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

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

Methods: MMD, defined as the inability to walk 400 m, was determined over an average follow-up of 2.6 years. Participants were divided into four subgroups: (1) nonobese (BMI < 30 kg/m2; n = 437); (2) nonobese 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 (hazard ratio 0.69, 95% confidence interval 0.48, 0.98). However, there was no statistically significant difference in benefit across obesity categories.

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

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 (MMD) in older adults (2-5). MMD can be defined as the inability to walk 400 m without sitting and without help from another person or walker (6). The inability to walk 400 m strongly associated with the development of mobility limitations and...
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 for quality of life and independence; however, few studies have examined the ability to reduce MMD in an older adult population with obesity. The Lifestyle Interventions and Independence for Elders (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 nonobese persons (7). In the LIFE Pilot Study, participants with obesity in the physical activity arm showed no improvement in 400-m walk time and blunted improvement in Short Physical Performance Battery (SPPB) compared to nonobese participants (8), while nonobese participants improved in 400-m 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 to 89 years at high risk for mobility disability. The objective of this study was 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) nonobese and low waist circumference, (2) nonobese 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 have been published (2,6,9). Briefly, the LIFE Study was a single-blind, multicenter, parallel randomized controlled trial of a physical activity (PA) intervention compared with a health education (HE) control arm. The study was conducted at eight 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 min/wk of structured physical activity and less than 125 min/wk of moderate-intensity physical activity who were 70 to 89 years old and at high risk for mobility disability based on scoring 9 or less on the 12-point SPPB (10). Eligible participants were able to walk 400 m 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 eight study sites, and all participants provided informed consent (ClinicalTrials.gov identifier: NCT0107 2500). The CONSORT diagram and study centers and personnel are provided (Supporting Information Figure S1 and Supporting Information Appendix S1).

Intervention

Participants were randomly assigned to either a PA (n = 818) or HE (n = 817) program. 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 two in-person, center-based training sessions per week and perform at-home activities three to four 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 were 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 composed of 60 to 90 minutes of interactive and didactic presentations, including approximately 10 minutes of group discussion and interaction and 5 to 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. BMI was calculated as body weight (kg) divided by height squared (m). 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 Gullick II Tape Measure (model 67020). BMI and WC were used to classify participants into the following categories: (1) nonobese and free of abdominal obesity (BMI < 30 kg/m²; n = 437); (2) nonobese with abdominal obesity (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 to 3 obesity (BMI ≥ 35 kg/m²; n = 312). Participants who were missing baseline WC data were excluded (n = 22). Virtually all (98%) participants with obesity had abdominal obesity.

Metabolic syndrome was defined based on the criteria recommended in the 2009 Joint Interim Statement from multiple scientific associations (11) as the presence of three or more
components, including (1) abdominal obesity (defined above); (2) hypertension (systolic blood pressure \( \geq 130 \) mm Hg and/or diastolic blood pressure \( \geq 85 \) mm Hg) or use of antihypertensive medication and a history of physician-diagnosed hypertension; (3) low high-density lipoprotein cholesterol (HDL-C) level (men: \(< 40 \) mg/dL and women: \(< 50 \) mg/dL) or use of HDL-C-raising medication; (4) elevated triglyceride level (\( \geq 150 \) mg/dL) or use of triglyceride-lowering medication; and (5) elevated plasma fasting blood glucose level (\( \geq 100 \) mg/dL) or use of glucose-controlling medication.

The SPPB comprises three lower extremity tasks: a 4-m usual-paced walk done twice, timed rising from a chair five 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, semitandem, 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 and at 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 (12). The CHAMPS questionnaire was collected at baseline and at 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-m 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 m at their usual pace, without overexerting, completing 10 laps of a 20-m walking course (40 m 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 in which the 400-m 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 (SD) 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 400-m 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 (400-m 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 400-m 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 400-m 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 version 9.4 (SAS Institute, Cary, North Carolina).

Results

Of the 1,635 randomized participants, 22 were excluded from this analysis due to missing baseline WC, yielding an analysis sample of 1,613 participants, with 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. Nonobese participants were older, more likely to be white and male, more highly educated, and less likely to have metabolic syndrome, diabetes, or arthritis. Nonobese participants also completed the 400-m 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 that the HE intervention arm was slightly older than the PA arm.

At 24 months, attendance at 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 (hazard ratio: 0.82, 95% confidence interval [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 \( \geq 30 \). 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 (hazard ratio: 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: 4-m walk speed and SPPB score, which were both measured at the 6-, 12-, and 24-month postrandomization visits. There was no overall intervention effect on 4-m 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 and abdominal obesity, but there was no statistical interaction between intervention arm and obesity category (\( p = 0.23 \)).
| TABLE 1 Baseline characteristics (mean ± SD; n [%]) by treatment arm and baseline obesity status: The LIFE Study |
|---------------------------------------------------------------|
| **Age (y)**<sup>***</sup> | 81.2 ± 5.2<sup>*</sup> | 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%) | 1,079 (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 (69.0%) | 179 (80.3%) | 167 (77.7%) | 149 (68.3%) | 105 (70.0%) | 1,226 (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%) | 1,085 (67.5%) |
| **CHAMPS total score** (18 items) | 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 |
| **BMI (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 |
| **WC (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 |
| **400-m walk time (s)** | 491.3 ± 110.7 | 499.9 ± 115.3 | 510.0 ± 109.8 | 553.6 ± 113.2 | 483.0 ± 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 (25.3%) |
| **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%) |

*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 groups < 0.05.

CHAMPS, Community Health Activities Model Program for Seniors Questionnaire; CHF, chronic heart failure; HE, health education; MI, myocardial infarction; PA, physical activity; SPPB, Short Physical Performance Battery; WC, waist circumference.
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 per week of moderate-intensity walking at baseline and at 6 months, 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 walking time among nonobese 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 min/wk of walking, as expected. Class 2+ obesity participants in the HE arm did not report any increase in their walking at 6 months (30 min/wk), while the PA group increased their walking to 135 min/wk. Although the class 2+ obesity PA participants had fewer minutes of walking at 6 months than the PA participants in other obesity categories, the class 2+ obesity subjects reported nearly five 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.

**Table 2** Attendance over 24 months at scheduled intervention sessions, percentage (± SE) by baseline obesity category: The LIFE Study

| BMI and WC | Overall | Nonobese (BMI < 30, low WC) | Nonobese (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) | 66% (± 0.27) | 65% (± 0.25) | 60% (± 0.29) |
|            | (n = 224) | (n = 216) | (n = 219) | (n = 150) |                  |
| Health education arm: Percent of sessions attended: adoption + maintenance | (n = 804) | 73% (± 0.25) | 71% (± 0.26) | 73% (± 0.23) | 72% (± 0.26) |
|            | (n = 213) | (n = 218) | (n = 211) | (n = 162) |                  |

WC, waist circumference.

Figure 1 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. HE, health education; PA, physical activity.
TABLE 3 Adjusted\textsuperscript{a} Short Physical Performance Battery score differences (physical activity – health education) by obesity category

|                      | 6-month follow-up | 12-month follow-up | 24-month follow-up | Overall mean difference |
|----------------------|------------------|-------------------|-------------------|-------------------------|
| Overall              | 0.26 (0.08 to 0.44) | 0.22 (0.03 to 0.42) | 0.13 (0.09 to 0.35) | 0.23 (0.07 to 0.39), \( P = 0.01 \) |
| Nonobese (BMI < 30, low WC) | -0.07 (-0.42 to 0.28) | 0.16 (-0.21 to 0.53) | -0.10 (-0.53 to 0.33) | 0.002 (-0.31 to 0.31), \( P = 0.99 \) |
| Nonobese (BMI < 30, high WC) | 0.60 (0.25 to 0.95) | 0.34 (-0.03 to 0.71) | 0.21 (-0.22 to 0.64) | 0.38 (0.05 to 0.71), \( P = 0.02 \) |
| Class 1 obesity (30 \( \leq \) BMI < 35) | 0.39 (0.04 to 0.74) | 0.15 (-0.22 to 0.52) | 0.21 (-0.22 to 0.64) | 0.25 (-0.08 to 0.58), \( P = 0.13 \) |
| Class 2+ obesity (BMI \( \geq \) 35) | 0.12 (-0.29 to 0.53) | 0.21 (-0.22 to 0.64) | 0.20 (-0.31 to 0.71) | 0.18 (-0.19 to 0.55), \( P = 0.36 \) |

All values are mean difference (95% confidence interval).
\( \text{aAdjusted for site, age, and gender; } P \text{ value for treatment x obesity group interaction} = 0.23. \)

WC, waist circumference.

Discussion
Based on prior data, we hypothesized that older adults with obesity would not achieve as large a benefit as nonobese 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-m 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 400-m walk.

Evidence from the LIFE Pilot Study showed that in participants with BMI \( \geq 30 \), 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 because 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 \( \times \) intervention effect; however, participants with class 2+ obesity showed the most improvement in overall minutes walked per 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 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 multicenter randomized intervention trial that 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 age 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, an outcome 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 I error. The LIFE Study sample size was selected to provide of the data, there is an increased potential for type I error. 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.

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.

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