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Does Lifestyle Exercise after a Cardiac Event Improve Metabolic Syndrome Profile in Older Adults?

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Introduction

Older adults who have metabolic syndrome are twice as likely to experience a cardiac event (myocardial infarction, coronary artery bypass surgery and angioplasty) as compared to older adults without metabolic syndrome.[1,2] Additionally, metabolic syndrome increases the risk of all-cause mortality among adults with cardiovascular disease.[3] Metabolic syndrome is a grouping of factors consisting of large waist circumference, reduced high density lipids, and elevated triglycerides, blood pressure (diastolic or systolic), and fasting glucose.[4] Engaging in lifestyle exercise is especially important for primary and secondary prevention of cardiovascular disease.[5,6] For overall cardiovascular health, the American Heart Association recommends at least 30 minutes of moderate-intensity aerobic activity within a target heart rate zone (50 percent to 85 percent of maximum heart rate by age) at least 5 days a week for a total of 2.5 hours a week.[7-9] Similarly, the U.S. Department of Health and Human Services recommends 150 minutes of moderate physical activity a week and this applies to older adults with chronic conditions.[9-12] Although recommendations for exercise for cardiovascular health are available, the extent to which lifestyle exercise after a cardiac event reduces metabolic syndrome risk factors is not known.

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Lifestyle exercise is defined as planned, structured physical activity to maintain or improve physical fitness that is performed on a routine basis.[13] Exercise is purposeful and done at an intensity that is moderate to vigorous. This is in contrast to physical activity,[14] *which* is the daily accumulation of at least 30 minutes self-selected activities (*planned or unplanned*) that are at least moderate to vigorous in intensity, or the more global concept of physical activity that consists of any bodily movement that expends energy and varies in intensity.[14] Persons engaging in lifestyle exercise determine the frequency and type of exercise to engage as opposed to exercise that is based on a supervised protocol. Participation in lifestyle exercise is posited to reduce metabolic syndrome by reduction in waist circumference, blood pressure, and improvement in the glucose insulin response.[15,16] Most studies examining the relationship between exercise after a cardiac event and metabolic syndrome have small sample sizes, use cross-sectional analysis, focus on healthier middle-aged adults (average age 45)[17], or do not use objective measures of lifestyle exercise.[18,19] The purpose of this secondary analysis of was to determine if performing the recommended amount of lifestyle exercise over a year (130 hours) predicts a reduction in at least one metabolic syndrome factor among older adults 12 months after a cardiac event.

Background

While metabolic syndrome has shown to be a risk factor of cardiovascular disease,[2,20] studies also have shown that exercise can reduce these risks.[21-23] Petrella et al. examined metabolic factors in healthy sedentary and active adults ages 55-75 and found that at ten year follow-up the sedentary group had greater metabolic abnormalities (64% vs. 36%) and three or more metabolic syndrome risk factors (35% vs. 22%) as compared to the active group.[23] Villareal and colleagues conducted a randomized control trial of obese adults (mean age 71) who received diet and exercise therapy (intervention group) or no therapy (control group) for 6 months and found that metabolic syndrome decreased by 59% in the diet and exercise therapy group and did not change in the no therapy group.[21] There were also significant changes in metabolic syndrome factors in the intervention group as compared to the control group in waist circumference, plasma glucose, serum triglycerides, systolic blood pressure and diastolic blood pressure.[21] In another 6-month intervention study, older adults (mean age 63) were provided supervised exercise 3 days a week for 26 weeks and the control group was given the National Institute on Aging Guidelines for Exercise and the American Health Association Step I Diet.[22] The supervised exercise group participants showed significant changes in waist circumference, diastolic blood pressure and high-density lipoprotein.[22]

In studies of physical activity (a broader concept than exercise), physical activity was associated with a reduction in metabolic syndrome. Park et al. analyzed the impact of sedentary time and physical activity in individuals with COPD in the National Health and Nutrition Examination Survey (NHANES) age 60 and older.[24] While there were no significant differences in sedentary and physical activity time in participants with and without the metabolic syndrome, individuals with a greater intensity of physical activity had a lower prevalence of the metabolic syndrome.[24] The effect of lifestyle exercise (unsupervised) on metabolic syndrome has not be studied in older adults following a cardiac event. Longitudinal studies evaluating the effect of lifestyle exercise on metabolic syndrome profile in older adults following a cardiac event using objective measures of exercise are needed.

Method

This study is an analysis of data to answer a secondary question addressing the effects of lifestyle exercise on metabolic syndrome factors of cardiac patients participating in a larger lifestyle exercise trial.[25] The larger study was a randomized controlled trial of 379 older adults who had a recent cardiac event (myocardial infarction, coronary artery bypass surgery, and/or angioplasty). Potential participants for the parent study were consecutively recruited near the end of their outpatient phase II cardiac rehabilitation program (CRP) and randomly assigned to receive one of two psychoeducational behavior change interventions or a usual care control group. One of the behavior change interventions used contemporary cognitive behavioral approaches such as self-efficacy enhancement, problem solving skills and relapse management. The other intervention used system improvement strategies (a series of small self-designed experiments) to change daily habits.[27] The intervention groups were aimed at sustaining lifestyle exercise after completion of cardiac rehabilitation. Both interventions consisted of a series of five small-group education sessions provided in three 1.5-hour sessions once a week during the last three weeks of the CRP and two sessions held at 1 and 2 months following completion of their CRP. Usual Care consisted of the routine care provided at the CRP. All participants received the usual CRP prescribed structured exercise (12 weeks of supervised exercise 3 times as week).

Inclusion criteria were: (1) 54 years of age or older, (2) first myocardial infarction, coronary artery bypass surgery, and/or angioplasty, and (3) ability to read and speak English. Potential participants were excluded if they had concurrent valve surgery, neurological deficits, acute renal failure, pulmonary complications, obvious musculoskeletal functional disability limiting the ability to engage in lifestyle exercise, and displayed any of the following cardiac characteristics: (a) severe left ventricular dysfunction (ejection fraction < 30%) (b) decreased systolic blood pressure > 15 mmHg with exercise, (c) serious arrhythmias at rest or exercise induced, and (d) exercise-induced ischemia indicated by angina > 2 mm of ST depression on the ECG. At completion of the cardiac rehabilitation program all participants were given an exercise prescription that contained their exercise target heart rate zone and instructions to exercise at least 30 minutes a day on at least five days a week (2.5 hours a week). Recruitment was conducted over a 2-year period (2008-2010) and participants were followed for one year. Measures of metabolic syndrome factors were obtained at baseline and 1 year, and lifestyle exercise was objectively measured over the study year using wristwatch heart rate monitors.

There were 236 participants from the parent study who had incomplete blood samples and these were not included in this secondary analysis. The 116 participants who had full data on metabolic syndrome factors at baseline (end of their CRP program) and the 1-year follow-up period are included in this analysis. No difference in demographic and physical factors were found between the parent study (N=379) and this study (N=116) with the exception of fewer minorities (13% vs 7%). The original study protocol was approved by the Institutional Review Board for Human Subjects Protection at University Hospitals of Cleveland and all subjects gave written informed consent for participation. The aims of the analyses herein are within the aims of the larger study.

Measures

Metabolic Syndrome—The Harmonized Method for persons living in the United States was used to define the five metabolic syndrome factors.[4] The categorical cut points for determining each metabolic syndrome factor are: (a) waist circumference ≥102 cm for men and ≥ 88 cm for women, (b) elevated triglycerides ≥150 mg/dL (1.7 mmol/L) or drug treatment for elevated triglycerides, (c) high density lipids ≤40 mg/dL (1.0 mmol/L) in males and ≤ 50 mg/dL (1.3 mmol/L) in females or drug treatment for low high density lipids, (d) fasting glucose >100 mg/dL or diagnosis of type 2 diabetes or drug treatment, and (e) systolic blood pressure ≥130 and or diastolic pressure ≥85 mm Hg or drug treatment for hypertension.[4] Participants are categorized as having metabolic syndrome if they have three of the five factors. Waist circumference and blood pressure were measured using standardized protocols by trained personnel at baseline and 1 year.[25] Fasting blood serum samples were used to measure triglycerides, high density lipids, low high density lipids, and fasting glucose.

Lifestyle Exercise—Although heart rate (HR) has been shown to be affected by temperature, humidity, training, fatigue and hydration, there is a clear association between HR and intensity of exercise;[28-30] thus HRMs are valid indicators of exercise. Lifestyle exercise was measured using Polar RS400™ portable heart rate monitors (Polar Electro Inc., Lake Success, NY, USA). These monitors were selected because of their ability to capture more types of exercise than accelerometers (such as swimming – a common form of exercise used by this population). This wristwatch monitor provides valid and reproducible exercise data, with high correlation with electrocardiographic data.[28-30] Correlation coefficients of .97[28] to .99[29] have been found over all heart rates up to 200/min. In addition, the validity of the computer files (memory) has been compared to HR as taken by ECG, with 100% agreement.[29] Stability has been determined based on the number of doubtful and unrealistic cases. Leger and Thievierge[29] found 0.1% unrealistic case (<2% unrealistic cases was considered to comprise reliable data). In the current study, less than 1% of the HR recordings contained unrealistic data.

Monitors (wrist watches and a chest receiver) were worn during each exercise session. Heart rate (HR) was recorded at 15-second intervals. The number of minutes exercised was calculated as the total number of 15-second intervals containing an elevated HR, during which the HR rose from the monitor baseline HR in an exercise session of at least 10 minutes in length. Resting and target heart rates (THRs) were calculated for all subjects following cardiac rehabilitation using the Karvonen system (PHR-RHR)*Training Intensity expressed as a decimal)+RHR,[31] in which 60% to 80% of maximum HR constitutes the Training Intensity. The Karvonen method has been shown to adequately determine THR for normal persons, post infarction, and post CABG patients,[32] as well as for patients who are taking beta-blockers, calcium channel blockers or other medications known to reduce resting HR and attenuate heart rate response to exercise.[31] In the current study, 88% of the participants took medications that attenuate heart rate. Since this high rate of HR-attenuating medications was expected in the sample, we opted not to exclude them from the study, but rather to apply an exercise intensity zone for them that was appropriate. Medication that might affect heart rate, in particular, heart rate-attenuating medications such as beta blockers, were monitored during the study period. Although heart rate is lower in persons using beta blockers, the maximal oxygen consumption and rate-perceived exertion do not appear significantly affected.[31] Therefore, the method used to calculate the exercise prescription using the heart rate response is not changed because the patient is taking beta blockers. During periods when medications were changed, patients continued to exercise to their assigned rating of perceived exertion established at the end of their CRP until the new dose of medication was equilibrated and a new target heart rate established.

Patients having pacemakers and automatic implantable cardiodefibrillators (AICD) also were included in the study because these patients can participate safely in exercise and show improved functional capacity as a result of exercise.[33] The accuracy of each HR monitor was checked by the project staff prior to use, by comparing the recorded HR of the staff member with a simultaneous ECG reading. Using a mailing system, subjects returned their monitors monthly to the study team after a new monitor was sent to their homes. Exercise amount consisted of the sum of the minutes of each exercise session over the study year. Subjects also kept activity diaries. Diary data were added to monitor data if a subject forgot to put on the monitor or there was monitor malfunction. Less than 4% of the exercise data were obtained from the exercise diaries. There were no gaps between monthly mailings as we had a sufficient overlap in our mailing weeks and we delivered and picked up the monitors from subjects homes if necessary. If subjects did not have monitor data or diary data for a given day, they were considered in the analysis as having done no exercise for that period. Subjects also recorded in the activity diaries changes in medications that could potentially affect HR.

Demographic and Covariate Predictor Variables—A set of covariates were measured including age, gender, race, employment status, diabetes status, and functional status. Each of these variables were selected based on their known association with either metabolic syndrome or one or more of the metabolic syndrome factors. Age, gender, race, and employment status were obtained by subject self-report. Functional status was measured using the six-minute work ($6M_{WORK}$) test,[34] which considers body weight into the six-minute walk test (6MWT)[35] to improve the prediction of V02max. The $6M_{WORK}$[36] test has been found to be highly correlated with laboratory measures of oxygen uptake during exercise with good reproducibility[36, 37] and is an improved measure of the 6MWT. Diabetes status was measured using subject self-report, followed by verification by medical record review (formal diagnosis and medication review).

Statistical Analysis

The metabolic syndrome and life style exercise data were extracted and confirmed by running frequency analyses and cross-tabulations. Baseline characteristics including age, sex, race, education, employment, NYHA classifications, and comorbidities were summarized using descriptive statistics. Summary statistics of metabolic syndrome profile(s) and amount of exercise at baseline and 12 months using mean, SD, and range were also calculated. The metabolic syndrome factor status change from baseline to one year was categorized into two groups: (a) individuals with the same or more metabolic syndrome factors were labeled as the not-improved group, and (b) individuals with at least one fewer metabolic syndrome factor were labeled as the improved group. Thus the primary outcome variable was the binary metabolic syndrome factor status change; "yes" for improved and "no" for not-improved.

A binary exercise variable (the primary predictors of interest) was created based on recommended exercise levels. Subjects who met the minimum recommendation of ≥130 hours of exercise during the study 12-month period were labeled as "yes", and those who did not meet the recommended exercise levels were labeled as "no." We studied the association between the change in metabolic syndrome factors and the recommended exercise level, while controlling for confounding factors of age, gender, race, baseline metabolic syndrome, diabetes, functionality, and employment using binary logistic regression analysis. In the final adjusted logistic model for the association between the change in metabolic syndrome factors and the recommended exercise level, we again controlled for the confounding variables. All the statistical analyses were performed using Stata 13.0.[38]

Results

One hundred and sixteen participants completed anthropometric, serum and accelerometer data. Of the total sample, twenty-eight percent (n-33) improved their metabolic syndrome profile at the end of the study year. Participants exercised a mean of 141.1 (SD=94.6; range = 0-501.9) hours over the study year, with those in the improved group exercising a mean of mean of 164.8(SD= 94.9; range =15.6-444.5) and those in the unimproved group exercising a mean of mean of 131.6(SD= 93.3; range = 0-500.9) percent of participants met the recommended exercise guideline of at least ≥130 hours over a year. Of those participants that improved their metabolic syndrome profile, 60.6% (n=20) met the minimum requirement of exercise for the year. In the unimproved group, 37.4% met the exercise guidelines. There was a statistically significant difference between the improved and unimproved group (p= .02). (Baseline characteristics of the subjects are presented in Table 1. The majority of the sample were white males and NYHA Class I. Most of the participants were unemployed, hypertensive, and taking heart rate-attenuating medications. At baseline at least one-quarter of the participants had co-morbid conditions. Table 2 describes the metabolic syndrome profile of the sample at baseline and a year following cardiac rehabilitation. In the total sample, the average number of metabolic syndrome factors was relatively stable over the study year. The average number of metabolic syndrome factors in the improved group was greater at baseline than the not-improved group. The unadjusted (Table 3) and the adjusted (Table 4) logistic regression analyses show that lifestyle exercise, baseline metabolic syndrome, diabetes, and employment were associated ($p<0.05$) with improvement in metabolic syndrome profile. Subjects who exercised ≥130 hours over the study year (minimum recommended amount of exercise) were 3.6 times more likely to reduce their number of metabolic syndrome factors by at least one (95% CI: 1.2 -10.5) as compared to participants who did not exercise at the recommended amount. In the improved group, HDL was increased in 72% of the participants and each of waist circumference and glucose were reduced in 60.6% of the participants (Table 5). Few participants had reductions in blood pressure.

Factors other than exercise that predicted a change in metabolic syndrome factors included employment and Type II diabetes. For the employed subjects, the odds of reducing metabolic syndrome factors by at least one were 2.4 (95% CI: 1.5, 5.5) times higher compared to unemployed participants. The employed group were younger and had fewer chronic conditions than the unemployed group ($p= <.01$ and $p= .05$ respectively). Participants with diabetes were less likely to reduce their metabolic syndrome factors odds ratio=0.2 (95% CI: 0.1, 0.8), compared to non-diabetic subjects. Age, sex, race, and functional capacity were not significantly associated with an improvement in the number of metabolic syndrome factors.

Discussion

Metabolic syndrome is a significant problem that is often undertreated in older adults.[20] Findings from our study indicate that older adults who participate in exercise at the minimum recommended amount in the year following completion of a CRP are considerably more likely to improve at least one metabolic syndrome factor. In addition to the findings of other studies that showed that physical activity and supervised exercise improve metabolic syndrome profiles in older adults, our study provides the first information about the influence of lifestyle exercise on metabolic syndrome factors in older adults after a cardiac event.

Engaging in the recommended amount of lifestyle exercise statistically improved the HDL levels of participants in our study. Higher HDL results in a lower risk of cardiovascular disease and stroke both of which are significant causes of disability and death among older adults.[1] Furthermore HDL is an antioxidant, anti-inflammatory, and improves glucose metabolism in skeletal muscles for overall cardiovascular health.[40] The improvements are statistically significant, but do not indicate clinical significance. Our study statistically supports the benefits of lifestyle exercise for older adults after a cardiac event through improvement in metabolic syndrome, a risk factor for cardiovascular disease.

Persons with type II diabetes are at greatest danger of cardiovascular disease from metabolic syndrome factors than persons without diabetes. [41,22] Exercise at the recommended amount has been shown to improve insulin response to glucose.[17,42] In our study, we demonstrated that the majority of participants who changed their metabolic syndrome profile improved their glucose level one year after cardiac rehabilitation. Reduction in just one metabolic syndrome risk factor leads to lower adjusted risk for cardiovascular disease. In data combined from the Jackson Heart Study and the Atherosclerosis Risk in Communities study, achieving target blood pressure, A1c or LDL cholesterol decreased the risk of cardiovascular events by 36%.[35-45] Employment status of the participant reduced the risk of metabolic syndrome factors. This in part may have been because the employed participants were younger and had fewer chronic conditions than the unemployed participants. A reduction in metabolic syndrome has also been seen other studies of postmenopausal women.[47] In our study there was little improvement in systolic or diastolic blood pressure. Mostly, participants were treated with antihypertensive medications and began the study with a lower baseline blood pressure. The intensity and type of exercise may influence blood pressure.

For example, isometric exercise (a form of strength training), as compared to aerobic, has shown greater reeducation in systolic and diastolic blood pressure.[44,45]

Limited knowledge exists on the effects of sustaining exercise after cardiac rehabilitation and metabolic syndrome factor improvement. Findings from our study statistically support the benefits of ongoing exercise after cardiac rehabilitation in older adults. Healthcare professionals working in cardiac rehabilitation can use the results from this study to educate older adult participants on the long term benefits of lifestyle exercise after discharge from the program. However, challenges remain in the uptake of cardiac rehabilitation after a cardiac event, with less than 30% of patients attending a CRP following a cardiac event.[46]

The findings of this study should be considered in light of the study limitations. Although the improvements in metabolic syndrome profile were statistically significant, we were unable to support the clinical significance of these changes in this sample. As a secondary analysis, the factors assessed were restricted to those in the original study. The addition of other factors that could have improved this assessment of the extent to which lifestyle exercise improves metabolic syndrome factors would include the length of time an individual had the factors prior to this assessment, family history of the respective metabolic syndrome factors, and consideration of the pattern of exercise over the study year. This study also lacked broad diversity in characteristics such age, education, ethnicity and therefore extrapolation to other populations should be done with caution. The limitations of our study present future opportunities. The effects of lifestyle exercise on metabolic syndrome should be examined in patients who do not attend cardiac rehabilitation, women and minorities.[41,46] Additionally, more research is needed to examine the dose effect of lifestyle exercise on metabolic syndrome in patients who cannot perform the recommended amount of exercise, such as frail older adults with multiple co-morbidities.

Conclusion

Metabolic syndrome has been shown to increase the risk of cardiovascular disease and other adverse health outcomes in older adults. Our study shows that lifestyle exercise at the recommended amount or greater can improve metabolic syndrome profile, with changes occurring in HDL cholesterol, waist circumference and glucose level. These study results are important to influence our non-pharmacological treatment recommendations of consistent lifestyle exercise and its benefits to reduce metabolic syndrome factors among older adults. This is particularly important for patients who have already had a cardiac event and are at an increased risk of another event.

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Table 1

Baseline Characteristics of Total Sample and by MetSyn Improvement Group

Characteristics	Total (N=116) Mean (SD), Range	Improved (n=33) Mean (SD), Range	No Improvement (n=83) Mean (SD), Range
Age	67.5 (8.4), 55-89	66.7 (8.8), 55-83	67.9 (8.3), 55-89
Male	86 (74.4%)	24 (72.7%)	62 (74.7%)
White	108 (93.1%)	31(93.9%)	76 (91.6%)
Minority	8 (6.9)	2 (6.1%)	6 (8.1%)
Years of education	15.4 (2.8), 11-24	14.8 (2.7), 12-20	15.3 (2.9), 11-24
Employed	49 (42.2%)	19 (57.6%)	30 (36.1%)
Not employed	67 (57.8%)	14 (42.4%)	53 (63.9%)
NHYA classification			
Class I	97 (83.6%)	28 (84.9%)	69 (83.3%)
Class II	10 (8.6%)	3 (9.1%)	7 (8.4%)
Class II	8 (6.9%)	1 (3.0%)	7 (8.4%)
Class IV	1 (.09%)	1 (3.0%)	0 (0.0%)
Chronic conditions			
Hypertension	113 (97.4%)	32 (96.9%)	81 (97.6%)
Obesity	40 (34.5%)	11 (33.3%)	29 (34.9%)
Arthritis	36 (31.0%)	11 (33.3%)	25 (30.1%)
Diabetes	29 (25.0%)	3 (9.1%)	26 (31.3%)
HR *-attenuating medications	102 (88%)	29 (87%)	73 (88%)
6-minute work test	1100 (1120)	1170 (306)	1100 (265)

*HR= heart rate

Table 2

Metabolic Syndrome Profile Characteristics at Baseline and 1 Year after Cardiac Rehabilitation for Entire Sample, Improved, and Not-improved Groups.

	Entire Sample		Improved		Not-improved	
Characteristics	**Baseline (N=116) Mean (SD), Range**	**1-Year (N=116) Mean (SD), Range**	**Baseline (n=33) Mean (SD), Range**	**1-Year (n=33) Mean (SD), Range**	**Baseline (n=83) Mean (SD), Range**	**1-Year (n=83) Mean (SD), Range**
Metabolic syndrome factors	2.6 (1.1), 0-5	2.5 (1.2), 0-5	3.1 (0.8), 2-5	1.9 (0.8), 1-4	2.4 (1.2), 0-5	2.8 (1.3), 0-5
Waist circumference, cm	39.1 (4.8), 26-53.5	39.4 (5.5), 28.5-66.5	39.4 (4.9), 30.5-48.5	38.7 (4.7), 28.5-50.5	39.04 (4.9), 26-53.5	39.6 (5.8), 29-66.5
Triglycerides, mg/dL,	105.7 (62.5), 30-562	111.4 (60.2), 35-411	107.4 (45.2), 46-220	100.70 (37.5), 40-234	105.0 (68.4), 30-526	115.6 (66.8), 35-411
High density lipids, mg/dL	43.0 (11.9), 21-105	46.8 (13.2), 18-92	41.12 (8.8), 30-68	46.70 (9.5), 34-69	43.8 (12.9), 21-105	46.8 (14.5), 18-92
Glucose, mean (SD), mg/dL	101.1 (22.5), 20-207	101.6 (23.0), 73-209	98.8 (12.13), 77-137	94.5 (15.4), 77-154	102 (25.6), 20-207	104.4 (24.9), 73-209
Systolic blood pressure, mm/Hg	117.6 (16.5), 91-160	121.8 (15.0), 88-161	117.71 (14.6), 95-152	122.1 (14.2), 96-157	117.66 (16.5), 91-160	121.7 (15.3), 88-161
Diastolic blood pressure, mm/Hg,	69.6 (8.1), 41-91	71.2 (9.7), 25-95	68.62 (6.9), 58-80	71.3 (9.5), 52-95	69.6 (8.1), 41-90	71.2 (9.9), 25-90

Table 3

Unadjusted Odds Ratio for Metabolic Syndrome Profile Improved After 1-Year

Metsyn Change	**OR**	**SE**	**LL**	**UL**	***p* value**
Exercise	2.6	1.1	1.1	5.9	0.02
Age	0.8	0.2	0.5	1.4	0.48
Gender	0.9	0.4	0.4	2.2	0.83
Race	2.9	3.2	0.3	24.9	0.32
Metabolic profile	3.3	1.6	1.4	8.3	0.01
Diabetes	0.2	0.1	0.1	0.8	0.02
Baseline functional status (6 Minute walk)	1.0	0.01	0.9	1.0	0.22
Employed	2.4	1.0	1.5	5.4	0.04

Metabolic syndrome factor change where: 0 = individuals with the same or more metabolic syndrome factors post intervention than baseline and 1 = individuals with less metabolic syndrome factors post intervention than baseline. *OR*=odds ratio, *SE.* =standard error, *UL*=upper limit of 95% confidence interval, and *LL*=lower limit of 95% confidence interval.

Table 4

Adjusted Odds Ratio for Metabolic Syndrome Profile Improved After 1-Year

Metsyn Change	OR	SE	LL	UL	*p* Value
Exercise	3.6	1.9	1.2	10.5	0.02
Age	1.0	0.0	0.9	1.1	0.18
Gender	1.2	0.7	0.4	3.9	0.79
Race	0.4	0.5	0.0	5.2	0.49
Metabolic syndrome profile	10.8	6.9	3.1	37.5	0.000
Diabetes	0.1	0.1	0.0	0.4	0.002
Baseline functional status (6 Minute walk)	1.0	0.01	0.9	1.0	0.07
Employed	3.4	1.9	1.1	10.5	0.02

Metabolic syndrome factor change where: 0 = individuals with the same or more metabolic syndrome factors post-intervention than baseline and 1 = individuals with less metabolic syndrome factors post intervention than baseline. *UOR.* =odds ratio, *SE.* =standard error, *UL* =upper limit of 95% cconfidence interval, and *LL* =lower limit of 95% confidence interval.

Table 5

Factors that Improved in Particiapnts who Changed their Metabolic Profile (n=33) in Rank Order

Factors	n (%)
HDL, mg/dL	24 (72.7)
Waist circumferance, cm	20 (60.6)
Glucose, mg/dL	20 (60.6)
Triglycerides, mg/dL	18 (54.6)
Diastolic blood pressure, mm/Hg	12 (36.4)
Systolic blood pressure, mm/Hg	10 (30.3)