPPB). The SPPB includes tests of standing balance, gait speed (4-m walk, except for two sites that used the 3-m walk), and time to complete five chair stands (Chalé-Rush et al., 2010; Guralnik et al., 1994). The SPPB is scored 0–12 according to quartiles of performance based on population norms. A change of +0.5 units is considered clinically meaningful, as declines of this magnitude are associated with risk of mobility impairment, loss of independence, and mortality (Studenski, 2011). We used a change of +0.05 m/s in gait speed as a clinically meaningful difference because the improvement of this amount was demonstrated in a randomized trial of timing and coordination exercises (Brach et al., 2017).

### Secondary

For assessing BMI (kg/m$^2$) at baseline, participants were weighed wearing light clothing, without shoes, using a calibrated digital scale. Height was measured to the nearest 0.25 cm using a portable stadiometer. Participants completed the physical and mental health component summary scales of the Medical Outcomes Study SF-36 (Ware & Sherbourne, 1992) and reported the frequency of depressive symptoms using the 20-item Center for Epidemiological Studies—Depression measure (Radloff, 1977). Medical conditions were elicited according to whether participants "had ever been told by their health care provider" that they had any of several medical conditions. Participants completed the Community Healthy Activities Model Program for Seniors Survey (CHAMPS) to assess the frequency and duration of different physical activities (Stewart et al., 2001). The CHAMPS can be used to estimate minutes per week for activities of at least moderate intensity (i.e., those categorized at 2.5 metabolic equivalents (METs) and above).

Self-efficacy and confidence for maintaining healthy eating and exercise were also assessed. Participants completed the 20-item Weight Efficacy Lifestyle Questionnaire (WEL; Clark et al., 1991). The WEL asks how confident respondents are in their ability to resist eating when under stress or facing social pressure, from 0 (*not at all*) to 10 (*extremely*). Participants also completed the 13-item Self-Efficacy for Exercise Scale (Resnick & Jenkins, 2000). The measure assesses how confident respondents are in their ability to exercise, from 0 (*not at all*) to 10 (*extremely*) when they are tired, in a bad mood, alone, or in other situations that may make it difficult to maintain an exercise regimen. Finally, participants completed a single question on willingness "to make changes in what, how, or how much you eat in order to eat healthier," which ranged from "very willing" to "not at all."

#### Device-derived physical activity

A subsample wore a SenseWear Pro Armband (SWA; BodyMedia Inc., Pittsburgh, PA) to record daily steps and both light/moderate and vigorous activities. Participants were instructed to wear the SWA on the left upper arm (triceps) for seven consecutive days at baseline and follow-up. Data from participants with at least 3 days of more than 85% on-body time at each time point ($n$ = 84) were included in analyses.

### Statistical Analyses

Changes in SPPB total score and gait and chair stand components were assessed for the full cohort of MOVE UP participants and then according to median weight change in the sample. Because of the group delivery of the intervention, analyses included a site-cluster random effects term. Tests for the variance of the site-cluster random effect for mean improvement ranged from $p$ = .15 to .26, indicating minimal site effects. All analyses were conducted using SAS 9.4 software (SAS Institute Inc. 2016, Cary, NC).

Baseline characteristics were compared between the weight loss groups using two-sample $t$ tests or Wilcoxon rank-sum tests for continuous variables and $\chi^2$ tests or Fisher's exact tests for categorical variables. Overall change was based on differences from baseline to Month 13, with Month 9 assessments used if the Month 13 assessment was missing. Race and the SF-36 mental health component scores were included in all models because of their association with success in weight loss interventions. Models included baseline predictors (selected if $p < .10$) as well as initial weight and two indicators of change over follow-up: whether participants lost at least 5% body weight and changes in physical activity per week.

Statistical power in MOVE UP assumed a projected total recruitment of 26 intervention sites with an average of 12 participants per site completing baseline and final study assessments. Under this assumption, the study had 80% power to detect an improvement in SPPB of 0.44 units or greater. The study had 80% power to detect at least a 5% change in weight from baseline at both the 6- and 13-month assessments based on comparable community weight loss studies (Katula et al., 2011).

## Results

Of 58 community-based facilities approached from January 2015 through November 2017, nearly half agreed to implement the program and completed enrollment and follow-up.

As shown in Figure 2, 629 individuals responded to publicity and completed a telephone screen, 485 were eligible by phone screening, and 355 (73.2%) completed field screening assessments. Of the 355, 20 were ineligible because of out-of-range BMI values. The 303 who consented and enrolled thus represent 90.4% of those eligible (303/335). Participants completed the program in 26 site groups, ranging in size from 5 to 15 per group. Baseline data collection was completed for 299. Follow-up (13-month assessment) was completed in June 2019.

The sample had a mean (*SD*) age of 67.7 (4.1) and was mostly female (87%). A majority had completed postsecondary schooling (33.4% with 4-year college degrees), and 22.7% were racial minorities. The mean (*SD*) BMI at baseline was 34.7 (4.7). The most common health conditions were arthritis and hypertension. The SPPB total score showed a strong ceiling effect, with a maximum score of 12 in 42.2%. Participants attended a median of 24 of the 32 sessions. MOVE UP programs at YMCAs, senior centers, churches, and residential sites had higher attendance than community centers.

### Effects of Attrition

Of 299 participants who completed the baseline assessment and started the MOVE UP intervention, 240 (80.3%) completed the 9- or 13-month outcome assessment (11 completed the 9-month assessment but not 13-month assessment) and were included in outcome analyses. Noncompleters differed from completers at baseline in

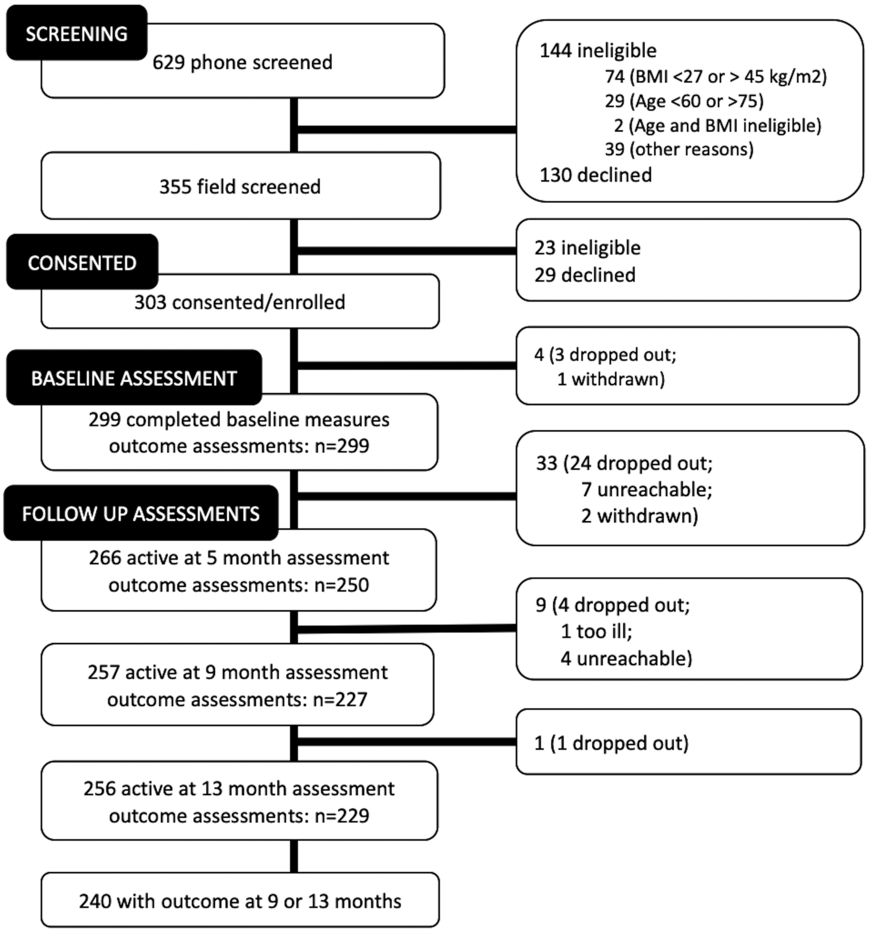


**Figure 2.** MOVE UP: Consolidated Standards of Reporting Trials flow chart. MOVE UP = the Mobility and Vitality Lifestyle Program.

race. Among African Americans, other, or multiple-race groups, 21.1% did not complete the final outcome assessment compared to 9.4% among Whites ($p$ = .007). Noncompleters also reported lower self-rated health at baseline, 63.8 versus 69.1 (SF-36, $p$ = .06). The two groups were similar at baseline in sociodemographic status, medical conditions, exercise and diet self-efficacy, mental health, physical activity, BMI, and SPPB lower extremity assessments.

## Baseline Differences by Weight Trajectory

Median weight loss in the sample was approximately 5% of baseline body weight (Table 1). Participants who lost less than 5% of initial body weight ($n$ = 117) or at least 5% ($n$ = 123) differed at baseline in race; 59.9% of White participants lost at least 5% compared to 31.7% of Black participants ($p$ < .0001). The two weight loss groups were similar at baseline in age, gender, BMI, self-efficacy in exercise and diet, medical conditions, depressive symptoms, and SPPB performance. People who went on to lose at least 5% of body weight had a higher mean (*SD*) for total physical activity by CHAMPS self-reported at baseline, 852 (617) versus 710 (557) min/week ($p$ = .06).

## Effects of MOVE UP on Lower Extremity Function

Over follow-up, MOVE UP participants improved in total SPPB score, gait speed, and time to complete chair stands (Table 2). Improvements were evident at 5 months and were maintained at 13 months. By 13 months (or Month 9 for $n$ = 11), SPPB total scores improved by +0.31 units ($p$ < .006), gait speed by +0.04 m/s ($p$ < .0001), and time to complete chair stands by −0.95 s ($p$ < .0001). Limiting analyses to participants with low (≤9) initial SPPB scores ($n$ = 47) showed larger changes. In this subgroup, SPPB total scores improved by +0.40 units ($p$ < .006), gait speed by +0.09 m/s ($p$ < .0001), and time to complete chair stands by −1.77 s ($p$ < .0001).

Comparing baseline and final SPPB total scores for the 240 participants, 92 (38.3%) improved, 41 (17.1%) declined, and 107 (44.6%) did not change. Of the group with no change in performance, 90 scored at the SPPB ceiling at both baseline and follow-up.

## Effects of MOVE UP on Lower Extremity Function by Weight Trajectory and Activity Change

MOVE UP participants who lost at least 5% of body weight had greater improvement in total SPPB score, gait speed, and time to complete chair stands than those who lost less

**Table 1.** Baseline Characteristics of Groups According to Weight Loss Trajectory Over Follow-Up (*N* = 240)

| | Lost <5% initial body weight (*n* = 117) | Lost ≥5% initial body weight (*n* = 123) | *p* |
|---|---|---|---|
| *Sociodemographics* | | | |
| Age, mean (*SD*) | 67.7 (4.0) | 67.6 (4.2) | .74 |
| Female, *n* (%) | 105 (89.7) | 106 (86.2) | .4 |
| Education, *n* (%) | | | |
| <HS | 4 (3.4) | 3 (2.4) | .23 |
| HS/GED | 15 (12.8) | 27 (22.0) | |
| Some college | 31 (26.5) | 31 (25.2) | |
| Associate | 12 (10.3) | 17 (13.8) | |
| Bachelor | 30 (25.6) | 19 (15.4) | |
| Graduate | 25 (21.4) | 26 (21.1) | |
| Race, *n* (%) | | | |
| White | 69 (40.1) | 103 (59.9) | <.0001 |
| Black | 41 (68.3) | 19 (31.7) | |
| Other/two or more | 7 (87.5) | 1 (12.5) | |
| *Activity and weight* | | | |
| Physical activity (min/week), CHAMPS | 710 (557) | 852 (617) | .06 |
| BMI | 34.6 (4.9) | 34.8 (4.6) | .78 |
| *Self-efficacy in exercise and diet* | | | |
| Confidence in exercise, mean (*SD*) | 59.4 (27.7) | 62.3 (26.4) | .41 |
| Very willing to make change in diet, *n* (%) | 68 (58.1) | 84 (68.3) | .1 |
| Confidence for healthy eating, mean (*SD*) | 100.8 (37.2) | 99.4 (33.4) | .75 |
| *Medical conditions* | | | |
| General health, SF-36, mean (*SD*) | 69.0 (16.2) | 69.4 (15.5) | .86 |
| Arthritis, *n* (%) | 93 (79.5) | 93 (75.6) | .47 |
| Hypertension, *n* (%) | 80 (68.4) | 79 (64.2) | .5 |
| Diabetes, *n* (%) | 25 (21.4) | 25 (20.3) | .84 |
| Cancer, *n* (%) | 24 (20.5) | 19 (15.4) | .31 |
| Coronary heart disease, *n* (%) | 8 (6.8) | 5 (4.1) | .4 |
| Kidney, *n* (%) | 4 (3.4) | 5 (4.1) | .79 |
| Count, medical conditions, mean (*SD*) | 3.4 (1.8) | 3.1 (1.7) | .18 |
| *Mental health* | | | |
| Mental health component (SF-36) | 82.0 (12.7) | 78.1 (13.8) | .02 |
| CES-D, mean (*SD*) | 7.3 (6.3) | 8.7 (8.0) | .15 |
| *Lower extremity function* | | | |
| SPPB | 10.74 (1.63) | 10.45 (2.20) | .25 |
| Gait speed, m/s | 0.97 (0.19) | 0.96 (0.18) | .56 |
| Chair stands, s | 10.99 (2.81) | 11.00 (2.36) | .98 |

*Notes:* HS = high school; GED = general education degree; CHAMPS = Community Healthy Activities Model Program for Seniors; BMI = body mass index; SF-36 = Short Form RAND assessment; CES-D = Center for Epidemiological Studies—Depression; SPPB = Short Physical Performance Battery. Of 299 participants who completed the baseline assessment, 240 completed the 9- or 13-month outcome assessment.

than 5% (Table 3). By 13 months, the group losing at least 5% improved in total SPPB score (+0.60, $p < .0001$), gait speed (+0.06 m/s, $p < .0001$), and time to complete chair stands (−1.18 s, $p < .0001$). Improvements in the group losing less than 5% were evident only in time to complete chair stands (−0.71, $p < .01$). Differences in rates of change between the two weight loss groups at 13 months favored people losing at least 5% and were significant for all three SPPB outcomes ($p < .01$).

Adjusted analyses confirm these differences. Weight loss of at least 5% was associated with +0.73 improvement in total SPPB score, an increase of +0.047 m/s in gait speed, and a decrease of −0.86 s in time to complete the five chair stands in analyses that adjusted for sociodemographic factors, mental health indices, motivation to lose weight or exercise, and baseline weight. The +0.73 gain in SPPB total score represents a clinically significant increase, because changes of +0.5 have been associated with changes in risk for functional decline and hospitalization (Studenski, 2011). The +0.047 m/s improvement in gait speed fell just short of the 0.05 clinical criterion reported for a trial of timing and coordination exercises (Brach et al., 2017).

Increases in physical activity may also be responsible for changes in SPPB and gait and chair stand components. We computed change in minutes per week of exercise-related activities (activities involving ≥2.5 METs) reported in the CHAMPS assessment over the course of MOVE UP and introduced this change score into regression models. Changes in activity were not independently associated with SPPB outcomes but did reduce the effect of weight loss on the total SPPB score (from +0.73 to +0.63 units; results available upon request).

Similarly, results from the device-worn physical activity subsample revealed only small differences in SPPB change among people who increased physical activity compared to those who did not (split at median, 1.5 METs). In the group with weight loss of less than 5%, SPPB scores increased by 0.12 in people not increasing activity ($n$ = 17) and 0.18 in people increasing activity ($n$ = 17). In the group with weight loss of at least 5%, SPPB scores increased by 0.42 ($n$ = 24) and 0.35 ($n$ = 26), respectively (all comparisons, N.S.).

**Table 2.** Change in SPPB and Component Measures ($N$ = 240)

| | Baseline ($n$ = 240) | 5 months ($n$ = 232) | Postintervention[a] ($n$ = 240) |
|---|---|---|---|
| | Mean (*SD*) | Mean (*SD*)[b] | Mean (*SD*)[b] |
| SPPB | 10.59 (1.94) | 11.02 (1.69), $p$ < .0001 | 10.90 (2.07), $p$ < .006 |
| Gait speed (m/s) | 0.97 (0.19) | 1.01 (0.18), $p$ < .0001 | 1.01 (0.18), $p$ < .0001 |
| Chair stands (s) | 11.00 (2.59) | 10.14 (2.37), $p$ < .0001 | 10.05 (2.61), $p$ < .0001 |

*Notes:* SPPB = Short Physical Performance Battery. Adjusted for a site-cluster random effect. Of 299 participants who completed the baseline assessment, 240 completed the 9- or 13-month outcome assessment.
[a]Postintervention: Month 9 if 13-month visit missed ($n$ = 11).
[b]Change versus baseline $p$ values.

## Weight Loss and Clinically Significant Improvement in Lower Extremity Function

We estimated the percentage of body weight loss required to achieve the clinically significant gains of +0.5 for SPPB and +0.05 m/s for gait speed. While people achieving more than 5% weight loss had an overall mean SPPB gain of 0.73, well above the clinically significant criterion of +0.5, in individuals achieving weight loss at the low end (nearer to 5%), the mean SPPB gain was still somewhat less than +0.5. We went a step further to establish the minimum weight loss required to ensure that the mean SPPB gain was more than 0.5 in all participants. In our sample, this was at least 6%. In a similar analysis, older adults achieved a clinically meaningful increase in gait speed when they lost at least 9% of body weight.

## Adverse Events

Participants experienced 43 adverse events over follow-up, including 27 hospitalizations. However, none were related to the intervention. Of the 43 events, 22 required medical re-clearance. Additionally, two participants exceeded weight loss of at least 7% in a 4-week period, triggering a safety review. Both participants were evaluated by their primary care physician, re-cleared, and able to complete the study.

## Cost Effectiveness

Excluding research staff time, the total cost of delivering MOVE UP was \$18,895 (\$8,679 for materials, \$9,575 for CHW mileage and stipends, and \$641 for assessment tools). The 240 participants completing 9- or 13-month assessment gained a total of 74 SPPB points and lost 3,059 lbs. The incremental cost-effectiveness ratio, compared to baseline values, was \$255 per unit gain in SPPB score and \$6.18 per pound of weight loss.

**Table 3.** Unadjusted Analysis of Change in SPPB and Component Measures, by Weight Loss Trajectory, $N$ = 240

| | Baseline | 5 months | Postintervention[a] |
|---|---|---|---|
| Lost <5% initial body weight, $n$ = 117 | | | |
| SPPB | 10.74 | 11.10 ($p$ = .0005) | 10.74 ($p$ = .90) |
| Gait speed (m/s) | 0.97 | 0.99 ($p$ = .14) | 0.99 ($p$ = .30) |
| Chair stands (s) | 10.99 | 10.36 ($p$ < .0001) | 10.28 ($p$ = .0014) |
| Lost ≥5% initial body weight, $n$ = 123 | | | |
| SPPB | 10.45 | 10.94 ($p$ = .0048) | 11.05 ($p$ = .0002) |
| Gait speed (m/s) | 0.96 | 1.02 ($p$ < .0001) | 1.02 ($p$ < .0001) |
| Chair stands (s) | 11 | 9.92 ($p$ = .0001) | 9.82 ($p$ < .0001) |
| $p$ value, change from baseline, ≥5% vs. <5% | | | |
| SPPB | | 0.64 | 0.008 |
| Gait speed (m/s) | | 0.048 | 0.004 |
| Chair stands (s) | | 0.2 | 0.012 |

*Notes:* SPPB = Short Physical Performance Battery. Adjusted for a site-cluster random effect. Of 299 participants who completed the baseline assessment, 240 completed the 9- or 13-month outcome assessment.
[a]Postintervention: Month 9, if 13-month visit missed ($n$ = 11).

## Discussion

The median weight loss in MOVE UP was approximately 5% of baseline body weight. This effect is comparable to weight loss reported for commercial programs (e.g., 4.7% and 4.9% in WW, formally Weight Watchers; Rogers et al., 2020). The results are similar to what has been reported in more intensive trials of standard behavioral treatment for weight loss; for example, at 12 months, 33.3% achieved 5% weight loss in a study that added technology (Spring et al., 2013), and 43% of the intervention group lost 5% weight in a study that combined digital obesity treatment with counseling from primary care providers (Bennett et al., 2013). As in MOVE UP, improvement in lower extremity function in the commercial studies was associated with weight loss. Thus, a structured but low-intensity lifestyle intervention implemented by CHWs appears to produce effects similar to commercial weight loss programs.

Because lower extremity performance is associated with loss of independence, weight management combined with physical activity offers an underappreciated public health strategy for promoting health across the life span.

Weight loss of at least 5% was associated with a clinically significant improvement in total SPPB score and an increase in gait speed similar to that produced in exercise trials. These analyses adjusted for sociodemographic factors and baseline indicators of mental health, physical activity, self-efficacy for engaging in lifestyle changes to reduce weight and change diet, and weight. Including the change in minutes per week of activity over follow-up in regression models did not eliminate the significant effect of weight loss on improvement in total SPBB score.

Results from MOVE UP suggest that promoting healthier eating, weight loss, and physical activity in a group setting is an effective strategy for reducing the risk of disability in older adults. It will be valuable to look more carefully at the benefit associated with weight loss and benefit from increases in physical activity, as these may differ by gender and race (West et al., 2019). We used the CHAMPS to estimate the change in minutes per week of exercise-related activity as well as device-based assessment in a subsample, but analyses suggest great variation across participants.

Further investigation of the benefits of weight loss and physical activity for lower extremity function among older adults would be valuable. In the MOVE UP cohort (which included people who did not lose weight and who also declined in SPPB performance), we determined that body weight loss of at least 6% resulted in clinically meaningful gains in lower extremity function. Body weight loss of at least 9% resulted in clinically meaningful changes in gait speed. A typical MOVE UP participant, that is, a woman with a BMI of 34.5 (height 5′ 4″, weight 200 lbs.), would need to lose 12 lbs to achieve a clinically meaningful gain in lower extremity function. If she lost another 6 lbs, her improvements in gait speed would be comparable to gains associated with evidence-based programs focused on exercise (Stewart et al., 2001). These outcomes could be strong inducements for weight management among older people apart from cardiometabolic benefits or concern with appearance.

Notably, these benefits were seen with only 75% adherence to the 32-session program. Future research will need to examine sources of variation in MOVE UP engagement and the critical dose and duration for public health gains, as well as the effects of CHW training and background.

In MOVE UP, African American and mixed- or other-race participants were less likely to achieve 5% weight loss. These results are consistent with results from the Look AHEAD trial of weight loss for people with type 2 diabetes. For example, in the intensive lifestyle intervention arm of Look AHEAD (structured meal plans and meal replacements as well as lifestyle counseling), 71.7% of White women achieved at least 5% body weight loss goal at Year 1 compared to 62.4% of African American women (West et al., 2019). The groups did not differ in session attendance, self-monitoring of diet and physical activity, or use of meal replacements. Only daily self-weighing distinguished the groups (African American, 34.6%; White, 51.7%). The Look AHEAD investigators suggest that daily self-weighing has potential for good uptake by older minority adults and that attention to barriers to self-weighing would enhance the cultural competence of behavioral weight loss interventions. An important area for future research is to determine the probable multilevel sources of differences in weight loss by race and ethnicity and adapt program elements and implementation practices accordingly.

MOVE UP's incremental cost effectiveness was $255 per unit gain in SPPB score and $6.18 per pound of weight loss. These values compare very favorably with a senior center weight loss program ($20.45 per pound; Krukowski et al., 2013) and a diet and resistance exercise intervention for older adults delivered by specialists ($4,220 per SPPB unit change; Dorhout et al., 2021). However, these differences should be interpreted cautiously because cost components vary across the programs. MOVE UP CHW stipends were low and many CHWs volunteered; likewise, sites donated space for the program and research funding covered many program costs (e.g., advertising, CHW training). With imputation of such costs (e.g., the CHW wage of $24/h recommended in the ACHIEVE intervention; Janssen et al., 2017), MOVE UP is likely to more closely resemble these programs in cost effectiveness.

This research is limited by the lack of a randomized design. Unmeasured differences between people losing at least 5% body weight and people not achieving this goal may be responsible for reported benefits in lower extremity function. However, MOVE UP weight loss groups did not differ at baseline in lower extremity function or BMI, physical activity, mental health, or self-efficacy for exercise or diet. In addition, multivariable models indicate a significant and independent effect for 5% body weight loss in lower extremity strength outcomes. Another limitation was the pronounced ceiling effect for the SPPB; 42% of participants at baseline achieved the maximum score of 12. We addressed this limitation by examining change in component scores, such as gait speed, and by calculating effects among participants scoring below the ceiling score. We also note the number of people who improved, declined, or were stable in SPPB scores across intervention assessments. Future research could incorporate a modification of the SPPB that includes a one-legged stand, which substantially reduces the ceiling effect (National Health and Aging Trends, 2013). Finally, our pre–post design was strengthened by an "intention to treat" approach, including people who had losses in function due to intercurrent illness (ascertained in weekly data safety monitoring) that were unrelated to the program. The high rate of multimorbidity in this age group was expected and must be considered in future dissemination efforts. We conclude that body weight loss is an important and feasible target for promoting lower extremity strength among older adults with overweight or obesity.

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## Conflict of Interest

None declared.

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