

INCREASING PHYSICAL ACTIVITY IN BLACK WOMEN: RESULTS FROM A RANDOMIZED TRIAL CONDUCTED IN FAITH-BASED SETTINGS

Melicia C. Whitt-Glover, PhD¹; Moses V. Goldmon, EdD²;
Ziya Gizlice, PhD³; Marie Sillice, PhD⁴;
Lyndsey Hornbuckle, PhD, RD⁵; Daniel P. Heil, PhD⁶

Objective: The Learning and Developing Individual Exercise Skills (L.A.D.I.E.S.) for a Better Life study compared a faith-integrated (FI) and a secular (SEC) intervention for increasing physical activity with a self-guided (SG) control group among African American women.

Design/Setting/Participants: L.A.D.I.E.S. was a cluster randomized, controlled trial. Churches (n=31) were randomized and women within each church (n=12–15) received the same intervention.

Interventions: FI and SEC participants received 24 group-based sessions, delivered over 10 months. SG participants received printed materials to review independently for 10 months. Participants were followed for 12-months post-intervention to assess long-term intervention impact.

Main Outcome Measures: Data on participant characteristics, physical activity, and intervention-related constructs were collected at baseline, 10 months, and 22 months.

Results: Intervention session attendance was greater for FI compared with SEC participants (15.7 + 5.7 vs 12.4 + 7.3 sessions, respectively, $P < .01$). After 10 months, FI and SEC participants significantly increased daily walking (+1,451 and +1,107 steps/day, respectively) compared with SG participants (-128 steps/day). Increases were maintained after 22 months in the FI group compared with the SG group (+1092 vs. +336 daily steps, $P < .01$). Between-group changes in accelerometer-assessed physical activity were not statistically significant at any time point.

Conclusions: The FI intervention is a feasible strategy for short- and long-term

INTRODUCTION

Physical activity among African Americans is low, particularly among African American women.^{1,2} Chronic diseases associated with low levels of physical activity are high among African American women (eg, obesity, diabetes, hypertension).³ Reviews of physical activity interventions that are focused on, or that include, African American women show only small, short-term post-intervention increases in physical activity and almost no interventions show long-term post-intervention sustainability (eg, ≥ 6 months post-intervention).⁴⁻⁷ Few physical activity interventions focused on African American women have used objec-

tive measures to assess physical activity change, which is a limitation given the tendency for over-reporting physical activity participation.

Faith-based organizations may be appropriate health promotion partners for improving health-related behaviors particularly since, among Americans, 89% report believing in God, 77% affiliate with a religion, and 36% attend worship services at least once per week; affiliation and attendance is higher for women and racial/ethnic minorities.^{8,9} In addition, faith-based organizations have physical space to hold activities and tend to be a trusted entity with deep social networks in the community.^{10,11} Spirituality is often a part of a person's self-concept/identity and

increases in physical activity among African American women. Additional dissemination and evaluation of the strategy could be useful for reducing chronic disease in this high-risk population. *Ethn Dis.* 2017;27(4):411-420; doi:10.18865/ed.27.4.411.

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¹ Gramercy Research Group, Winston-Salem, North Carolina

² Division of Liberal Studies, Lane College, Jackson, Tennessee

³ Center for Health Promotion and Disease Prevention, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

⁴ The Miriam Hospital and Alpert School of Medicine, Brown University, Providence, Rhode Island

⁵ University of Tennessee Knoxville, Knoxville, Tennessee

⁶ Exercise Physiology, Montana State University, Bozeman, Montana

Address correspondence to Melicia C. Whitt-Glover, PhD; President & CEO; Gramercy Research Group; 7990 N. Point Blvd, Suite 108; Winston-Salem, NC 27106; 336.293.8540, ext 110; mwhittglover@gramercyresearch.com

linking health behaviors to spirituality may intensify the messages received related to behavior changes.^{12,13} Previous reviews have highlighted the success of faith-based physical activity interventions and suggested this approach is promising.¹⁴ Reviews have also noted that a limitation of previous faith-based interventions is the use of the church as a venue of intervention (faith-placed), without incorporating the spiritual tenets of the church

L.A.D.I.E.S. addressed two important limitations in previous physical activity interventions among African Americans: development of an effective, culturally relevant, and sustainable intervention and the use of objective measures to assess physical activity outcomes.

into the interventions themselves (faith-based). While the association between spirituality/religion and health is well-documented in the literature in a number of groups including African Americans,¹⁵⁻¹⁹ little is known about whether strategies that are faith-based and that incor-

porate the spiritual beliefs of congregants into the intervention content has additional benefits compared with faith-placed interventions or standard or usual care conditions.

There is a need for effective, culturally relevant, sustainable interventions to promote physical activity in high-risk groups, with intervention impact assessed using objective measures of physical activity. The purpose of the Learning and Developing Individual Exercise Skills (L.A.D.I.E.S.) for a Better Life study was to determine the impact of a faith-integrated (FI; incorporated biblical scriptures and faith tenets into the intervention) or a secular (SEC; used general readings to illustrate concepts and did not incorporate scriptures or faith tenets into the curriculum) intervention compared with a self-guided (SG) intervention on increasing physical activity in low active African American women. L.A.D.I.E.S. addressed two important limitations in previous physical activity interventions among African Americans: development of an effective, culturally relevant, and sustainable intervention and the use of objective measures to assess physical activity outcomes.

METHODS

Detailed methods for the L.A.D.I.E.S. study have been published elsewhere.²⁰ All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975,

as revised in 2000. Informed consent was obtained from all participants included in the study. Briefly, the study was a cluster randomized design in which churches were assigned to the FI or SEC intervention, or an information only control group (SG). Content for each of the active interventions (FI and SEC) was informed by key concepts from social ecological theory and social cognitive theory.^{21,22} The study design and intervention content leveraged existing supportive relationships among women within the same social organization—in this case, church congregations—and similarities in sociocultural beliefs related to health behaviors. The design also focused on concepts related to self-efficacy, incentives/values placed on and external reinforcements for health behavior, and social support received from the individual's environment as it relates to supporting healthy behaviors. The FI curriculum incorporated biblical scriptures and faith tenets to illustrate increasing physical activity, identifying and overcoming barriers that prevented physical activity, identifying environmental and social supports for physical activity, goal setting and rewarding oneself for achieving health-related goals, and strategies for handling lapses in physical activity. The SEC curriculum illustrated the same concepts using general readings and did not include references to scriptures or faith tenets. Both the FI and SEC curricula included 24 sessions that were delivered over a 10-month period: weekly for four months (16 sessions); bi-weekly for two months (4 sessions); and monthly for four

months (4 sessions). If participants missed scheduled intervention sessions, they were offered individual make-up sessions with the group leader. Women participated in group or individual sessions with the same assigned group leader throughout the program and with women from their own churches only. Participants assigned to the SG arm received a publicly available guide that focused on strategies for safely increasing and maintaining physical activity levels, and instructions to review and follow the guide on their own for 10 months.²³ Churches in the SG arm were not prevented from conducting group-based activities, but were not invited to participate in, or provided with, the curricula from either the FI or SEC interventions.

L.A.D.I.E.S. recruited churches and African American women within these churches to engage in a physical activity promotion program. A previously published paper described the process for recruiting and enrolling churches, and participants within churches, into the study.²⁴ Eligible churches were those that self-identified themselves with congregations that were predominantly African American. Thirty-one churches, representing 30 sites (two churches were combined) were recruited and randomized into the L.A.D.I.E.S. study. Randomization to one of the three study arms occurred at the church level, using a blocked randomization allocation ratio of 1:1:1. All churches participating in the study agreed to accept randomization to one of the three programs, with the understanding that they were eligible to receive the content from

any programs to which they were not assigned at the end of the study.

Within each church, a female member was designated as a liaison who was not a study participant, but who assisted the study team with introduction into the congregation, recruitment, scheduling, and attended all study-related activities including data collection and intervention sessions. Church liaisons helped to recruit women from within their congregations who were: 1) self-identified African American; 2) regular attendees of the church being recruited; 3) ≥ 18 years of age; 4) not currently achieving recommended levels of physical activity, defined as self-reported achieving ≤ 150 minutes per week of moderate-to-vigorous intensity physical activity; 5) no physical limitations or medical conditions that would prevent participation in daily physical activity; and 6) no plans to move from the area within a two-year period. All women enrolled from a church received the same intervention.

Church- and participant-level data were collected at baseline, prior to the start of any intervention-related activities. Randomization occurred after the completion of baseline data collection at each church in an attempt to avoid participation bias. It was not possible to blind study team members or participants to intervention assignments. Follow-up data were collected immediately post-intervention at 10 months. Participants were instructed to maintain or continue to increase physical activity levels on their own post-intervention. Final data collection occurred at 22 months (12

months post-intervention) to assess long-term intervention impact.

The primary outcome of interest was daily physical activity, as assessed by pedometer (New Lifestyles Lifecorder 2160). Additional measures of physical activity were collected via accelerometer (Phillips Respironics, Inc; Bend, OR) and self-report. As described previously,^{20,25} study staff objectively assessed height, weight, body mass index (BMI), resting blood pressure, and resting pulse and collected self-report data on general participant characteristics and constructs of interest related to the theoretical framework, including physical activity self-efficacy, general and religious social support, desire for exercise, psychological distress, personality, private and organized religious practices, and self-reported religiosity.²⁰

Statistical Analyses

For this cluster randomized study, baseline sample characteristics (including primary and secondary outcomes) were summarized using descriptive statistics. Similarly, baseline characteristics were compared between respondents and non-respondents (dropouts) to determine if they differed systematically on values of baseline variables using chi-square tests and t-tests adjusted for clustering within churches. Analyses of primary (daily walking) and secondary outcomes were conducted using multivariable generalized linear mixed models (GLMM) that included churches as a random effect. In these GLMMs, we compared mean changes in primary and secondary outcomes at 10 and 22 months between in

Table 1. Baseline physical activity (PA)

Variable	Faith-integrated (FI)			Secular (SEC)			Self-guided (SG)		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Walking/steps, daily	131	4005	2084	126	3978	1743	100	3984	1552
Accelerometer-assessed sedentary behavior, daily									
1-min bouts	145	775.0	255.9	131	780.7	172.0	120	787.5	165.8
10-min bouts	145	688.3	253.4	130	696.9	180.7	120	698.2	185.7
Accelerometer-assessed light-intensity PA, daily									
1-min bouts	115	641.4	214.0	92	629.6	121.7	70	620.1	109.3
10-min bouts	115	531.8	227.8	91	514.7	137.3	70	504.8	119.1
Accelerometer-assessed moderate/vigorous PA, daily									
1-min bouts	145	22.9	29.3	131	26.3	48.4	120	22.7	20.1
10-min bouts	145	9.1	16.4	130	10.7	23.1	120	9.4	47.9
Self-reported moderate/vigorous PA, weekly	149	16.9	27.5	139	15.0	26.1	123	25.0	47.9

There were no statistically significant differences in baseline participant characteristics by randomization assignment.

each intervention group (FI and SEC) and with the control group (SG) to assess immediate and long-term impact of each intervention. In addition, we conducted two separate sets of GLMMs that included only baseline values of dependent variable as a fixed covariate in one set and marital status, income, BMI, and age as fixed effects along with baseline values in another set to compare adjusted differences in mean changes in primary and secondary outcomes between each intervention group and control group. All analyses were conducted using SAS Version 9.4 (SAS Institute, Cary, NC), taking into account clustering within churches.

RESULTS

Participant Characteristics

A full description of baseline participant characteristics has been published elsewhere.²⁵ Briefly, enrolled participants included 151, 141, and 126 women in FI, SEC, and SG groups, respectively. At base-

line, participants were aged 51.4 ± 12.9 years (range 18 – 85 years), mostly college educated (54.8%), married (45.1%), overweight (average BMI was 35.8 ± 9.9 kg/m²), and had blood pressure levels in the “normal” range (127±19.4 / 79±14.9 mm Hg). There were no statistically significant differences in baseline participant characteristics by randomization assignment.

Implementation

All 24 intervention sessions were implemented as designed for the FI and SEC groups. FI participants completed more sessions than SEC participants (15.7 ± 5.7 vs 12.4 ± 7.3, respectively, P<.01). FI participants completed 11.3 ± 3.5 of the 16 weekly sessions and 5.0 ± 2.3 of the 8 sessions that were delivered bi-weekly or monthly. SEC participants completed 9.3 ± 5.0 weekly and 4.8 ± 1.8 non-weekly sessions.

Baseline Physical Activity

Table 1 provides baseline participant physical activity charac-

teristics. In line with inclusion criteria, participants were low active (achieving <5,000 steps/day, achieving <30 daily minutes of moderate to vigorous PA). Participants self-reported 25.4 ± 45.4 minutes of walking/moderate-intensity/vigorous-intensity activity weekly.

Post-Intervention Changes in Physical Activity

Table 2 provides data for immediate post-intervention changes. After the 10-month intervention, FI and SEC participants significantly increased pedometer-assessed daily walking over baseline compared with SG participants (+1,451 steps/day for FI participants, +1,107 steps/day for SEC participants, and +128 steps/day for SG participants). Differences were retained when adjusted for baseline values and covariates of interest. Changes in accelerometer-assessed moderate-to-vigorous physical activity were not statistically significant (within- or between-groups). All three groups reported statistically significant within-group

Table 2. Change in physical activity (PA) from baseline to post-intervention, 10 months

	Faith-integrated (FI)			Secular (SEC)			Self-guided (SG)		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Walking/steps, daily	89	1451 ^{a,c}	2558	77	1107 ^{a,b}	2242	65	128	3247
Accelerometer-assessed sedentary behavior, daily									
1-min bouts	115	25.8	225.1	92	9.5	131.5	70	-60.6	287.6
10-min bouts	115	29.4	228.1	91	9.4	133.2	70	-66.7	328.1
Accelerometer-assessed light-intensity PA, daily									
1-min bouts	115	-25.3	234.4	92	-3.8	129.5	70	60.3	282.7
10-min bouts	115	-22.0	247.8	91	2.0	146.1	70	54.5	241.0
Accelerometer-assessed moderate/vigorous PA, daily									
1-min bouts	115	-.46	54.4	92	-5.7	35.4	70	.1	10.8
10-min bouts	115	2.4	45.6	91	-2.0	18.4	70	.3	5.6
Self-reported moderate/vigorous PA, weekly	119	138.6 ^a	133.8	92	147.6 ^a	245.7	91	77.8 ^a	142.4

a. Statistically significant (P<.05) within group differences.
 b. P<.05, statistically significant between group differences, comparing FI vs SG or SEC vs SG.
 c. P<.01, statistically significant between group differences, comparing FI vs SG or SEC vs SG.

increases in self-reported weekly physical activity after 10 months; however, between group differences in self-reported physical activity were not statistically significant.

Physical Activity Maintenance and Overall Changes in Physical Activity

During the 12-month post-intervention follow-up when

participants were expected to maintain post-intervention behavior change, no additional differences in daily walking were observed. Both FI and SEC participants had statistically significant decreases in accelerometer-assessed sedentary behavior and increases in light-intensity physical activity compared with the SG group (within and between group changes; data not

shown). Table 3 provides data for overall study changes, from baseline through 22 months, taking into account immediate post-intervention changes (10 months) and the 12-month maintenance phase. Overall, FI and SEC participants increased their pedometer-assessed daily walking; however, only the FI group achieved and retained statistically significant differences

Table 3. Change in physical activity (PA) from baseline to 22 months

	Faith-integrated (FI)			Secular (SEC)			Self-guided (SG)		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Walking/steps, daily	74	1092 ^{a,c}	1948	68	948 ^a	2537	59	336	2043
Accelerometer-assessed sedentary behavior, daily									
1-min bouts	97	-1.5	103.2	88	-34.3 ^a	137.3	82	-18.4	199.3
10-min bouts	97	-58.2	103.0	87	-88.0 ^a	143.5	82	-64.8 ^a	227.5
Accelerometer-assessed light-intensity PA, daily									
1-min bouts	97	4.4	129.5	88	41.4 ^a	140.1	82	19.0	200.0
10-min bouts	97	-68.1 ^a	171.3	87	-24.0	162.5	82	-42.2	192.1
Accelerometer-assessed moderate/vigorous PA, daily									
1-min bouts	97	-2.9	44.1	88	-7.1	35.7	82	-.6	25.1
10-min bouts	97	-1.3	26.3	87	-5.1 ^a	18.5	82	-2.4 ^a	10.0
Self-reported moderate/vigorous PA, weekly	105	91.6 ^a	81.3	97	124.8 ^a	180.9	86	100.9 ^a	183.4

a. Statistically significant (P<.05) within group differences.
 b. P<.05, statistically significant between group differences, comparing FI vs SG or SEC vs SG.
 c. P<.01, statistically significant between group differences, comparing FI vs SG or SEC vs SG.

when compared with SG participants (+1092 vs +336 steps/day, respectively, $P < .01$). Overall changes in daily walking in SEC participants compared with SG participants were not statistically significant. Changes in accelerometer-assessed and self-reported physical activity were statistically significant within groups, but not between FI compared with SG participants or between SEC compared with SG participants. All

Findings from our study provide information about at least one strategy that may be useful for long-term maintenance of physical activity following an intervention.

three groups reported statistically significant within-group increases in self-reported weekly physical activity after 22 months; however, between group differences in self-reported physical activity were not statistically significant.

DISCUSSION

L.A.D.I.E.S. was designed to test the impact on physical activity participation of two interventions, conducted within faith-based settings.

One intervention incorporated faith tenets within the intervention (FI) and the other focused on a secular approach and did not incorporate faith tenets (SEC). The study was powered to detect differences between both intervention and the self-guided control condition; however, the study was not powered to detect differences between the two intervention conditions. Findings from our current study of short-term increases in objectively monitored daily walking observed among intervention groups, compared with the control condition, are in line with findings from other interventions focused on African American women that assessed physical activity using a pedometer as we discuss below.

Immediate post-intervention results from L.A.D.I.E.S. showed statistically significant increases in daily walking ranging from ~1,100 to 1,400 steps/day in intervention. A previous study by Hill et al indicated that an increase of ~2,000 steps/day was sufficient for preventing excess weight gain.²⁶ Participants in our current study achieved increases that were about half the amount needed for preventing excess weight gain; however, we expect that even an increase of ~1,000 steps/day would confer some health and quality of life benefits in previously sedentary populations. Our pilot study that informed L.A.D.I.E.S. implemented an 8-session non-randomized physical activity intervention in African American men and women and showed significant post-intervention increases in pedometer-assessed daily walking of 1,373 steps among

71 participants with available pre-post data.²⁷ A separate randomized, controlled faith-based intervention trial focused on increasing physical activity in African American women showed an increase in pedometer-assessed walking of ~1,400 steps per day after an 8-week program ($n=34$), compared with a control group ($n=28$).²⁸ A study focused on increasing physical activity among 41 low socioeconomic status women provided pedometers, a log book, and weekly phone calls to encourage increasing daily walking for six months, followed by bi-weekly phone calls for six months and showed statistically significant pre-post increases in daily walking steps of +1,328, +1,258, +1,279, and +1,401 at 3-, 6-, 9-, and 12-months post-baseline.²⁹ In a non-randomized community walking intervention, 83 participants who received a pedometer and maintained a pedometer diary achieved an increase of 2,567 steps/day over 6 months.³⁰ A single group 12-month walking intervention among African American women that included storytelling, interactive learning, group-based physical activity, and assigned walking partners increased daily pedometer-assessed steps by 203 steps after 12 months and 1,425 steps after 18 months.³¹

Increases in daily walking in our current study were maintained after a 12-month, no contact post-intervention follow-up period, which is an addition to the literature on strategies that can successfully increase and maintain post-intervention changes in physical activity. A study of a culturally tailored television-

delivered weight control program for African American women included a physical activity component.³² The intervention included 12 weekly TV programs and 4 monthly booster videos. Participants (n = 363) had significant increases in physical activity 3-months post intervention, but differences disappeared at 8- and 12-months post-intervention. A 5-week healthy lifestyle intervention, which included lessons on nutrition and physical activity among 565 African American women in rural Alabama, showed an increase in the proportion of women who self-reported engaging in physical activity ≥ 5 days per week after 12 months; levels decreased to below baseline levels at 24-months.³³ Reviews of the literature on physical activity interventions have consistently called for inclusion of long-term post-intervention follow-up; this remains a need to understand sustained health benefits of interventions.^{4,6,34,35} Findings from our study provide information about at least one strategy that may be useful for long-term maintenance of physical activity following an intervention.

The lack of a statistically significant change in accelerometer-assessed physical activity was unexpected, particularly given the findings of statistically significant increases in pedometer-assessed daily walking. Few published physical activity intervention studies among African American women reported accelerometer data with which to compare our findings, highlighting the need for additional studies that evaluate physical activity interventions using accelerometers, which is useful for

understanding changes in physical activity by intensity-level.^{4,10} For our study, we expected to see changes in accelerometer-assessed moderate-to-vigorous physical activity that were in line with changes in daily walking. Current national guidelines recommend ≥ 150 minutes per week in moderate-to-vigorous intensity physical activity to achieve substantial health benefits.³⁶ In our study, participants received a pedometer to monitor their daily walking, along with personalized daily step count and moderate-to-vigorous intensity physical activity goals, and weekly feedback on goal attainment. The pedometers did not allow participants to monitor physical activity intensity. It is possible that participants focused on achieving step count goals, which they could monitor in “real time” with pedometers, to the exclusion of physical activity intensity-related goals. It is also possible that participants perceived they were engaged in more physical activity than was actually occurring. By design, study participants were low active at the beginning of the study and it is possible that increased movement could have been perceived as more intense than it actually was. Intensity-levels were based on algorithms specific to the accelerometer, rather than relative intensity. It is possible that L.A.D.I.E.S. participants decreased their usual daily activities in preparation for purposeful physical activity needed to reach study-directed physical activity goals, thus reducing their overall daily physical activity. A previous qualitative study highlighted the perception that rest is as important as, and even necessary

for, engagement in exercise/physical activity among African Americans.³⁷ Additional encouragement to maintain baseline physical activity levels and additional focus on strategies for increasing physical activity intensity may be needed for physical activity interventions in this population.

Our study identified increases in self-reported physical activity at all data collection time points, which is also in line with previous studies focused on promoting physical activity among African American women. Systematic reviews of physical activity interventions among African American women uniformly conclude that interventions are beneficial, particularly when self-report measures are used.⁴⁻⁷ Despite the limitations of self-report physical activity data, there is merit to using such measures, particularly in large, population-based samples where objective measures are not feasible.

Study Limitations

Our current study had some limitations that could have affected our findings. Although intervention sessions were implemented as intended, participants attended only 67% and 50% of FI and SEC intervention sessions, respectively. Attendance was highest when participants met weekly, and then dropped off when participants met less frequently. Anecdotal, participants expressed concern when sessions were delivered bi-weekly and monthly because participants felt it was easy to establish a pattern of missing sessions when the frequency was less than weekly. Participants received reminder calls prior to each session and liaisons and

co-participants from each church communicated with participants between sessions. Additional research is needed to identify, and understand how to overcome, barriers to intervention session attendance. Attrition in our current study was somewhat high, but was in line with attrition rates reported in other faith-based studies.^{38,39} Our study lasted 22 months, including the 10-month intervention phase and the 12-month follow-up phase, which is a significant amount of time to keep churches and participants engaged in a study. Attrition in our study was higher than interventions delivered using strategies other than group-based or in person,^{40,41} in non-faith-based intervention settings focused on outcomes other than physical activity (eg, weight loss),⁴² and in interventions targeting older populations.⁴³ Additional research is needed to understand strategies for maintaining participant engagement throughout interventions across a variety of settings, outcomes, and age groups. L.A.D.I.E.S. was implemented in Protestant churches that reported serving primarily African American congregations in the southeastern region of the United States. Thus, findings might not be generalizable to non-Protestant or non-African American congregations, to congregations outside the southeastern region of the United States, or in non-faith-based settings.

CONCLUSION

Our study has several strengths, including the focus on a high-risk

population, the long-term follow-up and success with maintaining behavior for 12 months post-intervention, and the use of objective measures to assess physical activity change. To our knowledge, this is the first study to: 1) demonstrate long-term maintenance of physical activity behavior change among African American women; and 2) demonstrate the short- and long-term impact on physical activity of a faith-based intervention that incorporated scriptures and biblical tenets. African American women are at high risk for chronic diseases associated with low levels of physical activity. Faith-based organizations are one venue that has potential for implementing and sustaining strategies to promote physical activity and help prevent disease. The positive and sustained impact of the FI intervention on physical activity levels suggests the FI program has merit and should be further disseminated and evaluated to confirm findings from our current study.

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CONFLICT OF INTEREST

No conflicts of interest to report.

AUTHOR CONTRIBUTIONS

Research concept and design: Whitt-Glover, Goldmon; Acquisition of data:

Whitt-Glover, Goldmon, Gizlice, Hornbuckle; Data analysis and interpretation: Whitt-Glover, Gizlice, Heil; Manuscript draft: Whitt-Glover, Goldmon, Gizlice, Hornbuckle, Heil, Sillice; Statistical expertise: Gizlice; Acquisition of funding: Whitt-Glover, Goldmon; Administrative: Whitt-Glover, Goldmon; Supervision: Whitt-Glover

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