

Impact of Latin Dance on Physical Activity, Cardiorespiratory Fitness, and Sedentary Behavior  
among Latinos attending an Adult Day Center

**Abstract**

The aim of this study was to determine if a Latin dance program with sedentary behavior information would have an impact on physical activity, cardiorespiratory fitness (CRF), and sedentary behavior among older Latinos attending an Adult Day Center (ADC). Participants [N=21, 75.4  $\pm$  6.3 years old, 22.4 $\pm$  2.8 MMSE score] were randomized into a dance or wait-list control group. Participants wore an accelerometer and inclinometer, completed a sedentary behavior questionnaire, and a non-exercise equation was used to calculate CRF. Results indicate small-medium effect sizes in the desired direction during midpoint of the intervention for physical activity, sedentary behavior-related outcomes, CRF, and self-reported sedentary behavior in the dance group, however; dance participants did not maintain that trajectory for the remaining two months of the intervention. Future studies may consider implementing behavioral strategies during midpoint of the intervention to encourage participants attending an ADC to maintain physical activity and sedentary behavior changes.

Keywords: Hispanics, sitting time, accelerometer, dance, adult day services

# Impact of Latin Dance on Physical Activity, Cardiorespiratory Fitness, and Sedentary Behavior among Latinos attending an Adult Day Center

## Introduction

Older Latinos in the United States are projected to represent 22.5% of the total population over 65 years by 2030 (West, Cole, Goodkind, & He, 2014). The increased older Latino population has implications for a demand in long-term care services. However, many older Latinos prefer to age in place and expect to be taken care by family members than be admitted into a long-term care facility (Herrera, Angel, Venegas, & Angel, 2012). Adult Day Centers (ADCs) are community-based services that help older adults age in place by offering a variety of services during daytime hours that support the health, nutritional, social, and daily living needs of adults with functional limitations (Fields, Anderson, & Dabelko-Schoeny, 2014). As such, ADCs are well-positioned settings for preventing and ameliorating chronic diseases via physical activity and sedentary behavior interventions.

Low levels of physical activity and low cardiorespiratory fitness are associated with an increased risk of heart disease, diabetes, and mortality (U.S. DHHS, 2008). More recent studies have also shown that sedentary behavior, defined as sitting or reclining postures during waking hours (Sedentary Behaviour Research, 2012), is also associated with obesity, cardiovascular disease and cancer, independent of regular moderate-to-vigorous physical activity (Sedentary Behaviour Research, 2012; Wilmot et al., 2012).

ADCs report offering physical activity programs (Anderson, Dabelko-Schoeny, & Johnson, 2013), which should be a critical element in these settings as over 40% of ADC participants have some form of disability, and nearly half of all ADC participants have mild cognitive impairment (Fields et al., 2014). Physical activity has been shown to slow the decline

in activities of daily living (Rolland et al., 2007), improve neuropsychiatric symptoms (Hoffmann et al., 2015), and decrease rate in cognitive decline (Farina, Tabet, & Rusted, 2016) among older adults. Unfortunately, there are limited data examining physical activity and sedentary behaviors among ADC participants.

Examining physical activity and sedentary behavior is especially pertinent among this population given that older Latinos aged 65-74 are 46% less likely to engage in leisure-time physical activity than older non-Latino whites (Marquez, Neighbors, & Bustamante, 2010). Furthermore, a recent longitudinal cohort study found that in a representative sample of Latinos aged 65-74, older Latinos spent an average of 11.11 hours/day in sedentary behaviors as measured by accelerometer (Merchant, Buelna, Castañeda, et al., 2015). A recent meta-analysis found that clinically meaningful reductions in sedentary time can be produced within physical activity interventions that include some component of reducing sedentary behaviors (Prince, Saunders, Gresty, & Reid, 2014). Thus, interventions that concomitantly improve physical activity and reduce sedentary behavior among older Latinos are warranted. To the best of our knowledge, studies have not yet examined physical activity and sedentary behavior of older Latinos attending ADCs; nor have physical activity and sedentary behavior interventions been implemented with this specific population.

A culturally appropriate dance program, BAILAMOS©, for cognitively intact, community dwelling older Latinos has previously shown that participation in this program can increase physical activity (Marquez, Bustamante, Aguinaga, & Hernandez, 2015). It is unknown if this program could have a similar impact on physical activity among older Latinos attending an ADC who may have cognitive impairment (Fields et al., 2014). Thus, the purpose of the present study was to determine if the BAILAMOS© program infused with discussion sessions

about sedentary behavior information would have an impact on physical activity, cardiorespiratory fitness, and sedentary behavior among older Latinos attending an ADC. We hypothesized that participants in the dance group compared to the wait-list control group would have greater increases in physical activity and cardiorespiratory fitness and decreases in sedentary time.

## **Methods**

*Sample.* Older Latinos were recruited via study flyers and announcements at an Adult Wellness Center in Chicago to participate in a 16-week Latin dance program. The Adult Wellness Center (considered a 501c3 tax exempt public charity) is an ADC which offers bilingual and bicultural services to the Spanish-speaking older adult population of Chicago and provides many supervised, structured activities that maintain, improve, and restore participants' abilities. In order to attend the ADC, individuals must meet certain eligibility criteria, including > 60 years old, U.S. citizen, Illinois resident, physician authorization, and a score of 29 or higher on the Determination Need Assessment (DON). Inclusion criteria for the present study were the following: (a) age  $\geq$  60 years old, (b) self-identification as Latino/Hispanic, (c) ability to speak or understand Spanish (d) Mild cognitive impairment (MCI) with scores of 18-26 (Logsdon et al., 2010; McGough et al., 2011) as measured by the Mini Mental State Examination (Folstein, Folstein, & McHugh, 1975), and (e) no plans to leave the country for more than two consecutive weeks over the next four months (study duration). Exclusion criteria included: (a) regular use of assistance to walk (e.g., cane), (b) stroke at any time, (c) >150 minutes of self-reported exercise defined as structured, planned, and repetitive aerobic activity like walking or swimming over an extended period of time with a specific objective such as increasing fitness, physical performance, or health (Bouchard, Shephard, & Stephens, 1994). Additionally, participants who passed initial screening were asked to get medical clearance in order to participate in the

research. Study approval was obtained from the University of Illinois at Chicago Institutional Review Board.

*Design.* The study was a pilot randomized controlled trial with a wait-list control. Participants who met inclusion criteria and completed baseline testing were randomized to either the dance program or the wait-list control group. Randomization was done by computer-generated random numbers and was delivered by a research staff member. The wait-list control group was asked to maintain their usual activities during weeks 1 through 16.

*Testing.* All testing took place at the ADC. This was preferred because participants already attended the ADC, and the space necessary for testing was available. At the testing a bilingual research staff member, blinded to study condition, explained the study and read the Informed Consent to the participant. After participants agreed to participate, they signed the Informed Consent. Consent of participants on their own was deemed appropriate, since they had MCI, not dementia. Questionnaires and assessments were then administered, and all measures were available in Spanish or English. Participants were also given an ActiGraph accelerometer and ActivPal monitor to wear for one week. Testing occurred at Baseline, 2-months, 4-months (post-testing), 6-months, and 8-months (4-month follow-up). The 4-month follow-up occurred during the months of December and February. For all time points, questionnaires and tests were administered in the same order as baseline testing. Participants were compensated with \$15 dollars for completion of the questionnaires, and another \$15 dollars for returning their accelerometer and ActivPal monitors.

*Intervention.* BAILAMOS<sup>®</sup> includes a 4-month, twice-weekly program (Marquez et al., 2015). Every dance session is one hour in length. BAILAMOS<sup>®</sup> includes four dance styles: Merengue, Cha Cha Cha, Bachata, and Salsa. The sequencing of dance styles was determined by level of

difficulty, with the simplest style introduced first (i.e., Merengue) and the most difficult style last (i.e., Salsa). Monthly discussion sessions are also held in which a research assistant focuses on increasing knowledge, outcome expectations, social support, and self-efficacy in order to increase lifestyle physical activity among participants. For the current intervention, several changes were made to the BAILAMOS<sup>®</sup> program. For instance, a research staff member was present at all dance sessions to set up the room and observe the class. Participants wore an orange Velcro bracelet on their right wrist and a green Velcro bracelet on their left wrist in order to help them distinguish between moves to the left and right. We followed the BAILAMOS<sup>®</sup> manual, but were cognizant of elements that seemed to confuse participants. We recorded such challenges, and revised the program as needed. For example, if some of the dance turns that are part of BAILAMOS<sup>®</sup> were too confusing, we revised the moves in ways that still challenged participants physically and cognitively, but did not overwhelm them or put their safety at risk. The monthly discussion sessions were also modified from the original version. For example, the first discussion session included an overview on program expectations and specifics, and a brief description of physical activity recommendations and sedentary behavior. The participants also received visual sedentary behavior feedback in which they were shown an output page of their baseline ActivPAL data. We then identified portions of their day in which they were the most sedentary (i.e., after lunch), and participants were encouraged to reduce their sedentary time and increase sedentary breaks throughout those specific times (the times were also highlighted in red). The second discussion session included information about the consequences associated with prolonged sitting and the benefits of sedentary breaks. The third discussion session had participants brainstorm on strategies to reduce sedentary behavior throughout the day (i.e., standing during TV commercials). Finally, the fourth discussion session discussed the

importance of habit formation and encouraged participants to share strategies that they had been incorporating.

### *Measures*

*Device-assessed physical activity.* Participants were given a triaxial GT3X+ accelerometer (Actigraph, Pensacola, Florida) over their non-dominant wrist since compliance of accelerometers is higher when worn on the wrist (Freedson & John, 2013; Troiano, McClain, Brychta, & Chen, 2014). Participants were instructed to wear the accelerometer for seven consecutive days, and were asked to remove it for showering or swimming. Participants wore the accelerometer at baseline, month 2, month 4, month 6, and month 8. Wear time are reported in days and hours. Data were included if the participant wore the accelerometer for  $\geq 3$  days and  $\geq 10$  hours/day. Data were processed with ActiLife software with data converted to 60-second epochs. Average counts per minute (CPM) are reported.

*Cardiorespiratory fitness.* Cardiorespiratory fitness (CRF) was assessed using a validated regression equation that does not involve exercise testing (Jurca et al., 2005; Mailey et al., 2010). This equation estimates CRF based on sex, age, body mass index, resting heart rate, and level of physical activity on a scale from 1-5. CRF in METs was calculated using the following equation:  $\text{gender} \times (2.77) - \text{age} \times (.10) - \text{BMI} \times (.17) - \text{resting heart rate} \times (.03) + \text{physical activity score} + 18.07$  (Jurca et al., 2005).

*Device-assessed sedentary behavior.* Participants were given an ActivPAL 3TM® inclinometer monitor (PAL Technologies, Glasgow, Scotland, UK). The research assistant placed the ActivPal on their non-dominant leg (same side as accelerometer), and participants were asked to keep it on for seven continuous days. Continuous wear was achieved by waterproofing the monitor with a nitrile sleeve to cover the monitor, wrapping it with a cushioned first aid tape (for comfort), and

attaching it to the leg with an adhesive dressing (3M Tegaderm 9546HP). Participants were provided with written placement instructions and extra adhesive dressings in the event that they needed to remove the monitor and reattach it. Participants were requested to complete a sleep log in which they would record wake time and sleep time. Participants wore the ActivPAL at baseline, month 2, month 4, month 6, and month 8. The 'Events' files were used to analyze data; these list all bouts of sitting/lying, standing and steps, with the time each bout begins and bout duration (Edwardson et al., 2016). Waking time was isolated by using the sleep logs and visually identifying sleep times from the 'Events' files; this occurred when participants did not return the sleep logs. An extremely long bout of sitting/lying would be identified around late evening or early morning and that data would be removed from the file (Edwardson et al., 2016). Activity was classified as sedentary sum of time where activity code = 0, standing sum of time where activity code = 1, light sum of time where activity code = 1 or 2 and METs  $\leq 3$  and moderate-to-vigorous physical activity (MVPA) as sum of time where METs  $> 3$ . Sedentary breaks were also calculated as the total number of sedentary periods (Hamilton, Hamilton, & Zderic, 2004).

*Self-reported sedentary behavior.* The Spanish version of the Sedentary Behavior Questionnaire SBQ (Rosenberg et al., 2010) which has acceptable reliability (Munguia-Izquierdo et al., 2013) was used to assess sedentary behavior at baseline, month 2, month 4, month 6, and month 8. This questionnaire assesses the amount of time sitting while doing nine behaviors. Since this questionnaire was translated using Spanish from Spain, several words were changed to Spanish from Latin America, specifically Mexico, to convey appropriate meaning of certain words.

Cronbach's alphas for the SBQ items was adequate,  $\alpha = .84$ .

*Data Analysis.* Data analysis was conducted in SPSS (IBM, version 22, Chicago, IL). All participants were encouraged to complete testing at all five time points regardless of dance



attendance rate. An intent to treat analysis was employed. Repeated measures analyses of variance (ANOVAs) were used to determine the effects of the dance intervention compared to the wait-list control at midpoint (month 0 to month 2) of the intervention and at month 0 to month 4. We calculated Cohen's  $d$  values as an estimate of the effect sizes (small, .20; medium, .50; and large, .80; (Cohen, 1988)). We also conducted paired  $t$  tests to assess maintenance of physical activity from month 4 to month 8 in the dance group only.

## **Results**

*Participant Characteristics.* Twenty-one participants enrolled in the study. Ten participants were randomized to the dance intervention and 11 participants to the wait-list control group. Study details regarding flow of participants have been previously described (Aguinaga & Marquez, 2017). The mean age of the participants was  $75.4 \pm 6.3$  years, mean MMSE score was  $22.4 \pm 2.8$ , 76.2% were women, and mean years of education was  $6.3 \pm 4.3$  years (Table 1). Dance participants had an attendance rate of 60%. Four participants dropped from the program due to back and lower extremity pain ( $n=2$ ), hip fracture (not associated with the dance program;  $n=1$ ), and perceiving the dance sessions as too difficult ( $n=1$ ). Dropouts were considered those participants who stopped coming to the program and did not come back. Including dropouts, participants attended 19/32 dance sessions, and excluding dropouts, participants attended 27.17/32 dance sessions.

*Device-assessed physical activity.* Mean accelerometer wear time was assessed at all 5 time points. Wear time ranged from 18.33 hours to 20.07 hours, and days worn ranged from 7.50 to 8.85 days. The repeated measured ANOVA demonstrated no time or time x group effects for all of the time points. When assessing effect sizes, the midpoint analysis (month 0 – month 2) revealed a medium effect ( $d = .68$ ) which was driven by dance participants' increase in activity

counts (+251.81 CPM/day vs -71.33 CPM/day). The month 0 to month 4 analysis revealed a small effect ( $d = .40$ ) that was driven by decreases in activity counts in the dance group, suggesting that changes made during the first two months were not maintained for the remaining duration of the intervention. During the maintenance period, dance participants experienced a small effect ( $d = .19$ ), in which dance participants returned to baseline activity levels (Table 2).

*Cardiorespiratory Fitness:* The results of the repeated measures ANOVA indicated a significant time effect at midpoint and at month 0 – month 4 in which both groups improved their cardiorespiratory fitness, ( $F_{1,19} = 24.06, P = .001, \eta^2 = .56$ ). Interaction effects were not significant; however, a small effect size driven by improvements in cardiorespiratory fitness in the dance group at month 0-month 4 was observed, ( $d = .25$ ). During the maintenance period, dance participants experienced a large effect size,  $d = 1.01$ , in which dance participants significantly decreased their CRF levels ( $t(9) = 3.31, p = .01$ ).

*Device-assessed sedentary behavior.* Mean ActivPAL wear time was assessed at all 5 time points. Wear time ranged from 7.49 to 8.77 days. The repeated measures ANOVA revealed no time or time x group effects for all of the time-points. When assessing effect sizes, the midpoint analysis revealed small effects for sitting time and light activity which was driven by the control group's decrease in sitting time and the dance group's decrease in light activity, ( $d = .25, .25$ ).

Small effects were also observed in MVPA, steps, and breaks, which were driven by improvements in these outcomes among the dance group. The month 0 – month 4 analysis revealed a small effect for sitting time, driven by a reduction in sitting time in the wait-list control, and the effect sizes for light activity, MVPA, steps, and breaks were insignificant.

*Self-reported sedentary behavior.* The repeated measures ANOVA reveal no time or time x group effect in the midpoint analysis. During month 0- month 4, there was a significant time

effect for weekday sedentary time, ( $F_{1, 19} = 18.71, P = .001, \eta^2 = .50$ ) in which both groups decreased their sitting, time and a significant time x group effect, ( $F_{1, 19} = 4.87, P = .04, \eta^2 = .20$ ). There were large effect sizes during the midpoint analysis and the month 0- month 4 for weekday sitting, which were driven by greater decreases in sitting time in the wait-list control. A small effect was seen at midpoint for weekend sitting time that was driven by decreases in the wait-list control group's sitting time. During the maintenance period, the dance group experienced small – medium effects in which participants continued to decrease weekday and weekend sedentary behavior, respectively.

### **Discussion**

This study assessed the impact of a Latin dance intervention on physical activity, CRF, and sedentary behavior among older Latinos attending an ADC. We found small-medium effect sizes favoring the dance group for accelerometer CPM, MVPA, steps, and breaks in which these outcomes improved during the first two months of the intervention suggesting that changes may occur rather quickly. However; participants did not maintain that trajectory for the remaining two months of the intervention for some of the outcomes (accelerometer CPM, MVPA, steps, and breaks), and participants returned to baseline levels during month 4 assessments. Additional behavioral strategies may be necessary during midpoint of the intervention to encourage participants attending an ADC to maintain physical activity and sedentary behavior changes. Notably, both groups did significantly improve in CRF during the month 0 – month 4 time points.

The increase in CRF by 1.77 metabolic equivalents in the dance group represents a large effect size; however, the wait-list control group also increased their CRF by 1.33 metabolic equivalents during the month 0-month 4 time point. Changes in CRF amongst the control group

may be due to participation in other activities at the ADC or possibly, but highly unlikely, contamination effects. Whether these improvements are attributed to the dance intervention or the ADC programming, increasing CRF amongst this population is important because increased CRF has been associated with better physical and cognitive functions in older adults (Barnes, Yaffe, Satariano, & Tager, 2003; Kaminsky et al., 2013). Furthermore, Martinez-Gomez and colleagues (2015) found that a 1-MET increase in non-exercise CRF is associated with a 20% lower mortality among older women. Interestingly, data comparing month 4 to month 8 indicate that dance participants decreased their CRF levels by 1.31 metabolic equivalents, suggesting that dance participants' CRF was maintained above baseline levels once the dance intervention ended. Thus, participating in dance may be important for maintaining CRF in this group of older Latinos attending an ADC.

Self-reported weekday sedentary behavior data showed that dance participants self-reported a decrease in sedentary behavior by 1.3 hours from month 0 – month 4 while the wait-list control group self-reported a decrease in sedentary behavior of 4 hours. Thus, all participants were self-reporting less time spent sedentary; however, this did not correspond to the ActivPAL sitting data. According to the ActivPAL sitting data, dance participants had reduced sedentary behavior by 9.6 minutes, while the wait-list control group reduced their sedentary behavior by 43 minutes. Dance participants continued to self-report even less sitting time during the maintenance period; however, their month 8 ActivPAL sitting data showed that they were sitting twice as much as what they were self-reporting. Our findings are contrary to the literature in which most self-reported data estimate daily sedentary time two hours greater than what is measured by the accelerometer (Marshall et al., 2015; Rosenberg, Bellettiere, et al., 2015). However, Rosenberg and colleagues also found that older adults were underreporting their sitting

time on the SBQ in comparison to both the accelerometer data and ActivPAL data (Rosenberg, Gell, et al., 2015). To the best of our knowledge, no studies have examined device-assessed and self-reported sedentary behavior among older Latinos. Thus, using device-assessed and self-reported measures to assess sedentary behavior among older Latinos need further exploration in order to determine whether older Latinos over-report or under-report their sedentary behavior in comparison to their device-assessed sedentary behavior.

Current data suggest that older Latinos do not participate in the recommended levels of moderate-to-vigorous physical activity and participate in high levels of sedentary behavior (Marquez et al., 2010; Merchant, Buelna, Castaneda, et al., 2015; Sisson, Camhi, Tudor-Locke, Johnson, & Katzmarzyk, 2012; Vásquez et al., 2017). However, our data indicate that participants were already engaging in more than 30 minutes of moderate-to-vigorous physical activity at baseline even though participants were screened about their physical activity participation prior to enrolling in the study. The intervention also began in June, and the maintenance period was from October-February. Despite the maintenance period taking place during the Chicago fall/winter months, dance participants maintained their high MVPA levels throughout this time period, thus weather did not seem to impact physical activity levels. These high activity levels may be attributed to attending a culturally tailored ADC; therefore, we may have not seen the full impact that Latin dance has on older Latinos due to ceiling effects. The data, however, provide evidence on how attending an ADC may influence physical activity, sedentary behavior, and CRF. It appears that for this sample at least, the ADC is providing the appropriate programs and activities for older Latinos to participate in more than the recommended amount of moderate-to-vigorous physical activity. The activities that the ADC offered were dance parties, folkloric dancing, walking after lunch and other aerobic activities.

Further research should be conducted among other ADCs in order to determine if most older adults attending ADCs meet physical activity recommendations or if these findings were unique to this particular ADC.

The present study has several notable strengths. First, this study assessed physical activity, sedentary behavior, and CRF using a mixture of device-assessed and self-reported measures among older Latinos attending an ADC. As such, we have demonstrated that older Latinos who attend an ADC have high compliance to wearing accelerometers on their wrist, wearing an ActivPAL continuously for ~7 seven days, and are able to answer questions about their sedentary behavior and level of physical activity. Furthermore, we were able to assess maintenance of physical activity among the dance participants during months 6-8. To the best of our knowledge, no studies have assessed these outcomes among this population, and studies examining ADC participants have mostly examined non-Latino whites (Anderson et al., 2013). These outcomes could be important not only for older Latinos themselves, but also, for ADCs and stakeholders who deliver services to older adults. These data could serve as an indicator of how well their programming is affecting their participants and could provide information as to whether they need to modify their programming so that their participants are more active and less sedentary. Another strength of the study was that it took place at the ADC as opposed to a university setting, thus eliminating transportation and access barriers that participants may face when enrolling in a study.

Limitations of this study include the small sample size and competing activities in the ADC. Because all participants were exposed to the enriched ADC environment, the control group also had many opportunities to participate in other physical activities while the dance intervention was going on. Thus, we were comparing our dance intervention to a rich array of

other programming that was offered by the ADC. Given that the dance and control groups attended the same ADC and had similar changes in CRF, it cannot be ruled out that contamination occurred. Although the researchers did ask participants to not share information with other participants, participants may have still shared information. Future studies may consider randomizing groups to different ADCs and randomizing ADCs to different conditions (Keogh-Brown et al., 2007). Another limitation of the study was that the participants were already meeting physical activity guidelines at baseline even though the exclusion criteria indicated that participants engage in less than 150 minutes of self-reported exercise. Participants may have not perceived some of their activities (i.e., folkloric dancing) as exercise, thus underreporting their minutes of exercise. Such high levels of physical activity may explain ceiling or floor effects observed in physical activity and sedentary behavior outcomes. Future studies may consider using mixed methods (i.e., interviews and activity monitors) when assessing the impact of physical activity interventions. Such information could provide insight on how participants' perceptions about physical activity compares to device-assessed physical activity.

In conclusion, these results warrant further research in the study of the impact of a Latin dance program and its impact on physical activity and sedentary behavior related outcomes among older Latinos attending an ADC. However, this study demonstrates that ADCs may play a critical role in promoting moderate-to-vigorous physical activity as evidenced by the high levels of physical activity between both groups throughout the course of the intervention. Future studies may consider testing the BAILAMOS© program in an ADC that is not currently offering dance as part of their programming. Furthermore, researchers may also consider implementing strategies during midpoint of the program in order to encourage participants to continue

increasing physical activity and reducing sedentary behavior. Researchers interested in achieving significant reductions in sedentary behavior may create interventions that place a greater focus on sedentary behavior while still emphasizing the importance of moderate-to-vigorous physical activity.



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