HHS Public Access

Author manuscript

Obesity (Silver Spring). Author manuscript; available in PMC 2018 July 01.

Published in final edited form as:

Obesity (Silver Spring). 2017 July ; 25(7): 1199–1205. doi:10.1002/oby.21860.

Exercise's Effect on Mobility Disability in Older Adults With and Without Obesity: The LIFE Study Randomized Clinical Trial

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Abstract

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Clinical Trial Registration: clinicaltrials.gov identifier: NCT01072500

Disclosure: BS serves on the Scientific Advisory Board for Actigraph. All other authors have no conflicts of interest to disclose.

Author Contributions: SK: study conduct/design, concept, drafting and revision of manuscript. LL and EH: drafting, analysis, revisions. SB, JG, CL, AK, AM, MP, WJR, BS, and TM: conduct/design, revisions. AB: revision of manuscript.

Objective—Some data suggests that obesity blunts the benefits of exercise on mobility in older adults. We tested the homogeneity of the effect of a physical activity intervention on major mobility disability across baseline obesity classifications in the Lifestyle Interventions and Independence for Elders (LIFE) Study. LIFE randomized 1,635 sedentary men and women 70–89 years to a moderate intensity physical activity (PA) or health education (HE) program.

Methods—Major mobility disability (MMD), defined as the inability to walk 400m, was determined over an average follow up of 2.6 years. Participants were divided into 4 subgroups: 1) non-obese (BMI < 30 kg/m2; n=437); 2) non-obese with high waist circumference (WC >102 cm [men], >88 cm [women]; n=434); 3) class 1 obesity (30 kg/m2 ≤ BMI < 35 kg/m2; n=430); and 4) class 2+ obesity (BMI ≥ 35 kg/m2; n=312). Cox proportional hazard modeling was used to test an obesity by intervention interaction.

Results—The PA intervention had the largest benefit in participants with class 2+ obesity (HR 0.69, 95% CI 0.48, 0.98). However, there was no statistically significant difference in benefit across obesity categories.

Conclusion—A structured PA program reduced the risk of MMD even in older adults with extreme obesity.

Keywords

Obesity; Physical Activity; Functional Disability; Clinical Trials

Introduction

In the United States, obesity affects nearly 13 million adults aged 65 and over.[1] Both overall obesity and abdominal obesity are strongly associated with the development of mobility limitations and major mobility disability in older adults.[2–5] Major mobility disability (MMD) can be defined as the inability to walk 400 meters without sitting and without help from another person or walker.[6] The inability to walk 400m, can represent a proxy for common daily activities such as the inability to walk a block around the neighborhood or to walk several street blocks to enter a store. MMD can have implications on quality of life and independence, however few studies have examined the ability to reduce MMD in an older adult population with obesity. The LIFE Study is the first study to demonstrate that a moderate intensity physical activity program can significantly reduce the risk for onset of MMD in high-risk sedentary older adults,[6] but we do not know how baseline obesity status is related to the intervention outcome.

Previous data on older populations from both epidemiologic studies and clinical trials suggest that obesity may attenuate the beneficial effects of physical activity on mobility. For example, in the Health, Aging, and Body Composition (Health ABC) study, physically active older adults with obesity had a significantly higher risk of mobility limitations compared to inactive non-obese persons.[7] In the LIFE Pilot study, participants with obesity in the physical activity arm showed no improvement in 400m walk time, and blunted improvement in Short Physical Performance Battery (SPPB) compared to non-obese participants,[8] however, non-obese participants improved in 400m walk time and SPPB score.

Together these findings suggest that obesity may blunt the benefits of physical activity for the prevention of mobility disability. In order to examine this issue in more detail, we performed a *post-hoc* analysis of the main LIFE Study data, a randomized trial of physical activity including 1,635 adults aged 70–89 at high risk for mobility disability. The objective of this study is to test whether the degree of obesity at baseline influences the strength of the association between randomization to an exercise intervention and incidence of MMD. Based on previous data we hypothesized that participants with obesity would have a blunted response to exercise compared to participants without obesity. To further extend previous work, we examined the intervention effects by severity of obesity in the following four classifications with/without abdominal obesity: (1) non-obese and low waist circumference, (2) non-obese with high waist circumference (3) Class 1 obesity, and (4) Class 2+ obesity.

Methods

Study Design

The LIFE Study's design, recruitment and primary results are published.[2, 6, 9] Briefly, the LIFE Study was a single-blind, multi-center, parallel randomized controlled trial of a physical activity (PA) intervention compared with a health education (HE) control arm. The study was conducted at 8 U.S. centers testing whether randomization to a moderate intensity PA program would reduce the rate of MMD compared to the HE program. The study enrolled inactive men and women reporting less than 20 minutes per week of structured physical activity and less than 125 minutes per week of moderate intensity physical activity who were 70 to 89 years old, and were at high risk for mobility disability based on scoring 9 or less on the 12-point Short Physical Performance Battery (SPPB).[10] Eligible participants were able to walk 400 meters without assistance in less than 15 minutes, had no major cognitive impairment, and could safely participate in the intervention. Recruitment occurred from February 2010 through December 2011; the trial ended in December 2013. The median follow-up time was 2.7 years (interquartile range, 2.3–3.1 years). Participants were followed for up to 3.5 years. The LIFE Study was approved by the institutional review board at all 8 study sites and all participants provided informed consent [clinicaltrials.gov identifier: NCT01072500]. The CONSORT diagram and study centers and personnel is provided (Supplementary Figure S1 and Supplementary Appendix).

Intervention

Participants were randomly assigned to either a PA (n=818) or a HE program (n=817). The PA program focused on walking, strength, balance, and flexibility training. In a single session, the goal was 30 minutes of walking at a moderate intensity, 10 minutes of lower-extremity strength training using ankle weights, and 10 minutes of balance training of major muscle groups. Participants were expected to attend 2 in-person center-based training sessions per week and perform at home activities 3–4 times a week for the entire study period. Supplementary instructional materials (e.g., videotapes, printed materials) were supplied to participants to reinforce the physical activity training occurring during setting-based instruction so that it could be conducted in the home environment. Participants were also instructed to maintain a simple daily activity calendar/log at home to record the details

(i.e. intensity (rating of perceived exertion), duration, and frequency) of physical activity which was reported to the clinic staff during intervention visits.

The HE arm involved in-person group workshops focused on aging-relevant topics such as nutrition, safety, and legal/financial issues. Sessions were comprised of 60–90 minutes of interactive and didactic presentations including approximately 10 minutes of group discussion and interaction and 5–10 minutes of upper extremity stretching exercises. The HE sessions were held in-person once a week for the first 26 weeks then monthly thereafter. Attendance was calculated as the percentage of scheduled visits attended. Visits that could not be scheduled for medical reasons are not included in the denominator.

Measures

General health status, medical history, functional limitations and demographics were collected by self-report at baseline. Participants were measured and weighed in light clothing and without shoes. Height was measured using a wall-mounted stadiometer, and body weight was measured using a calibrated balance-beam scale. Body Mass Index (BMI) was calculated as body weight (kg) divided by height squared (meters). Waist circumference (WC) was measured at the abdomen horizontally at midpoint between highest point of the iliac crest and lowest part of the costal margin in the mid-axillary line using a Gulick II Tape Measure (model 67020). BMI and WC were used to classify participants into the following categories: 1) non-obese and free of abdominal obesity (BMI < 30 kg/m^2; n=437) 2) non-obese with abdominal obesity (WC >102 cm [men], >88 cm [women]; n=434); 3) class 1 obesity (30 $kg/m^2 \leq$ BMI < 35 kg/m^2; n=430); and 4) class 2–3 obesity (BMI ≥ 35 kg/m^2; n=312). Participants who were missing baseline WC data were excluded (n=22). Virtually all (98%) of obese participants were also abdominally obese.

Metabolic syndrome was defined based on the criteria recommended in the 2009 Joint Interim Statement from multiple scientific associations[12] as the presence of 3 or more components, including (1) abdominal obesity (defined above); (2) hypertension (systolic blood pressure (SBP) ≥ 130 mm Hg and/or diastolic blood pressure (DBP) ≥ 85 mm Hg) or use of antihypertensive medication and a history of physician-diagnosed hypertension; (3) low HDL-C cholesterol level (men: HDL-C < 40 mg/dL and women: < 50 mg/dL) or use of HDL-C-raising medication; (4) elevated triglycerides levels (triglycerides ≥ 150 mg/dL) or use of triglyceride-lowering medication and (5) elevated plasma fasting blood glucose level (glucose ≥ 100 mg/dL) or use of glucose-controlling medication.

The Short Physical Performance Battery (SPPB) is comprised of three lower extremity tasks: a 4-meter usual paced walk done twice, timed rising from a chair 5 times as fast as possible without using arms, and the ability to maintain standing balance for at least 10 seconds with progressively more challenging stances (side by side, semi-tandem, and full tandem).[10] The faster of the two walks and times on the other tests are used to calculate a score with participants garnering up to 4 points for each task. SPPB was collected at baseline, 6 months, 12 months, 24 months, and 36 months after randomization.

Self-reported physical activity was assessed using the Community Health Activities Model Program for Seniors Questionnaire (CHAMPS-18 items) to assess participation in walking

or strength training activities.[11] The CHAMPS questionnaire was collected at baseline, 6 months, 12 months, 24 months, and 36 months after randomization.

Outcome

The primary outcome of MMD was defined as the inability to complete a 400-meter walk test within 15 minutes without sitting and without the help of another person or walker. At the assessments, participants were asked to walk 400-meters at their usual pace, without overexerting, completing 10 laps of a 20-meter walking course (40m per lap). Participants were allowed to stop for up to 1 minute for fatigue or related symptoms. The use of a cane was allowed. A panel, blinded to the intervention assignment, adjudicated participants who were in situations where the 400m walk could not be performed (e.g. the participant was hospitalized or seen at home, where a suitable walk course was not available): 14% of events were based on adjudication.

Statistical Analysis

Baseline characteristics were summarized by intervention arm and obesity status, using mean and standard deviation, or number and percentage. Self-reported minutes per week of moderate intensity walking exercises were tallied at 6 and 24-months post randomization. SPPB measures and 400m walk speed were analyzed using mixed-effects analysis of covariance models for repeated measures outcomes with an unstructured parameterization for longitudinal covariance. Models included field center and sex (used to stratify randomization), baseline value for SPPB (400m gait speed), intervention, clinic visit, and an intervention by visit interaction. Least squares means were obtained from these models and contrast statements were used to estimate the average effects over the entire follow-up period.

Cox regression models, stratified by field center and sex, were used to evaluate the effect of obesity on MMD. Failure time was measured from the time of randomization to the first incidence of MMD; follow-up was censored at the last successfully completed 400m walk test. For participants who did not have any MMD assessments, we assigned 1 hour of follow-up time, because we know that they completed the 400m walk at baseline. An interaction term was entered into the primary Cox model and likelihood ratio tests were used to assess the consistency of the intervention effect across levels of baseline obesity.

No adjustments were made for multiple testing. Nominal P values are reported throughout as simple guides to possible associations. Statistical analyses were performed using SAS (SAS Institute), version 9.4.

Results

Of the 1635 randomized participants, 22 were excluded from this analysis due to missing baseline waist circumference yielding an analysis sample of 1613 participants, 809 randomized to the PA arm and 804 in the HE arm. Participant characteristics by obesity category and intervention arm at baseline are presented in Table 1. Non-obese participants were older, more likely to be white and male, more highly educated, and were less likely to have metabolic syndrome, diabetes, or arthritis. Non-obese participants also completed the

400m walk more quickly than participants with obesity. There were no significant differences in baseline characteristics among participants in the HE or PA intervention arms across obesity categories, except the HE intervention arm was slightly older than the PA arm.

At 24-months, attendance to the scheduled center-based intervention sessions was 63% for the PA program and 73% for the HE program. Table 2 presents session attendance by obesity category. Session attendance was similar for each obesity group within each treatment arm.

As reported previously, randomization to the PA group was associated with an 18% reduction in the rate of MMD (HR: 0.82, 95% CI 0.69, 0.98, p = 0.04). Figure 1 shows the overall intervention effect on risk of mobility disability, the effect within each obesity category and the effect for those with BMI < 30 and those with BMI ≥ 30. The point estimates for the intervention effect on reducing mobility disability were below 1 in each obesity category, and the strongest effect was observed in those with class 2+ obesity (HR: 0.69, 95% CI 0.48, 0.98). A formal test of statistical interaction between obesity category and treatment arm did not reach statistical significance (p=0.49). After adjustment for the comorbid conditions heart failure, heart attack, lung disease, and diabetes, the results were nearly unchanged.

Additionally, we looked at the intervention effect on two measures of mobility performance: four meter walk speed and SPPB score, which were both measured at the 6, 12 and 24-months post-randomization visits. There was no overall intervention effect on 4-meter walk speed over the first 24-months of the study (p=0.73), nor was there evidence of an interaction between intervention arm and obesity status (p=0.36) (data not shown). There was an overall beneficial PA effect on SPPB score (Table 3; mean change score= 0.23, 95% CI 0.07, 0.39, p=0.013). The obesity strata that showed the largest PA effect on SPPB score was the group with BMI < 30 who had abdominal obesity, but there was no statistical interaction between intervention arm and obesity category (p=0.23).

To explore why the largest intervention effect for MMD may have been observed in those participants with class 2+ obesity, we examined the intervention effect on exercise behaviors compared to baseline. Figure 2 shows the median of self-reported minutes/week of moderate intensity walking at baseline and at 6 months, as defined as walking exercises such as minutes of walking/golf, jogging, walking uphill, walking fast, or leisure walking. The baseline minutes are pooled. The median minutes of walking among non-obese individuals in the HE arm was 105 minutes at baseline with no change at 6-month follow-up, while the PA arm reported 225 minutes. Persons with class 1 obesity in the HE arm spontaneously increased their walking by 75 minutes at 6 months, while the PA participants reported 210 minutes of walking/week, as expected. Class 2+ obesity participants in the HE arm did not report any increase in their walking at 6 months (30 min/week), while the PA group increased their walking to 135 minutes/week. Although the minutes of walking in the class 2+ obesity PA participants at 6 months was not as high as the levels in PA participants in other obesity categories, the class 2+ obesity subjects reported nearly 5 times as many minutes walking as HE subjects in their obesity category. In other obesity categories PA

participants at 6 months reported only about twice as many minutes walking as HE participants.

Discussion

Based on prior data, we hypothesized that older adults with obesity would not achieve as large a benefit as non-obese older adults. This hypothesis was not supported as participants with class 2+ obesity showed the largest intervention benefit (31% reduction in risk of MMD). However, we did not find statistical evidence for an interaction between obesity category and intervention arm, and those with class 2+ obesity did not show parallel benefits with respect to either SPPB performance or 4-meter gait speed.

One prior observational study, and two smaller randomized trials suggested obesity might blunt the effects of exercise on mobility disability.[5, 7, 8] The Health ABC study suggested that obesity “trumped” the effect of other behavioral risk factors on the onset of mobility limitation.[7] Health ABC differed substantially from LIFE in its recruitment criteria; only participants who reported no difficulty in walking a quarter of a mile at baseline (i.e. at lower risk for mobility disability) were included, whereas LIFE recruited persons at high risk for mobility disability. In addition, Health ABC’s end-point was based on self-reported walking not on the completion of a 400m walk.

Evidence from the LIFE-P study showed that in participants with BMI ≥ 30, SPPB scores improved but walking speed did not.[8] Similarly, in this study, the LIFE trial did not find a benefit of the intervention on walking speed, in general or in any obesity category. The PA intervention did improve SPPB scores overall, but again we did not find strong evidence that this result differed by obesity category.

There is not a simple correspondence between measured lower extremity performance using walk speeds or performance scales and MMD, and repeat measurements of gait can only be obtained in those still well enough to attend assessment visits for the study. The LIFE trial took pains to adjudicate the mobility disability status of persons unable to attend clinic visits. Finally, the LIFE study being considerably larger than previous trials was able to quantify effects within obesity categories with better precision.

We observed an impressive benefit in those with class 2+ obesity strata, but stratum-specific effects can be misleading since the comparisons were neither preplanned nor adequately powered. Nevertheless, exploring why this result may have arisen might help to shape hypotheses for future research. Obesity status was strongly linked with fewer minutes of self-reported walking at baseline. At 6 months, persons with class 1 obesity in the HE arm spontaneously increased their minutes of walking (by 75 minutes) while the class 2+ obesity HE participants did not report any increase in their minutes of walking. The fact that the HE participants with class 1 obesity increased their walking may have conflated the examination of obesity × intervention effect, however participants with class 2+ obesity showed the most improvement in overall minutes walked/week thus the strongest benefit on reducing risk of MMD.

Alternatively, those with class 2+ obesity may differ from other participants in important ways including the number and management of chronic health conditions, and or additional lifestyle factors such as dietary quality and environment. For example, the prevalence of metabolic syndrome was higher in the participants with obesity. A previous LIFE analysis showed the LIFE intervention effect to be greater in individuals with metabolic syndrome.[13]

This study has several strengths. The LIFE Study was a multi-center randomized intervention trial, which included a diverse population of older adults (70–89 years old) who were at risk for MMD—a portion of the elderly population that has received less systematic attention in this area. Additionally, the retention and adherence were very good (63–73%). Few studies have examined MMD risk among adults 70+[14]; none to our knowledge were large randomized clinical trials with a follow-up of longer than 18 months. The study used an objective and reliable method to determine MMD and outcomes with greater clinical salience than continuous measures of gait speed or lower extremity performance.[15]

The analysis has several limitations, which should be acknowledged. First, because the current analysis is based on a post-hoc stratification of the data, there is an increased potential for Type 1 error. The LIFE Study sample size was selected to provide >80% power to detect a 21% reduction in MMD. Thus, the power in any specific obesity stratum is correspondingly lower. Therefore, the failure to demonstrate a significant effect in any particular stratum should not be taken as evidence of a lack of an effect in that stratum. Correspondingly, the study would have only power to detect large interactions between randomization group and obesity status. Additionally, there was no information collected about participation in health promoting activities outside of the study nor was there a group that received no intervention, which may limit the interpretation of the results.

Conclusion

Older persons with obesity at high risk for mobility disability benefited from a structured moderate intensity physical activity program demonstrating a reduced risk of MMD. The experience of the LIFE trial suggests that such an exercise program is both safe and effective even in persons with class 2+ obesity. Future studies should examine how obesity status moderates the effectiveness of physical activity interventions, as physical activity and obesity can play an important role in risk for MMD.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding information:

The Lifestyle Interventions and Independence for Elders Study is funded by a National Institutes of Health/National Institute on Aging Cooperative Agreement #UO1 AG22376 and a supplement from the National Heart, Lung and Blood Institute 3U01AG022376-05A2S, and sponsored in part by the Intramural Research Program, National Institute on Aging, NIH. The research is partially supported by the Claude D. Pepper Older Americans Independence Centers at the University of Florida (1 P30 AG028740), Wake Forest University (1 P30 AG21332), Tufts University (1P30AG031679), University of Pittsburgh (P30 AG024827), and Yale University (P30AG021342)

and the NIH/NCRR CTSA at Stanford University (UL1 RR025744), Tufts University is also supported by the Boston Rehabilitation Outcomes Center (1R24HD065688-01A1). LIFE investigators are also partially supported by the following: Dr. Thomas Gill (Yale University) is the recipient of an Academic Leadership Award (K07AG3587) from the National Institute on Aging. Dr. Roger Fielding (Tufts University) is partially supported by the U.S. Department of Agriculture, under agreement No. 58-1950-0-014. Any opinions, findings, conclusion, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Dept. of Agriculture.

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What is already known about this subject?

- The presence of obesity is strongly associated with the risk of mobility disability in older adults
- Obesity may limit the benefits of physical activity on mobility disability
- Few physical activity intervention studies have examined the interaction of obesity and mobility disability in older adults

What does this study add?

- This study adds evidence from a large multi-center randomized clinical trial of older adults demonstrating the ability to reduce risk of mobility disability in individuals with obesity
- While there was no significant interaction between obesity category and intervention effect, individuals with class 2+ obesity showed the greatest benefit of the physical activity program reducing risk of major mobility disability by 31%
- A structured moderate-intensity physical activity program can reduce the risk of mobility disability among older adults

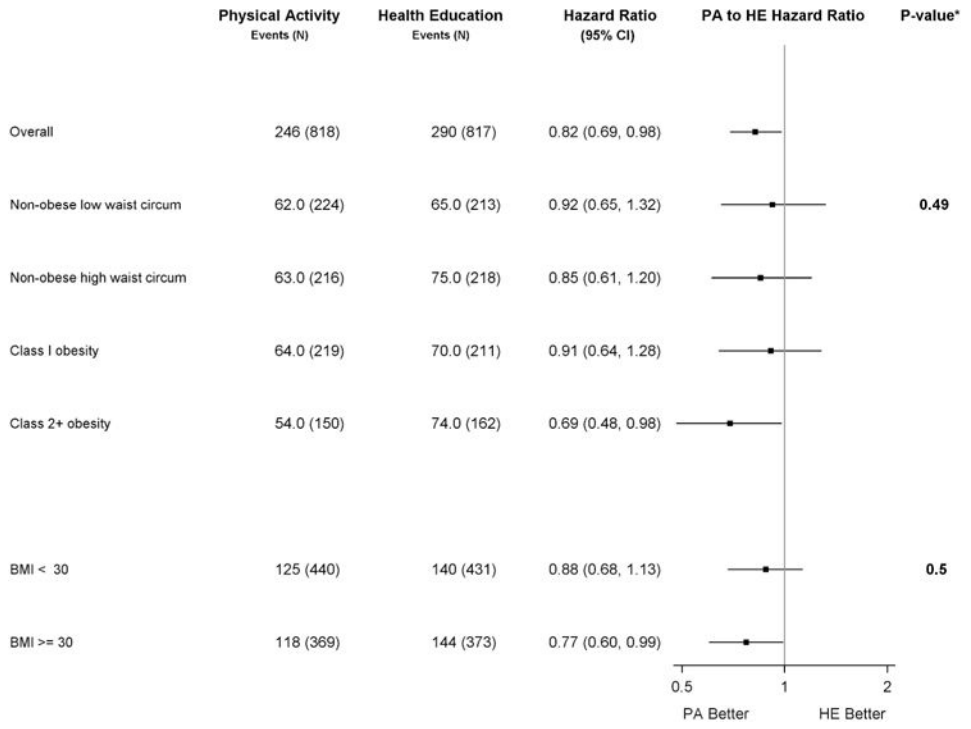

Figure 1. The Effect of a Physical Activity Program on the Risk of Major Mobility Disability by Baseline Obesity Status over 3.5 years of follow up: The LIFE Study

*P-value for category by treatment arm interaction.

PA: Physical Activity, HE: Health Education

BMI: Body Mass Index

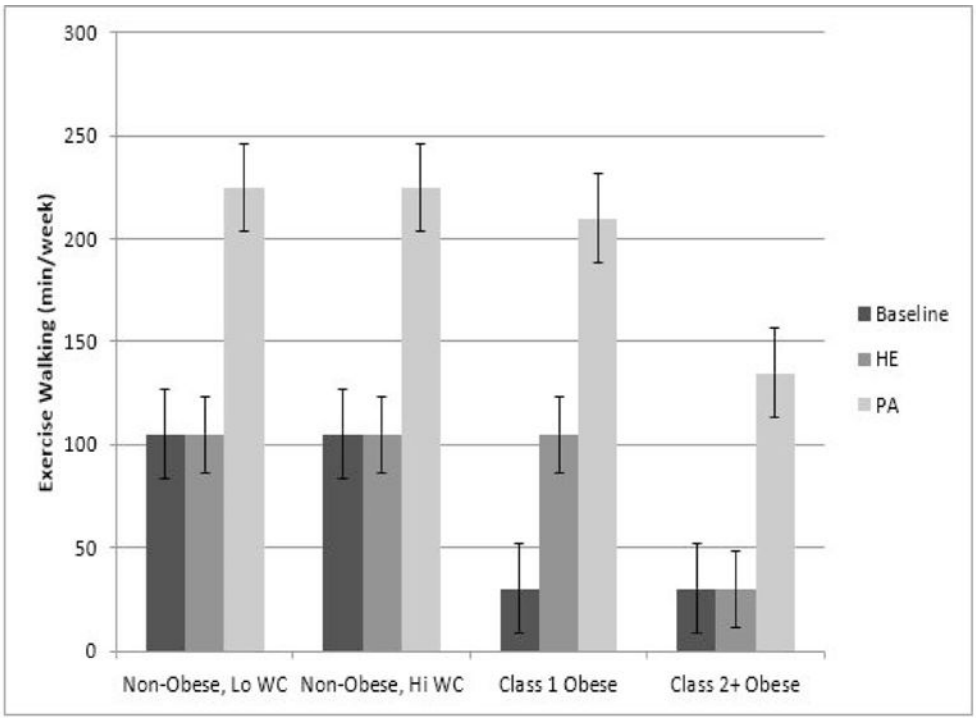

Figure 2. Median Minutes of Self-Reported Moderate Intensity Walking (CHAMPS score) at Baseline and 6 Months by Obesity Category and Intervention Arm

The Baseline Mean is Pooled across Arms.

Error bars represent +/− 1 standard error.

PA: Physical Activity, HE: Health Education

WC: Waist Circumference

Obesity (Silver Spring). Author manuscript; available in PMC 2018 July 01.

Table 1

Baseline Characteristics (mean ± sd; N (%) by Treatment Arm and Baseline Obesity Status: The LIFE Study

	Health Education Arm				Physical Activity Arm				
	Non-Obese (BMI<30) Low WC	**Non-Obese (BMI<30) High WC**	**Class 1 (30 ≤BMI<35)**	**Class 2+ (BMI≥35)**	**Non-Obese (BMI<30) Low WC**	**Non-Obese (BMI<30) High WC**	**Class 1 (30 ≤ BMI<35)**	**Class 2+ (BMI≥35)**	**Overall**
	(N=213)	**(N=218)**	**(N=211)**	**(N=162)**	**(N=224)**	**(N=216)**	**(N=219)**	**(N=150)**	**(N=1613)**
Age (years) [**,***]	81.2 ± 5.2 [*]	80.0 ± 5.0	78.3 ± 4.8	75.9 ± 4.5	80.6 ± 5.1	79.8 ± 5.3	77.9 ± 4.9	75.5 ± 4.1	**78.9 ± 5.2**
Female (%)	131 (61.5%)	150 (68.8%)	148 (70.1%)	112 (69.1%)	140 (62.5%)	147 (68.1%)	145 (66.2%)	106 (70.7%)	**1079 (66.9%)**
Race/Ethnicity									
Black	22 (10.3%)	18 (8.3%)	46 (22.0%)	36 (22.2%)	31 (13.9%)	35 (16.3%)	56 (25.7%)	37 (24.7%)	**281 (17.5%)**
White	172 (80.8%)	186 (85.3%)	153 (73.2%)	115 (71.0%)	179 (80.3%)	167 (77.7%)	149 (68.3%)	105 (70.0%)	**1226 (76.2%)**
Other	19 (8.9%)	14 (6.4%)	10 (4.8%)	11 (6.8%)	13 (5.8%)	13 (6.0%)	13 (6.0%)	8 (5.3%)	**101 (6.3%)**
Current Smoker (%)	8 (3.8%)	8 (3.7%)	4 (1.9%)	3 (1.9%)	11 (5.0%)	7 (3.2%)	7 (3.2%)	1 (0.7%)	**49 (3.1%)**
Education (%)									
≤ High School	58 (27.4%)	58 (26.9%)	81 (38.6%)	59 (36.4%)	66 (29.6%)	68 (31.5%)	79 (36.1%)	54 (36.0%)	**523 (32.5%)**
≥ College	154 (72.6%)	158 (73.1%)	129 (61.4%)	103 (63.6%)	157 (70.4%)	148 (68.5%)	140 (63.9%)	96 (64.0%)	**1085 (67.5%)**
CHAMPS Total Score (18 items) (min/week)	21.8 ± 36.5	20.6 ± 34.6	15.9 ± 34.1	14.0 ± 29.4	15.5 ± 30.8	16.0 ± 33.3	14.5 ± 30.7	18.5 ± 34.8	**17.1 ± 33.2**
Body Mass Index (kg/m2)	24.2 ± 2.6	27.5 ± 1.8	32.3 ± 1.5	39.9 ± 4.5	24.5 ± 2.7	27.5 ± 1.8	32.2 ± 1.4	39.2 ± 3.7	**30.2 ± 6.0**
Waist Circumference (cm)	85.6 ± 8.8	99.6 ± 7.5	106.8 ± 10.2	120.3 ± 13.4	85.7 ± 9.0	99.3 ± 8.0	107.1 ± 9.6	120.4 ± 12.3	**101.8 ± 15.5**
SPPB Total Score	7.4 ± 1.6	7.2 ± 1.7	7.5 ± 1.5	7.1 ± 1.6	7.4 ± 1.7	7.5 ± 1.5	7.5 ± 1.5	7.4 ± 1.7	**7.4 ± 1.6**
Walk Time 400-meters (s)	491.3 ± 110.7	499.9 ± 115.3	510.0 ± 109.8	553.6 ± 113.2	493.0 ± 109.6	488.9 ± 110.4	508.9 ± 107.7	542.8 ± 122.4	**508.3 ± 113.7**
Diabetes	35 (16.5%)	59 (27.2%)	64 (30.6%)	56 (34.6%)	32 (14.4%)	50 (23.3%)	59 (26.9%)	55 (36.7%)	**410 (25.5%)**
Metabolic Syndrome	29 (14.6%)	109 (52.7%)	129 (64.8%)	110 (69.6%)	28 (13.1%)	118 (59.3%)	139 (67.1%)	100 (69.4%)	**762 (49.9%)**
MI/Heart Attack	22 (10.4%)	15 (6.9%)	14 (6.7%)	17 (10.6%)	21 (9.5%)	14 (6.5%)	17 (7.8%)	6 (4.0%)	**126 (7.9%)**
Heart Failure or CHF	9 (4.3%)	11 (5.1%)	12 (5.7%)	12 (7.5%)	11 (5.0%)	8 (3.7%)	4 (1.8%)	3 (2.0%)	**70 (4.4%)**
Chronic Lung Disease	25 (11.8%)	38 (17.5%)	31 (14.8%)	27 (16.7%)	32 (14.4%)	32 (14.9%)	31 (14.2%)	32 (21.3%)	**248 (15.5%)**
Arthritis	39 (18.4%)	42 (19.3%)	45 (21.4%)	38 (23.8%)	32 (14.5%)	37 (17.2%)	47 (21.5%)	34 (22.8%)	**314 (19.6%)**

WC= Waist Circumference, BMI= Body Mass Index

[*] P-value comparing PA and HE within obesity category < 0.05.

** P-value for comparison of PA to HE for combining both BMI < 30 groups < 0.05.

*** P-value for comparing PA to HE combining both BMI ≥ 30 group < 0.05.

Table 2

Attendance over 24-months at Scheduled Intervention Sessions, percentage (± SE) by Baseline Obesity Category: The LIFE Study

		BMI and Waist Circumference			
	Overall	**Non-Obese (BMI < 30, Low WC)**	**Non-Obese (BMI < 30, High WC)**	**Class 1 obesity (30 ≤ BMI < 35)**	**Class 2+ obesity (BMI ≥ 35)**
Physical Activity Arm: Percent of sessions attended: excluding sessions during medical leave	(N=809) 63% (± 0.27)	(N=224) 66% (± 0.27)	(N=216) 65% (± 0.25)	(N=219) 60% (± 0.29)	(N=150) 63% (± 0.25)
Health Education Arm: Percent of sessions attended: Adoption + Maintenance	(N=804) 73% (± 0.25)	(N=213) 71% (± 0.26)	(N=218) 73% (± 0.23)	(N=211) 72% (± 0.26)	(N=162) 75% (± 0.24)

WC= Waist Circumference, BMI= Body Mass Index

Table 3

Adjusted* Short Physical Performance Battery Score Differences (Physical Activity – Health Education) by Obesity Category. Mean difference (95% Confidence Interval)

	6-month Follow-up	12 month Follow-Up	24 month Follow-up	Overall Mean Difference
Overall	0.26 (0.08, 0.44)	0.22 (0.03, 0.42)	0.13 (−0.09, 0.35)	0.23 (0.07, 0.39), p=0.01
Non-obese (BMI < 30, Low WC)	−0.07 (−0.42, 0.28)	0.16 (−0.21, 0.53)	−0.10 (−0.53, 0.33)	0.002 (−0.31, 0.31), p=0.99
Non-obese (BMI < 30, High WC)	0.60 (0.25, 0.95)	0.34 (−0.03, 0.71)	0.21 (−0.22, 0.64)	0.38 (0.05, 0.71), p=0.02
Class 1 obesity (30 ≤ BMI < 35)	0.39 (0.04, 0.74)	0.15 (−0.22, 0.52)	0.21 (−0.22, 0.64)	0.25 (−0.08, 0.58), p=0.13
Class 2+ obesity (BMI ≥ 35)	0.12 (−0.29, 0.53)	0.21 (−0.22, 0.64)	0.20 (−0.31, 0.71)	0.18 (−0.19, 0.55), p=0.36

*Adjusted for Site, Age and Gender; p-value for Treatment × Obesity Group Interaction = 0.23

WC= Waist Circumference, BMI= Body Mass Index