

# Sisters in Motion: A Randomized Controlled Trial of a Faith-Based Physical Activity Intervention

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**OBJECTIVES:** To evaluate a faith-based intervention (Sisters in Motion) intended to increase walking in older, sedentary African-American women.

**DESIGN:** Randomized controlled trial using within-church randomization.

**SETTING:** Three Los Angeles churches.

**PARTICIPANTS:** Sixty-two African-American women aged 60 and older who reported being active less than 30 minutes three times per week and walked less than 35,000 steps per week as measured using a baseline pedometer reading.

**INTERVENTION:** Intervention participants received a multicomponent curriculum including scripture readings, prayer, goal-setting, a community resource guide, and walking competitions. Intervention and control participants both participated in physical activity sessions.

**MEASUREMENTS:** The primary outcome was change in weekly steps walked as measured using the pedometer. Secondary outcomes included change in systolic blood pressure (SBP). Outcomes were assessed at baseline and 6 months after the intervention.

**RESULTS:** Eighty-five percent of participants attended at least six of eight sessions. Intervention participants averaged 12,727 steps per week at baseline, compared with 13,089 steps in controls. Mean baseline SBP was 156 mmHg for intervention participants and 147 mmHg for controls ( $P = .10$ ). At 6 months, intervention participants had increased their weekly steps by 9,883 on average, compared with an increase of 2,426 for controls ( $P = .02$ ); SBP decreased on average by 12.5 mmHg in intervention participants and only 1.5 mmHg in controls ( $P = .007$ ).

**CONCLUSION:** The Sisters in Motion intervention led to an increase in walking and a decrease in SBP at 6 months. This is the first randomized controlled trial of a faith-based

physical activity program to increase physical activity in older African-American women and represents an attractive approach to stimulate lifestyle change in this population. *J Am Geriatr Soc* 58:1863–1869, 2010.

**Key words:** physical activity; African Americans; randomized controlled trial

Regular physical activity provides substantial health benefits for older adults by preventing or ameliorating chronic diseases and disabilities and helping maintain personal independence.<sup>1–4</sup> Older African-American women are the least physically active race–sex subgroup in the United States.<sup>5</sup> Despite this disparity in rates of physical activity, few of the reported physical activity interventions for older adults report outcomes according to race and sex.<sup>6–8</sup> In addition, few physical activity interventions have specifically targeted older, sedentary African-American women.<sup>8</sup>

Integrating behavioral strategies such as building self-efficacy for exercise within a faith-based structure holds promise for decreasing sedentary lifestyles in older African-American women.<sup>2,8,9</sup> Spirituality and religion are powerful cultural influences for many African Americans, and more than 95% of older African-American adults report praying nearly every day.<sup>10</sup> Spirituality and faith are often used as resources to help overcome personal crises and barriers and together with approaches such as personal goal setting may help to overcome obstacles to behavior change.

A faith-based, physical activity intervention (Sisters in Motion) was developed for African-American women aged 60 and older and tested in a pilot randomized controlled trial in three churches in south Los Angeles. It was hypothesized that the multicomponent Sisters in Motion curriculum would result in higher physical activity levels in intervention participants than control participants measured at 6 months of follow-up. In addition, it was hypothesized that this increase in physical activity would in turn lead to improvement in multiple secondary outcomes, including blood pressure reduction, weight loss, and less chronic pain.

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## METHODS

### Study Design and Participants

The study design was a randomized controlled trial. The purpose of the study was to evaluate whether a multicomponent, faith-based intervention, delivered in a small-group format, could successfully increase physical activity in older, sedentary African-American women in the community. The University of California at Los Angeles institutional review board approved the research protocol.

Inclusion criteria were African American race, female sex, aged 60 and older, self-reported physical activity of less than 30 minutes three times per week, and ability to ambulate without a walker. Exclusion criteria were failure to attend each of two baseline, prerandomization data collection sessions, walking more than 35,000 steps per week at baseline as measured using pedometer, and an affirmative response to any item from the Community Healthy Activities Model Program for Seniors (CHAMPS) Modified Physical Activity Questionnaire. These items included chest pain with exercise, any history of loss of consciousness, any “heart problems” that participants had been told might make exercise risky, or any other reason why the participant themselves felt that they should not exercise. In addition, the primary care physician of each potential research subject was contacted with a medical consent form informing the physicians of the study protocol. It was possible to identify a primary care physician for all participants. Subjects were excluded if their physician responded and indicated a medical contraindication to participation.

Through word of mouth and existing community contacts, a convenience sample of three churches with predominantly African-American members that were interested in joining the study was identified. These churches included a Catholic parish, an African Methodist Episcopal (AME) church, and a Seventh Day Adventist church. Study participants at each of the churches were recruited with the assistance of church members, typically the leaders of existing “senior groups” within each church. In addition, flyers advertising the research study were placed in community centers in the vicinity of each participating church. The program was particularly well received at one of the three churches, with high participant demand, so a second cohort was recruited after the first group finished.

Once participants provided informed consent and were enrolled in the study, they attended two data-gathering sessions in which they completed a baseline survey and had their weight and blood pressure measured. Blood pressure was measured on two occasions at least 15 minutes apart, and the values were averaged to provide a single result. Participants were also provided with a Yamax SW-200 Digiwalker pedometer and instructed in proper wearing technique and procedure, including the need to wear the pedometer at all times other than when bathing or sleeping.

### Randomization

After enrolling at least 15 participants at each church and collecting baseline data as described above, a modified randomization procedure was implemented within that church. Two different weekdays were identified for study implementation, based on the availability of space at each church. Participants were then allowed to sign up for the

day that best fit their personal schedule before one day was designated for the intervention group and the other day for the control group. Approximately 65% of participants expressed no preference about scheduling, and these participants were assigned to 1 of the 2 days with the use of a random number generator. Once participants were evenly distributed between the 2 study days, the random number generator was used to designate one as the intervention day and the other as the control day. This modified randomization procedure, allowing participants to select the day on which they attended the study, was used to provide the women with greater control over their experience as research participants.

### Description of the Intervention

The intervention and control protocols were implemented separately during 8 weekly 90-minute meetings on 2 different days of the week, followed by separate once-monthly meetings for 6 months also on 2 different days of the week. One research assistant led the intervention group meetings, and another led the control group meetings, following separate scripted protocols. Although the intervention and control groups both engaged in 45 minutes of physical activity each week, only the intervention participants were exposed to the faith-based curriculum. Because the purpose of this behavioral intervention study was explained in detail during the informed consent process, it was not possible to “blind” the participants to their randomized study assignment. The research assistants were also aware of the randomized study assignment for their groups. The principal investigator met individually with each research assistant for 2 hours before the first weekly session to discuss the research protocols and for 1 hour weekly thereafter to discuss the previous session and plan the next session.

The 8-week intervention curriculum was designed to incorporate evidence-based best practice approaches for physical activity programs targeting older adults, including providing activity choices and positive reinforcement, enhancing self-efficacy, and building social support for exercise.<sup>9</sup> The goal during the first 8 weeks was to establish active behaviors that would persist over time after the curriculum had been completed. Control participants were not exposed to any of the intervention curriculum but instead received lectures of the same time duration that addressed unrelated topics such as advanced directives and identity theft. Intervention and control groups met on different days of the week to minimize contamination.

The intervention curriculum included four components, including a community resource guide based on the CHAMPS model<sup>11</sup> and weekly scripture readings and group prayer (Table 1). Participants in the intervention group at each church self-selected into small groups of three or four and set personal activity goals to help themselves and other members of their small group become and remain active. Finally, the small groups competed in a weekly pedometer competition. The small group with the greatest mean increase in step counts each week over baseline was credited with a “win,” although the pedometer readings were never revealed to participants. Members of the small group with the most wins at the end of the 8 weeks each received a \$15 gift card. A score of 0 steps was averaged

**Table 1. Details of the Intervention and Control Group Protocols Implemented at Each Site**

	<b>Intervention Group (8-week program)</b>	<b>Control Group (8-week program)</b>
<b>Group Structure</b>	Participants self-selected into small groups of 3-4 women	One large group
<b>Curriculum/Lectures (45 minutes)</b>	1) Faith-based component <ul style="list-style-type: none"> <li>• Scripture reading, with a discussion of how the spiritual message related to physical activity, overall health, and mutual group support</li> <li>• Group prayers to close each session</li> </ul> 2) Goal-setting and reinforcement Each participant set 2 weekly goals: <ul style="list-style-type: none"> <li>• personal goals for physical activity</li> <li>• goals to assist other members of their small group with initiating and maintaining physical activity</li> </ul> The research assistant led a discussion each week of the prior week's goals, including a conversation about strategies to overcome any barriers to PA           3) Pedometer competition <ul style="list-style-type: none"> <li>• Each week, the step counts of each participant were averaged to calculate a group score. The group with the greatest mean increase in steps from the pre-study baseline received a "win" for that week. Participants who did not attend for a given week were assigned a value of zero steps.</li> </ul>	Lectures on topics unrelated to physical activity (e.g., memory loss, advance directives, identity theft)
<b>Physical Activity Session (45 minutes)</b>	Classes led by fitness instructor or research assistant. Activities included walking, resistance and balance exercises, as well as line dancing, praise dancing to spiritual music, and basic yoga.	Same as intervention group

into the group mean for any participant who missed a weekly session to encourage attendance.

The intervention and control study arms both participated in exercise classes during their weekly meetings, including flexibility, resistance, and aerobic exercises. The exercise classes were based on the National Institute on Aging (NIA) Activities for Older Adults<sup>12</sup> and also included line dancing, praise dancing to spiritual music, and basic yoga exercises. After the initial few classes, participants were allowed as a group to decide on the specific activities they wanted to emphasize for the remaining classes. An African-American fitness instructor from the community, who was blinded to the randomized study assignments, led the majority of the exercise classes. Although participants in each church were exposed to the main fitness instructor, she had conflicting commitments during some weeks. The research assistants stepped in to lead a minority of the exercise classes for their respective study groups. The pedometers were removed from participants before each exercise class, the readings manually recorded, and the pedometers returned afterwards to limit the measured primary outcome to steps that participants walked on their own, outside of the weekly meetings. During this initial phase of the study, the pedometers were taped shut between sessions, and participants were instructed not to remove the tape.

After the initial 8 weeks, the intervention groups shifted to monthly meetings for 6 months, with an emphasis on maintaining increases in physical activity (Table 1). Although the scripture readings and pedometer competition were discontinued, the groups were encouraged to continue setting activity goals, and some groups continued to engage in prayer around this issue. Participants were asked to wear their pedometers for the week before each session. During this phase of the study, pedometers were untaped, and group

members were able to discuss how many steps they walked and encouraged to discuss strategies to address any decline in steps from the previous month's total. Control groups also met monthly, but instead of discussions on physical activity, they had additional lectures on unrelated topics.

### *Outcome Measures*

The research protocol, including baseline and 6-month follow-up data collection, took place from August 2006 through October 2007. Persons not affiliated with the study, who were blinded to randomized study assignment, recorded the postintervention outcomes. The primary study outcome was change in weekly steps walked at 6 months after the intervention, as measured using the pedometer and entered by the research assistant into a study computer. Digiwalker Yamax SW-200 pedometers, which have been shown to correlate closely with readings from more expensive accelerometers such as the CSA (Computer Science and Applications, Inc., Fort Walton Beach, FL) and Tri-Trac R3D (Professional Products, Inc., Madison, WI), were used.<sup>13</sup> In addition to change in steps walked, 6-month secondary, exploratory outcomes, including change in systolic blood pressure (SBP), change in diastolic blood pressure, change in weight, and change in pain as measured according to the American Geriatrics Society pain score, were also examined. As an additional secondary outcome, change in self-reported physical activity as measured according to the CHAMPS Physical Activity Questionnaire using a modified version designed for an African-American population was examined.<sup>14</sup> The CHAMPS questionnaire measures time spent engaged in each of approximately 40 activities, and the responses were compiled to create a variable measuring weekly hours of overall physical activity.

Other recorded baseline data included information on participant demographics such as age, education, income, self-rated health, and need for assistance with any instrumental activities of daily living. Information was gathered on number of participant comorbidities,<sup>15</sup> and several psychosocial characteristics at baseline were measured, including participant self-efficacy for exercise,<sup>16</sup> exercise-related social support from family and friends,<sup>17</sup> and perceived barriers to exercise.<sup>18</sup>

### Statistical Analyses

Unadjusted *t*-tests were used to compare change scores between intervention and control participants for all study outcomes. Because SBP values differed significantly between the two randomized groups at baseline, a linear regression with an indicator for control versus intervention assignment was also conducted as a post hoc sensitivity analysis, controlling for baseline SBP. All analyses were conducted with an intention-to-treat design based on initial randomization, regardless of the number of sessions attended.

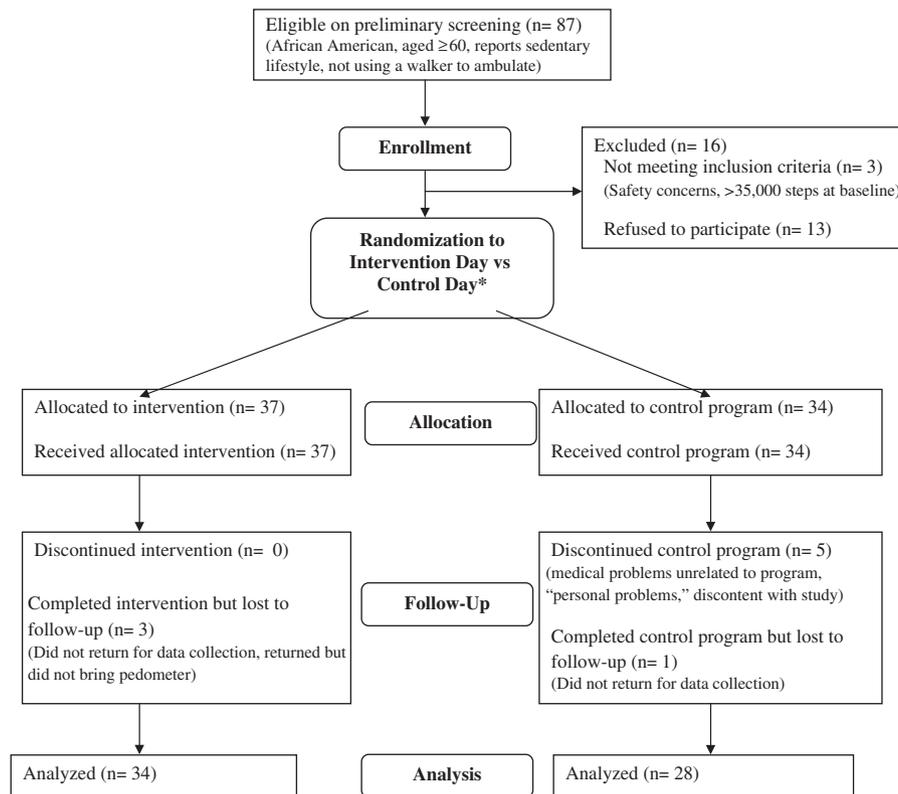
### RESULTS

Eighty-seven women who met the study inclusion criteria were recruited (Figure 1). Sixteen were excluded before randomization based on self-reported or provider-reported medical contraindications, participant self-withdrawal for nonmedical reasons, or pedometer step counts greater than 30,000 per week at the data-gathering session. The 71

remaining participants were enrolled in the study, with 37 randomized to the intervention arm and 34 to the control arm. Approximately 85% of participants attended at least six of the initial eight weekly sessions, and no research-related adverse events were recorded for any participant. Because of study attrition and loss to follow-up, the analysis of the primary outcome includes data from only 34 intervention and 28 control participants.

There were no statistically significant differences in baseline demographic and clinical characteristics between intervention and control participants (Table 2). Baseline values of the primary outcome measure were similar across study arms, with intervention participants walking 12,727 steps per week on average and control participants walking 13,089 ( $P = .88$ ). Although not statistically significant, there was a trend toward higher baseline SBP in intervention (155.8 mmHg) than control participants (146.9 mmHg,  $P = .10$ ). There were no statistically significant differences observed at baseline for other secondary outcomes.

At 6-month follow-up, intervention participants had increased their mean weekly walking activity by 7,457 steps more than control participants, on average (Table 3,  $P = .02$ ). The decrease in SBP at follow-up was greater for intervention than control participants ( $P = .007$ ). In a post hoc regression model controlling for SBP at baseline, there was a nonsignificant trend toward lower blood pressure in the intervention group (data not shown,  $P = .07$ ). Although intervention participants appeared to have greater overall physical activity as measured in hours per week ( $P = .50$ )



\*Participants were divided between two weekdays (35% selected a particular day, 65% were assigned by investigators). After participants were equally distributed between the 2 days, one was randomly designated as the intervention day, and the other was randomly designated as the control day.

Figure 1. Flow diagram tracking Sisters in Motion participants.

**Table 2. Baseline Characteristics According to Group Assignment**

Characteristic	Intervention (n = 34)	Control (n = 28)	Unadjusted P-Value
<b>Demographic</b>			
Age, mean ± SD	73.3 ± 9.6	72.2 ± 5.8	.62
Income < \$2,000/month, %	62	42	.13
Education < 12 years, %	24	22	.90
Self-rated health excellent or very good, %	35	31	.71
Requiring assistance with any instrumental activity of daily living, %	21	18	.79
Body mass index, mean ± SD	29.6 ± 5.5	31.6 ± 5.4	.17
Comorbidity score, mean ± SD	2.6 ± 1.7	2.6 ± 1.4	.86
<b>Psychosocial, mean ± SD</b>			
Self-efficacy for exercise scale (range 0–90)*	53.1 ± 22.2	55.0 ± 20.3	.74
Exercise support from family scale (range 13–65)†	23.3 ± 8.3	22.7 ± 9.8	.79
Exercise support from friends scale (range 10–50)†	21.1 ± 10.1	20.0 ± 10.2	.68
Perceived barriers to exercise scale (range 14–70)‡	34.2 ± 10.3	33.9 ± 6.3	.90
<b>Baseline measures of study outcomes, mean ± SD</b>			
Primary outcome: steps walked per week	12,727 ± 9,387	13,089 ± 8,636	.88
<b>Secondary outcomes</b>			
Hours per week of physical activity	8.7 ± 8.9	9.5 ± 8.9	.68
Systolic blood pressure, mmHg	155.8 ± 19.7	146.9 ± 22.2	.10
Diastolic blood pressure, mmHg	82.5 ± 9.2	81.1 ± 11.3	.61
Weight, pounds	177.5 ± 36.7	183.7 ± 43.4	.55
American Geriatrics Society pain score (range 0–100)§	25.3 ± 20.1	21.2 ± 19.3	.42

\* Higher scores indicate greater self-efficacy.

† Higher scores indicate greater support.

‡ Higher scores indicate greater barriers.

§ Higher scores indicate more pain.

SD = standard deviation.

and lower diastolic blood pressure ( $P = .48$ ), lower weight ( $P = .51$ ), and greater pain ( $P = .87$ ) at follow-up than control participants, the differences were not statistically significant.

## DISCUSSION

Sisters in Motion, one of the first physical activity interventions designed specifically to target sedentary, older African-American women, resulted in increased walking behavior measured 6 months after intervention onset. The increase in steps walked excluded activity in guided exercise classes and instead represented physical activity that participants undertook on their own initiative. Women in

the intervention arm had lower SBP than control participants at follow-up, although baseline values were different across study arms. In a sensitivity analysis that adjusted for baseline SBP, this difference had a trend toward statistical significance ( $P = .07$ ). This multicomponent, faith-based intervention may represent a promising approach to increase physical activity and lower blood pressure in a highly sedentary and hard-to-affect population subgroup.

The increase of approximately 7,000 steps per week that intervention participants walked translates to approximately 3 miles. This is an important improvement in a sedentary population of older women. Although the amount of time required to walk 3 miles depends on walking speed and stride length, the Sisters in Motion study

**Table 3. Study Outcomes at 6-Month Follow-Up, Unadjusted**

Outcome at 6 Months	Intervention	Control	Mean Difference Between Intervention and Control (Standard Error)	Unadjusted P-Value for Difference
Primary: Change in mean steps walked per week (n = 62)	9,883	2,426	7,457 (3,020)	<b>.02</b>
<b>Secondary</b>				
Change in hours per week of physical activity (n = 61)	9.5	6.9	2.6 (3.8)	.50
Change in systolic blood pressure, mmHg (n = 61)	– 12.5	– 1.5	– 11.0 (3.9)	<b>.007</b>
Change in diastolic blood pressure, mmHg (n = 61)	– 5.9	– 3.8	– 2.1 (3.0)	.48
Change in weight, pounds (n = 61)	– 2.3	– 1.5	– 0.8 (1.3)	.51
Change in American Geriatrics Society pain score (n = 61)	4.3	3.7	0.6 (3.5)	.87

participants probably increased their activity by approximately 60 minutes per week if walking at a moderate pace and 70 to 75 minutes per week if walking at a slower pace.<sup>19</sup> Research has established a dose-response benefit to physical activity, with even light or moderate activity associated with some improvement in health outcomes.<sup>2</sup> Walking at a light or moderate pace for only 10 to 15 minutes per day has been linked to lower rates of cardiovascular disease, cardiovascular mortality, and all-cause mortality in postmenopausal women.<sup>20–22</sup> The effects of this increase in physical activity in terms of functional outcomes such as mobility, balance, and maintaining independence is less clear, although there may be some benefits as a result of greater energy expenditure and maintained muscular strength.<sup>23,24</sup> Recent guidelines endorse that any increase in regular physical activity by older adults is valuable and associated with some health benefits.<sup>25</sup>

Although at least two large cognitive-behavioral interventions implemented in secular community settings have been able to increase physical activity in older African Americans,<sup>26,27</sup> many faith-based interventions have been less successful.<sup>28–30</sup> A recent pre-post trial of a faith-based program showed an increase in physical activity, although the absence of a comparison control group complicates the interpretation of this study.<sup>31</sup>

The results from the Sisters in Motion pilot randomized trial indicate that integrating a cognitive-behavioral intervention with a faith-based curriculum can be an effective approach. Faith-based programs for older African Americans are attractive in part because they provide the potential for increased “reach” as measured within the RE-AIM (Reach, Efficacy/Effectiveness, Adoption, Implementation, Maintenance) model.<sup>32</sup> Although older African Americans may not be exposed to community centers that offer physical activity programs, more than 85% attend church at least a few times per month.<sup>10</sup> African Americans who identify strongly with the spiritual program content may also have better attendance and therefore more-intense exposure to the cognitive-behavioral program components.

At 6-month follow-up, the secondary study outcomes did not differ significantly between intervention and control participants. Although the trend toward lower SBP in intervention participants may represent actual improvement, it may also represent simple regression to the mean given the baseline differences in blood pressure values. A larger, adequately powered trial of the Sisters in Motion intervention may help to clarify the importance of this finding. No significant evidence was found of weight loss or less pain. Although most participants were obese, the lack of weight change is not surprising because the increase in steps walked was unlikely to translate into the 60 to 90 minutes of daily activity required for weight loss.<sup>25,33</sup> Acute pain in intervention participants from initiating a new activity program may have offset any associated benefits in reduction of chronic pain, leading to a nonsignificant result.

Although a significant difference between the two groups was observed in steps walked, a similar difference was not found in self-reported physical activity. This may be due in part to the limitations of a self-reported measure of physical activity. Although it was attempted to minimize discussion of physical activity in the control group, participants were aware that the study was measuring changes in

physical activity and may have overstated their activity for reasons of social desirability. Alternatively, control participants may have disproportionately engaged in activities not measured by the pedometer, such as stretching or resistance training.

This study had several limitations. These include a short duration of observation so that it was not possible to assess the effect of Sisters in Motion on long-term rates of physical activity. Although the competitions and external incentives for the intervention groups to use the pedometers ended after the first eight sessions, intervention participants may have become more accustomed to using the pedometers regularly than control participants. This could have led to an overestimation of the difference in effect size at 6 months. Participants were allowed to self-select the weekday on which they wanted to participate before randomization, and there is a possibility that unmeasured differences could have contributed to bias (e.g., participants who selected Fridays were somehow different from participants who selected Tuesdays). In addition, given the multicomponent intervention curriculum, it was not possible to assess which specific activities were the strongest determinants of behavior change. Although a deliberate effort was made to involve churches representing different Christian denominations, the restriction to a single, urban metropolitan area may somewhat limit generalizability to other African-American populations.

In conclusion, a randomized, controlled trial of a faith-based physical activity intervention (Sisters in Motion) led to a moderate increase in walking behavior and decline in SBP in older African-American women. Although no significant differences in secondary outcomes such as weight and level of reported pain were not observed, this faith-based approach shows promise in increasing physical activity. A larger trial of the intervention protocol, with a longer follow-up period, will determine whether Sisters in Motion produces sustained changes in walking behavior and blood pressure, as well as improvement in outcomes such as chronic pain and health-related quality of life, in this largely sedentary population.

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**Conflict of Interest:** The study authors have no financial or personal conflicts of interest related to this manuscript. This includes no employment or affiliations, grants, honoraria, consultancies, stocks, royalties, prior expert testimony, board memberships, patents, or personal relationships that would constitute a conflict.

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