BAILA TECH – Technology and Exercise in the Hispanic Community

BY

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THESIS

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IGM

Contribution of authors

Chapter 1 is an introduction that provides some background of my research studies and states the relevance of the studies. Chapter 2 is a brief literature review that leads reader to understand the problem and how the studies aimed to assess and address some of the current gaps in the literature. Chapter 3 is an unpublished manuscript of the formative qualitative study using focus groups for which I was the Principal Investigator where conceptualized and wrote the project proposal, submitted an Institutional review Board application, recruited and screened participants. I was also the note taker during the focus groups, and I was the resolved issues with themes agreement. Dr. David Marquez was involved in conceptualizing the study, and oversaw study procedures and writing. Ms. Brenda Munguia and Jackelyn Cantoral were involved in data analysis and assisted with literature review and writing. Dr. Susan Buchholz provided insights in data analysis and writing. Drs. Eduardo Bustamante, Spyros Kitsiou, and Ben Gerber provided feedback in the writing. Chapter 4 is also an unpublished manuscript that describes the feasibility study of the BAILA TECH intervention. I was the Principal Investigator where conceptualized and wrote the project proposal, submitted an Institutional review Board application. I planned and oversaw recruitment, screening, and testing participants. I was actively involved in the intervention delivery and feasibility data collection. I analyzed the data and wrote the manuscript. Dr. David Marquez was involved in conceptualizing the study, and oversaw study procedures and writing. Drs. Eduardo Bustamante, Spyros Kitsiou, Ben Gerber, and Susan Buchholz contributed with the study design and procedures, and provided feedback in the writing. Chapter 5 is also an unpublished manuscript that describes the impact of the BAILA TECH intervention in health outcomes. This analysis is from the same study, where I was the Principal Investigator, I conceptualized and wrote the project proposal, submitted an Institutional review Board application. I planned and oversaw recruitment, screening, and testing participants. I was actively involved in the intervention delivery and feasibility data collection. I analyzed the data and wrote the manuscript. Dr. Susan Aguinaga was involved in data analysis. Dr. David Marquez was involved in conceptualizing the study, and oversaw study procedures and writing. Drs. Eduardo Bustamante, Spyros Kitsiou, Ben Gerber, and Susan Buchholz contributed with the study design and procedures, and provided feedback in the writing.

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LIST OF ABBREVIATIONS

App	Mobile application
BARSE	Barriers self-efficacy
BMI	Body Mass Index
CHAMPS	Community Healthy Activities Model Program for Seniors
COPD	Chronic Obstructive Pulmonary Disease
CRF	Cardiorespiratory Function
GPS	Global Positioning System
HIPAA	Health Insurance Portability and Accountability Act
HR	Heart rate
LSE	Lifestyle Self-Efficacy
LPA	Light Physical Activity
LTPA	Leisure Time Physical Activity
mHealth	Mobile Health
MMSE	Mini Mental State Examination
MPA	Moderate Physical Activity
MVPA	Moderate-to-vigorous Physical Activity
PA	Physical Activity
PI	Principal Investigator
RPE	Rate of Perceived Exertion
SF-12	Short Form Health Survey
SMART	Specific, Measurable, Attainable, Realistic, Timely
SB	Sedentary Behavior
SBQ	Sedentary Behavior questionnaire
U.S.	United States of America
VPA	Vigorous Physical Activity

SUMMARY

Six focus groups were conducted with 27 Latinos 55 years and older who owned a cell phone to identify older Latinos' perceptions and experiences with technology and PA, and to guide the development of a culturally-appropriate mobile health-infused dance intervention protocol for older Latinos using text messages and wearable devices. At the discussions participants were presented a Fitbit and were asked about their perceptions about the wearable. Discussions were recorded, transcribed verbatim in Spanish, and translated to English. Directed content analysis was conducted. Participants reported being aware of PA benefits, and mentioned dancing as a pleasant type of PA. Many participants perceive technology as a needed resource; however, few participants were against technology. Many participants wanted to learn how to use text messages. Participants reported the need of guidance when learning a new technology. Although a few participants said it was an unnecessary tool, most participants were interested in using the PA wearable tracker.

A single group feasibility study was conducted for 16 weeks with 20 Spanish-speaking middle-aged and older Latinos who had a smartphone. Participants were tested at baseline and post intervention. Questionnaires assessed physical activity, sedentary behavior, social support for exercise, physical activity self-efficacy, physical and mental health, and executive function. Participants received a Fitbit® Charge 2 at an orientation session and were asked to wear the Fitbit for at least 10 hours/day for 19 weeks (16 weeks of the program + two baseline weeks and one post testing week) and received text messages for the last 12 weeks of the program. The intervention was held twice a week, for two hours each session. The first 30 minutes were devoted to a technology class, followed by one hour of the BAILAMOS© Latin dance program, and an extra 30 minutes of technology practice. Technology sessions were developed to assist with participants' understanding of the Fitbit device and mobile application. Feasibility was assessed by recruitment capability; acceptability and suitability; and resources.

Twenty participants (100%) wore the wearable for the 19 weeks, and 17 participants (85%) completed the dance program. Participants reported great enjoyment of the program and stated the dance, technology classes, and the support from peers and from the instructors were essential. Large effect sizes were observed for self-reported light PA (d = .93), moderate PA (d = 1.19), and moderate-vigorous PA (d = 1.05). Medium effect sizes were observed for device-assessed moderate-vigorous PA (d = .69), and small effect sizes for device-assessed steps (d = .45). Thus, a mobile health-infused dance program appears feasible for middle-aged and older Latinos.

I. INTRODUCTION

A. Background and Rationale

Middle-aged and older Latinos are a significant proportion of the U.S. population, with more than 21 million Latinos 55 years and older living in the U.S. (Bureau, 2015). Latinos are the fastest growing minority group in the US, and older Latinos are the fastest growing segment of older adults (Department of Health and Human Services, 2017). Older Latinos have high risk of chronic diseases, and low levels of leisure time physical activity (LTPA) (Daviglus et al., 2012). On top of the deleterious effects of aging and lack of physical activity (PA), research has shown that even for active people, sedentary behavior (SB) is an additional health risk (Evenson, Buchner, & Morland, 2012). Older Latinos spend 8 hours per day on average in sedentary time (Evenson et al., 2012). Less than 30% of older American adults meet the PA Guidelines (U.S. Department of Health and Human Services, 2008) of engaging in 150 min/week of moderate PA (Troiano et al., 2008).

Research has shown that older Latinos do not commonly engage in formal types of PA, and walking and dancing are cited as the types of PA older Latinos engage the most (Marquez, Bustamante, Aguinaga, & Hernandez, 2015; Marquez, Neighbors, & Bustamante, 2010a). Based on the public health need of engaging older Latinos in PA, a culturally appropriate dance program for older Latinos (BAILAMOS©) was developed by Dr. Marquez and an accomplished Latin dance instructor (Marquez et al., 2014).

Our previous work has incorporated dance as a culturally appropriate form of LTPA that uses motor and cognitive skills, and can provide social engagement (Marquez et al., 2015). BAILAMOS© is a 4-month Latin dance program for middle-aged and older Latinos that is held twice a week for one hour each session. Classes are offered in four dance styles: merengue,

bachata, cha cha cha, and salsa. Evidence from a feasibility pilot and a small randomized controlled trial provide preliminary support for the impact of BAILAMOS© on PA and cognitive functioning (Marquez et al., 2017). A pilot trial has demonstrated a main effect for global cognition for participants in the dance program, compared to a health education control group. It has also shown a group x time interaction for episodic memory, with a greater improvement in episodic memory in the dance group (Marquez et al., 2017). Although BAILAMOS© offers an age- and culturally-appropriate type of PA, participants who only participate in PA via the dance program, do not meet the recommendations of 150 min/week of moderate PA (U.S. Department of Health and Human Services, 2008), mainly because of lack of PA on non-dance days.

The Latino population has been gaining access to technologies, and is familiarized with text messaging; however, low education levels, low literacy and age-related disabilities are barriers to the use of technologies, especially among older Latinos (Bender et al.,, 2016; Gell et al., 2013; Victorson et al., 2014). These barriers reinforce the need of developing mobile health intervention for the Latino population, so language, culture, and literacy concerns are targeted. Low text and visual features are among the cited strategies to use in mobile health with the Latino population (Bender et al., 2016).

According to the Pew Research Center (2017) 98% of the Latino population in the US own a cell phone (75% own a smartphone). Smartphone ownership is also growing even among those with low income, and 50 years and older (64 and 74%, respectively) (Pew Research Center, 2017). One study reported that the use of text messaging to motivate PA participation among older Latinos is feasible (Collins et al., 2013). However, almost all studies using mobile health technology (mHealth) to increase PA have involved non-Latino participants (Buchholz et al., 2013).

Various types of mHealth technologies, such as text messaging and wearable devices are being implemented in behavior change interventions for assessment of and prompting PA in older adults (Sullivan & Lachman, 2017). Research delivering interventions with technology

devices to middle-aged and older adults are showing promising results. Text message prompts are assisting middle-aged and older adults to engage in PA (Lilje et al.,, 2017). Wearables are reported to be acceptable and useful for middle-aged and older adults (Mercer et al., 2016; O'Brien et al., 2015); and feasibility has been shown in a randomized trial (McMahon et al., 2016).

Interventions including technology as a delivery method suggest that its use has positive outcomes in behavioral change and can increase adherence to PA interventions (Fjeldsoe, Marshall, & Miller, 2009; Hyun Kim & Glanz, 2013). Wearable devices, such as the Fitbit® (Fitbit, Inc., San Francisco, California, USA), automatically track step counts and allow participants to monitor their PA participation using a smartphone application (Diaz et al., 2015). There is an increase in research using wearable devices (Ainsworth et al., 2015; Diaz et al., 2015; Evenson, Goto, & Furberg, 2015; Mercer et al., 2016). There is evidence to support the validity of wearables on step counts and energy expenditure, mainly in activities such walking and running (Diaz et al., 2015; Evenson et al., 2015). Research has shown that wearables are a promising tool for increasing PA (Alley et al., 2016; Wang et al., 2015, 2016), even for middle-aged and older adults (Mercer et al., 2016).

Mobile health interventions targeting the Latino population should also incorporate important Latino cultural values, such as the importance and role of family and religion, and gender roles (Victorson et al., 2014). Based on the literature with older adults and technology (Lilje et al., 2017; McMahon et al., 2016; Mercer et al., 2016; O'Brien et al., 2015) we believe that incorporating technological components (Fitbit and text messages) to the BAILAMOS© program can increase PA engagement on non-dance days and so a feasibility trial is needed.

Research on feasibility studies are growing. Feasibility studies are conducted for several reasons, such as to test a study protocol, to estimate sample sizes, to test study procedures, and to determinate acceptability of an intervention (Lancaster, Dodd, & Williamson, 2004). Researchers are developing and reporting recommendations to design and assess feasibility

studies as this type of study is not usually published due to lack of structured guidelines to evaluate feasibility (Craig et al., 2008; Lancaster, 2015; Lancaster et al., 2004; Orsmond & Cohn, 2015; Thabane et al., 2010). The focus of feasibility studies is recommended to be placed on assessing the different aspects of the proposed study and intervention, and not in testing efficacy (Lancaster, 2015a). Common aspects to be analyzed in feasibility studies include recruitment and consent rates estimations, evaluation of data collection and randomization procedures, and define proper desired outcomes (Lancaster, 2015; Orsmond & Cohn, 2015). Feasibility studies precede large-scale efficacy interventions.

As the use of technology is increasing among the Latino population, and older Latinos are not commonly involved in research, including technology in research studies with older Latinos can assist in reducing the digital divide. Moreover, this study will help form the basis for a culturally- and age- relevant mHealth PA intervention for this group. Thus, we proposed to determine the feasibility (recruitment capability; acceptability and suitability; and resources and management) and preliminary impact of a dance program for older Latinos with technological components (BAILA TECH - *Tecnología y Ejercício en la Comunidad Hispana*).

B. Significance and Relevance

The innovation of the proposed study relies on testing the different components of the feasibility of the dance intervention with technological components, and its preliminary outcomes. We aim to conduct an mHealth intervention with dance for middle-aged and older Latinos, and assess the different metrics of the feasibility process. To the best of our knowledge, there was no intervention with middle-aged and older Latinos in an age- and culturally- appropriate dance program that used wearables and text messages. Rigorous feasibility studies are an emerging area, and we are not aware of a strict feasibility study with middle-aged and older Latinos, dance intervention, and mHealth.

The BAILAMOS© program was innovative due to the rigorous development process with contributions from experts in research and in the field, and with feedback from older Latinos. Each session was created to challenge participants both physically and cognitively, and to promote social engagement.

Even though the program provides strict elements to promote PA engagement, participants would have to seek additional strategies to achieve national PA Guidelines. mHealth such as smartphones, mobile applications (apps), and wearable activity trackers are being increasingly used in research to provide participants with additional components of the research with reduced costs (Direito et al., 2016).

Research has shown that Fitbits, text messages, and fitness technology apps increase PA (Hall, Cole-Lewis, & Bernhardt, 2015; Sullivan & Lachman, 2017; Wang et al., 2015, 2016). Middle-aged and older adults participating in research have demonstrated acceptance of using Fitbits and text messages (Collins et al., 2013; Mercer et al., 2016). Our formative work with focus groups also support the implementation of these new components to the BAILAMOS© program. To the best of our knowledge, there was no other study where participants socialize and share experiences using Fitbits. Our BAILA TECH proposal included the growing segment of middle-aged and older Latinos in a culturally appropriate PA intervention using dance and promising mobile technologies.

Specific Aim 1: To identify perceptions and use of technology among older Latinos and to identify older Latinos' suggestions about a dance program using text messaging and wearables.

Hypothesis 1: There is high use but mixed positive and negative perceptions toward technology among middle-aged and older Latinos.

Specific Aim 2: To determine the feasibility (recruitment capability; acceptability and suitability; and resources and management) of the BAILA TECH program.

Hypothesis 2: The feasibility of the BAILA TECH program will be evidenced by ≥15% recruitment rate; adherence to the program of ≥ 50% attendance to the dance classes, and

Fitbits being worn for ≥ 50% of days; retention rate of 70%; intervention costs of roughly (~$350 per participant); and positive feedback on the program and the technology from the post intervention debriefing session and program evaluation will reflect program acceptability, satisfaction, and demand.

Specific Aim 3: To determine the preliminary impact of the BAILA TECH program in older Latinos' lifestyle PA, and on sedentary behavior, executive function, PA self-efficacy and social support, and physical and mental health.

Hypothesis 3: The intervention will yield small-medium effect sizes reflecting improvements in pre- and post-intervention measures of PA and sedentary behavior (self-report and device-assessed), executive function, PA self-efficacy and social support, and physical and mental health.

II. LITERATURE REVIEW

A. Aging and Physical Activity

The U.S. older adult population is growing quickly, and it is expected to reach 83.7 million by 2050 (Ortman, Velkoff, & Hogan, 2014). Healthy ageing is defined as “the process of developing and maintaining the functional ability that enables well-being in older age” (World Health Organization, 2015), and it is an important goal to be reached not only to the older people and their relatives, but also to reduce health care costs.

One study aimed to identify healthy ageing predictors and the results highlighted the importance of two indexes: lifestyle (physical activity, healthy diet and others) and psychosocial (social participation, including leisure, and social networking) (Sowa et al., 2016). Regular physical activity (PA) is associated with important health benefits, such as reduced risk of cardiovascular diseases, colon and breast cancers, type 2 diabetes, and depression (U.S. Department of Health and Human Services, 2008). Evidence has also shown that regular PA is safe for healthy and for frail older people (McPhee et al., 2016).

Current U.S. National guidelines recommend engaging in PA to acquire health benefits. Adults (> 18 years) should participate in at least 150 minutes of moderate-intensity aerobic PA weekly, at least 75 minutes of vigorous-intensity aerobic activity (U.S. Department of Health and Human Services, 2008).

Walking is an acceptable and appropriate PA intervention for older adults, and having someone to walk with facilitate engagement in walking (Victor et al., 2016). With the new technological tools to track PA new guidelines and recommendations are being suggested in regards to step counts. Older adults are recommended to reach 8,000 steps per day; however, this goal can be easily achieved by some, and be very difficult for others, depending on one’s health conditions. An approach that is becoming popular is “better than usual approach” or

“something is better than nothing” (Tudor-Locke et al., 2011; U.S. Department of Health and Human Services, 2008). Indeed, a study showed that meeting the PA recommendations was associated with lower risk of death, but also engaging in PA even if less than the recommendations can provide benefits (Leitzmann et al., 2007).

Research has also shown that breaking sedentary time with engagement in bouts of 10 minutes of PA can be beneficial for sedentary people (Powell, Paluch, & Blair, 2011). Sedentary behavior (SB) is defined as “any waking activity characterized by an energy expenditure ≤ 1.5 metabolic equivalents (METs) in a sitting or reclining posture” (Merchant et al., 2015), that includes commuting time, in the workplace, in the household, and in leisure activities (Owen et al., 2010). Research on SB is an emerging topic; however, there is already a consistent understanding that long periods of sedentary time is deleterious even for those who achieve the PA recommendations (Merchant et al., 2015; Owen et al., 2010).

Despite the health benefits of PA, few people are actually active. About only 30% of older adults in the U.S. meet PA guidelines. As 11.1% of aggregate health care expenditures in the U.S. during 2006–2011 were associated with physical inactivity (Carlson et al., 2015), the inactivity cost was estimated $53 billion (Ding et al., 2016). Besides costs, it is estimated that 6 –10% of worldwide deaths from non-communicable diseases are due to physical inactivity (Lee et al., 2012).

Although the prevalence of physical inactivity gradually declined over the past three decades in the majority of U.S. states, a substantial proportion of American adults remain physically inactive (Troiano et al., 2008). On the contrary significant health benefits can even be seen among older adults who became physically active relatively late in life (Hamer, Lavoie, & Bacon, 2014). Thus, older adults may be encouraged to increase their PA by programs in their neighborhood, and also by low cost and enjoyable activities, group-based activities, and by having family or friends support (McPhee et al., 2016).

B. Older Latinos and Physical Activity

According to a 2008 report of the U.S Census Bureau, Latinos were the largest minority group accounting for about 15% of the American population (U.S.Census Bureau, 2008). Middle-aged and older Latinos are a significant proportion of the U.S. population, with more than 21 million Latinos aged 55 and older living in the U.S. (Bureau, 2015). Older Latinos have high risk of developing chronic diseases (Daviglus et al., 2012). There are higher mortality indices of Latino immigrants compared to the total U.S. population for diabetes, chronic liver disease and cirrhosis, HIV mortality, and cervical, liver, and stomach cancer, as well as for work-related injury and homicide (Vega, Rodriguez, & Gruskin, 2009).

Among Latino adults living in the U.S., adults of Mexican background were the least sedentary (11.6 h/day), and Dominicans were the most sedentary (12.3 h/day) (Merchant et al., 2015). Older adults' mean of sedentary time was also the least for Mexican American at age 50-64 (11.6 h/day) and 65-74 (12.5 h/day) compared to other background (11.7 – 12.2 h/day and 12.8 – 13.1 h/day, respectively) (Merchant et al., 2015).

Latinos traditionally report lower levels of leisure time PA compared to non-Latino whites (Marquez et al., 2010a). Indeed, 67.6% of Latinos from Texas did not meet PA recommendations (Bautista et al., 2011). Studies have shown that non-Latinos blacks and Latinos were more inactive during their leisure time than were non-Hispanic whites (Marquez et al., 2010; Marshall et al., 2007). For all racial/ethnic groups, the highest prevalence of inactivity was among Latinos 65 years and older (Marshall et al., 2007).

In another study Mexican American adults 60 years old or more had the highest levels of physical activity, according to counts per minute or duration of moderate – or greater intensity activity counting every minute (Troiano et al., 2008). The inclusion of occupational and transportation activity in the objective measure may explain why Mexican American adults had the highest levels of physical activity, as Latinos expend more energy at work than other racial/ethnic groups (Marquez et al., 2010a; Troiano et al., 2008)

Lack of motivation after intensive hours of work, lack of time because family responsibilities, and unsuitable weather were cited by Latinos as barriers to participate in PA (Greaney et al., 2012). Lack of transportation and access to facilities are also barriers to engagement to leisure-time PA faced by Latinos (Juarbe, Turok, & Pérez-Stable, 2002). Perceived neighborhood walkability was associated with engaging in physical activity (Silfee et al., 2016). A study with Latinos from two groups in South Texas showed that the perceived barriers to exercise were “lack of time”, “too tired”, “lack of self-discipline”, “lack of child-care to be able to exercise”, lack of a safe and convenient place to do exercise,” “lack of equipment/accessories,” “lack of knowledge about exercise”, and “don’t like to do exercise/or I think exercise is boring” (Bautista et al., 2011).

As low education and low income are factors associated with lower levels of PA, these factors also play a role in Latinos’ low adherence to PA. The number of Latinos quitting high school education has been decreasing throughout the years, as in fact 12% of Latinos had left high school in 2014 (Krogstad, 2016). However, in comparison to other ethnic groups Latinos still remain having one of the largest percentages in withdrawing from a high school education (Krogstad, 2016). In 2014, statistics depicted only less than 2 million of foreign born Latinos beyond the age of 25 receiving a bachelor’s degree or higher while this number was larger for white non- Latinos, almost 50 million (Stepler & Brown, 2016).

More than four million foreign born Latinos 16 years and older who worked in the U.S. were compensated salaries ranging from $20,000 to $49,999 in 2014 (Stepler & Brown, 2016). In 2014, 24% of Latinos had the probability of reaching poverty (Pew Research Center, 2016). Being low income, especially living at poverty level can be a major struggle to accessing resources, and to engage in PA.

One study had shown that English proficiency is associated with education level income, and health insurance coverage. Only 20.7% of Latinos who had limited English proficiency had more than a high school degree, 48.5% had an annual income >$20,000/year, and 60.3% were

continuously insured (August & Sorkin, 2011). Therefore, it is important to understand barriers older Latinos experience to engage in PA and in order to provide strategies to increase PA participation among these population.

C. Technology and older adults

Although communication and searching for information are among the most common technology uses for older adults, they are willing to learn about technology and explore other utilities of mobile phones, computers and the Internet (Chen & Chan, 2013; Mitzner et al., 2010; Wagner, Hassanein, & Head, 2010; Ware et al., 2017). There is growing research on older adults' use of technology reporting that calls and text messages to communicate with family and friends are the most common features used on mobile phone (Redfern et al., 2016).

Text messages have also been used to provide health information in recent trials, but many older adults were not regular users of messaging, even those with adequate health literacy. Participants still reported messages were easy to use and convenient; however others mentioned how this delivery methods seems not personal, invasive, or for younger generations (Redfern et al., 2016). Text messages have also been used to increase PA by providing health information, and serve as reminders to initiate behavior change; however, there is need for tailored messages to support individual goal monitoring (Morton et al., 2015).

Even among older adults, text messages were an effective tool to assist with increasing PA (Parker & Ellis, 2016). Text messages were the most frequently used intervention delivery channel identified in a systematic review. It showed that the majority of studies reported at least one significant positive effect on PA or diet outcomes, and 50% of the interventions were effective in promoting PA (Müller et al., 2016).

Smartphones are proving to be a multi-purpose tool and are changing daily tasks such as utilization for employment opportunities, social relationships, finding information, accessing reading materials, and online shopping (Rainie & Perrin, 2017). They may be useful to help

increase PA through the use of mobile applications (apps). Sensors and mobile health apps are used to monitor and help to modify health behaviors, including step count.

Physical activity trackers such as pedometers and wearables, are devices that track step counts, and may support behavior change through education, PA feedback, and assist with accountability (Gualtieri, Rosenbluth, & Phillips, 2016). A study showed that participants who increased PA reported that the goal-setting components of the intervention supported the change in PA (Victor et al., 2016).

A systematic review analyzed studies where interventions with technology were used (e.g. website-based interventions, telephone-based interventions, text messaging-based). All interventions comprised tailored PA recommendations and the great majority encouraged PA tracking either with a tracking device or an online diary. They were compared to non-technology interventions (e.g. print interventions) or non-intervention groups. They found that interventions using technology can effectively promote PA in older adults aged 55 years and above in the short-term, while evidence for long-term effects is lacking. However, the results were inconclusive regarding the question of whether mHealth interventions have a greater impact on PA behavior among older adults than non-technology interventions (Muellmann et al., 2018).

Sensors and mobile health apps are used to monitor and help to modify health behaviors, but their costs and the necessary technological skills to operate the devices can be barriers to vulnerable populations, older adults, racial and ethnic minorities, poorly educated individuals, and low-income earners, exactly who could benefit most from these technologies (Alley et al., 2016).

A study showed that some participants do not have a positive impression when they are presented with a wearable by mentioning expressions like “a fashion trend,” “a gimmick,” or what “snobby people wore” to maintain “an air of superiority”. However, with initial use 80% of participants reported positive perceptions with PA tracking features of the device. Participants also reported that the device assisted with encouraging PA engagement by not “making

excuses for not being active” or by challenging themselves based on data from the previous day. Informal discussions and peer support were provided in the study, and 70% of participants stated the discussions and support were essential for positive use of the PA tracker. Group discussions focused on sharing successes and fails with the PA tracker to provide opportunities for learning, and also on strategies to increase PA levels (Gualtieri et al., 2016).

Even though wearable PA trackers can assist with increasing PA levels, having additional support might encourage prolonged use of the tracker and promote maintenance of PA levels (Alley et al., 2016). Formal training might be needed in interventions to guarantee participants are able to explore all the features and leverage to behavior change.

III. OLDER LATINOS' PERCEPTIONS OF PHYSICAL ACTIVITY AND TECHNOLOGY

Isabela G. Marques, Jackelyn Cantoral, Brenda Munguia, Susan W. Buchholz, Spyros Kitsiou, Eduardo E. Bustamante, Ben S. Gerber, David X. Marquez

A. Abstract

The U.S. older adult population is growing rapidly, and it is expected to reach 83.7 million by 2050. Technology is advancing exponentially, as new devices and features are released daily. Mobile health (mHealth), the application of mobile technology in health care and public health, has become increasingly popular for measuring and encouraging physical activity (PA) in recent years; however, little research has been done with older Latinos. The purpose of this study was to identify older Latinos' perceptions and experiences with technology and PA. This was an exploratory qualitative study to guide development of a culturally-appropriate mHealth-infused dance intervention for older Latinos using text messages and wearable devices. Six focus groups were conducted with Latinos 55 years and older who owned a cell phone. Participants were recruited from a primarily Latino neighborhood in Chicago. Participants were asked about their overall perceptions and experiences with PA and technology using a moderator guide. Participants were also shown a PA wearable device and asked about their perceptions about the wearable. Discussions were recorded, transcribed verbatim in Spanish, and translated in English. Directed content analysis was conducted. Twenty-seven Latinos (n=14, M age 68.07, 52% female) participated in the discussions. Four themes - beliefs/attitudes, benefits/facilitators, barriers, and concerns - emerged in regards to four topics: physical activity, technology in general, text messages, and wearable activity tracking devices. Participants reported being aware of PA benefits, and mentioned dancing as a pleasant type of PA. Several health personal benefits from PA were cited, including pain and stress relief. Lack

of motivation and companionship were the main barriers for PA engagement. Fear of injury was cited as a concern to participate in PA. Many participants perceive technology as a needed resource as it facilitates communication and information acquisition. Few participants were against technology usage as it is changing social relationships and replacing jobs. Lack of skills and need of guidance were mentioned as the main barriers for technology adoption; and vulnerability and addiction were the main concerns with the use of technology. Participants were also concerned about technology increasing sedentary behavior, especially among children and youth. Many participants stated that text messages facilitate communication as it allows for late reply; however, they cited lack of skills for using text messages and expressed willingness to learn how to text. However, a few participants were not interested in text messages and stated that text messages contribute to impersonal relationships. When presented with a wearable device many participants mentioned it could be used as a motivational tool for PA engagement due to the feedback it provides, and how it contributes to self-monitoring and behavior awareness. A few participants said the wearable was unnecessary and represented consumerism, and expressed concerns with lack of privacy. Even though there are barriers and concerns to technology use, many participants perceived technology as a convenient resource that could assist with health promotion. Using text messages and wearables in PA interventions targeting older Latinos might be feasible.

B. Introduction

The U.S. older adult population is rapidly growing, and it is expected to reach 83.7 million by 2050. Maintaining high physical activity (PA) among older adults is essential for healthy aging (Sun, Norman, & While, 2013); however, about only 30% of older adults in the U.S. meet PA recommendations of engaging in 150 minutes of PA per week (CDC, 2014). Low levels of leisure-time PA (LTPA) are also correlated with sedentary behavior (SB) (Dogra et al.,

2017), and both low levels of PA and high levels of SB are health risk factors which are more prevalent among groups with low socioeconomic status (CDC, 2014).

Older Latinos are less likely to engage in LTPA compared to their non-Latino white counterparts (Marquez, Neighbors, & Bustamante, 2010), and older Latinos encounter cultural barriers to engaging in LTPA such as time constraints due to women's roles, lack of transportation and access to facilities (Juarbe et al., 2002). The use of technology to overcome barriers that older Latinos face to engage in LTPA can be a plausible strategy among this group.

Technology is advancing exponentially, as new devices and features are released daily. Technologies targeting and designed to assist older adults are called gerontechnology. Gerontechnology aims to provide assistance for healthy aging, promoting independency and social engagement (Chen & Chan, 2013).

Cell phone ownership among the Latino population increased from 76% to 86% between 2009 to 2012, and the number of Latinos who own a cell phone is similar to non-Latino black (90%) and white adults (84%) (Lopez, Gonzalez-Barrera, & Patten, 2013). Behavioral interventions have recently started to use text messages as a delivery method to reach participants more easily and intervention studies with older Latinos have been conducted (Burner et al., 2018; Collins et al., 2013).

Fitness technology, including PA trackers (wearables PA tracker) and smartphone applications (apps), have become increasingly popular for measuring and encouraging PA in recent years (Sullivan & Lachman, 2017). Wearables are electronic devices used for monitoring PA and other health-related metrics (e.g. heart rate), which are often connected to a smartphone or other device through Low-Energy Bluetooth (Evenson, Goto, & Furberg, 2015). Behavior change techniques such as self-monitoring, goal setting, feedback, rewards, and social factors are often included in fitness technology (Mercer et al., 2016; Sullivan & Lachman, 2017). Wearables have been used as facilitators of behavior change to increase LTPA. Older

adults have reported wearables as easy to use, convenient, and beneficial to their health (McMahon et al., 2016).

As the access and use of technology and cell phone ownership is becoming more prevalent among older Latinos, mHealth interventions can provide benefits for older Latinos. Research on barriers faced by older adults to adopt technologies has been conducted (Mitzner et al., 2010; Vaportzis, Clausen, & Gow, 2017); however, research specifically on older Latinos' experiences with technology are scarce to nonexistent. Thus, the purpose of this study was to identify older Latinos' perceptions and experiences with technology and PA. This was an exploratory qualitative study used to guide development of a culturally-appropriate mHealth-infused dance intervention for older Latinos using text messages and wearable devices.

C. Methods

Participants

Focus groups were conducted with middle-aged and older Latinos. Participants were recruited at a senior center and health fair from a primarily Latino neighborhood in Chicago. Eligibility criteria included: age of 55 and older, self-identify as Latino, speak Spanish, be cognitively intact assessed by the Mini Mental State Exam (MMSE) (>14/21) (Folstein, Folstein, & McHugh, 1975), and own a cell phone (smartphone not mandatory). Interested participants were screened for eligibility, and if eligibility criteria was met, they were scheduled for a focus group.

Instruments

A questionnaire on technology usage and LTPA engagement (Collins et al., 2013) was completed before the focus group. The moderator guide was divided into two sections. The first section asked broadly about (1) participants' perceptions of technology in general (likes and dislikes) (2) daily usage, (3) barriers for technology usage, (4) willingness to learn about a new

technology, (5) the impact of technology on health, (6) the impact of technology on PA, and (7) participants' engagement in PA. The second section of the discussion was devoted to refining a research protocol of a dance program for older Latinos with the incorporation of wearables and text messages. Participants were presented with a Fitbit® Charge HR™ wearable and the research team briefly explained its functions. Then participants were asked about their perceptions about the device, and encouraged to ask questions about it to form their opinions. Participants were also asked questions about how text messages might be used to motivate them to be more physically activity.

Procedures

The study was approved by the University of Illinois at Chicago Institutional Review Board. Discussions were held at the Pilsen Satellite Senior Center at Casa Maravilla, in Chicago, IL. The focus groups were conducted by a bilingual and bicultural moderator that followed a moderator guide with probing questions, and a research assistant was present to take field notes. Both research assistants were doctoral students in Kinesiology with an appropriate background in behavior change. Participants were compensated with $20 for their time. Discussions were audio-recorded and lasted between 50 to 70 minutes.

Analysis

Discussions were transcribed verbatim in Spanish and then translated to English by bilingual and bicultural research assistants. A transcription protocol was followed to ensure that a standardized approach was followed. A research assistant listened to the audio files while reading the transcripts to ensure the transcription and translation were appropriate. A directed content analysis was conducted (Hsieh & Shannon, 2005). Themes were derived from the data and relevant literature was used as a guidance for initial codes. A codebook was created, and there were different iterations that resulted in the final version of the codebook. Two research assistants coded the translated transcripts, and the PI made final decisions when

disagreements occurred. QRS NVivo qualitative analysis software (QRS International Pty Ltd, Melbourne, Australia) was used to assist with data management and coding.

D. Results

Twenty-seven participants comprised six focus groups (M age = 68, SD = 5.5, female n=14, 51.9%). Fourteen participants (51.9%) were married, and 23 (85.2%) were not working. Most participants were from Mexico 92.6% (n=25), and preferred speaking Spanish (92.6%). Twenty-one participants (81%) reported an annual household income of less than $20,000 (Table 1).

The most used cell phone function was making phone calls (n = 26, 96.3%); and the second most used function was for text messaging (n = 11, 40.7%). Forty-four percent sent a text message less than once a week (n = 12). Seventy percent of the participants (n = 19) felt comfortable with using their phone. Smartphone ownership was 66.7% (n = 18). Of the 18 smartphone users, only 61% (n = 11) accessed the internet on their cell phone (Table 2).

Participation in LTPA was 85.2% (n = 23). Dancing and walking were the most popular types of LTPA reported (48% and 44%, respectively). Twenty-five percent of participants reported spending 1 to 2 hours in LTPA (n =7), and 44.4% (n = 12) spent 3 to 7 hours a week engaging in LTPA (Table 3).

Table 1. Demographic characteristics

	Mean / n	**SD / %**
Age	69	5.5 (±)
Female	14	51.9 (%)
Married/partnered	15	55.6 (%)
Country of birth		
Mexico	25	92.6 (%)
U.S.	1	3.7 (%)
Ecuador	1	3.7 (%)
Years lived in the U.S	36.46	14.7 (±)
Age when immigrated	29.31	14.7 (±)
Preferred language		
Spanish	25	92.6 (%)
English	1	3.7 (%)
Both	1	3.7 (%)
Year of education		
Currently employed	4	14.8 (%)
Income		
Unknown	3	11.1 (%)
Low	17	63.0 (%)
Average	7	25.9 (%)
High	0	0 (%)
Annual income		
Unknown or declined	4	14.8 (%)
Less than $5,000	7	25.9 (%)
$5,000 - $10,000	1	3.7 (%)
$10,000 - $20,000	13	48.1 (%)
$20,000 - $40,000	2	7.4 (%)

Table 2. Technology usage among all cell phone users (n=27)

	n	**%**
Smartphone	18	66.7
How comfortable are you in suing your cell phone?		
Comfortable	19	70.4
Neutral	5	18.5
Uncomfortable	3	11.1
Most used cell phone function		
Calls	26	96.3
Text messages	1	3.7
Second most used cell phone function		
Text messages	11	40.7
Internet search	3	11.1
Apps	2	7.4
Music	1	3.7
No other usage	10	37.0
How often do you receive text messages?		
Less than once a week	8	29.6
Once a week	5	18.5
Once a day	8	29.6
Up to 5 times a day	3	11.1
More than 5 times a day	3	11.1
How often do you send text messages?		
Less than once a week	12	44.4
Once a week	5	18.5
Once a day	5	18.5
Up to 5 times a day	2	7.4
More than 5 times a day	3	11.1

Table 3. Participation in LTPA

	n	**%**
Regular participation in LTPA	23	85.2
Dancing	13	48.1
Walking	12	44.4
Aerobics	6	22.2
Weight lifting	5	18.5
Swimming	4	14.8
Biking	3	11.1
Running	2	7.4
Water aerobics	1	3.7
Yoga/Tai chi	1	3.7
Sports	1	3.7
Days/week in LTPA participation		
1 – 2 days	5	18.5
3 – 4 days	6	22.2
More than 5 days	11	40.7
Hours/week in LTPA participation		
Less than 1 hour	4	14.8
1 – 2 hours	7	25.9
3 – 4 hours	5	18.5
More than 5 hours	7	25.9

Focus groups results revealed four main themes: (a) beliefs/attitudes; (b) benefits/ facilitators; (c) barriers (d) and concerns, across four topics: physical activity, technology in general, text messages, and wearables in particular (table 4).

Table 4. Perceptions of physical activity, technology in general, text messages, and wearable

	Beliefs/Attitudes	**Benefits/Facilitators**	**Barriers**	**Concerns**
Physical Activity	- Awareness of LTPA benefits - Breaks in SB	Perceived health benefits from PA	- Lack of motivation - Lack of companionship - Lack of time - Distance to facilities - Weather	- Fear of injury
Technology in general	- Necessary - Unnecessary -Against technology usage	- Communication - Information - Advancements - Navigation	- Lack of skills - Need guidance - Need practice - Cost	- Lack of ability to learn - Vulnerability - Addiction - Risks for health - Increase in SB
Text messages	- Willing to learn - Not interested	-Allows later reply -Facilitate communication - Store information	- Impersonal communication - Lack of skills	- Car accidents
Wearables	- Motivational tool - Unsure about its usability - Unnecessary - Consumerism	- Self-monitoring - Awareness of behaviors - PA tracking - Providing feedback - Peer encouragement	- Cost	- Lack of privacy

Physical Activity

Beliefs/Attitudes

Participants mentioned that even though they are aware of the benefits, some of them are not able to regularly engage in PA. Those participants who do not regularly engage in PA are still aware of the deleterious effects of lack of movement, as one participant reported being aware of her sedentary time and taking action to break the sedentary time:

> "When I feel like I haven't exercised in a while, I go down the stairs because I feel like I can no longer move. I go to the store, a close one and I go walking. But that's when I want to. Because I know that it isn't healthy to not move" (female participant).

Benefits/facilitators

Participants were able to cite several health benefits of PA engagement, mainly pain relief and stress relief, but also improvements in blood circulation, mental health, memory and improvements in general health, and stated that they had experienced themselves some of these benefits, and some participants started PA after an aggravation of a health issue. They had reported physical, emotional and mental benefits of dancing.

> "If you guys look at my legs, they are all colored for the lack of movement. And diabetes because of the lack of circulation. But since I came to the dance, or I continue to dance, they are clearing up" (female participant).

> "I like dancing because you move your entire body. And it depends on each person, how they dance, some move more than others. And in that moment one laughs about everything and it relaxes you. And it feels more enjoyable that way" (female participant).

The topics on memory improvements and Alzheimer's disease prevention were specifically related to dancing "With dancing you are also working you brain, you are learning how to do the steps" (male participant). Although walking and swimming were also reported as types of PA they engaged in, the discussion on PA health benefits was focused on dancing as many participants reported participating in the dance classes offered at the senior center.

Barriers

The most common barriers to PA engagement were the lack of motivation and lack of companionship. A common statement was the awareness of the need to exercise but the lack of motivation. Some participants stated that they are only active if they are part of an exercise class. Lack of time was cited by only one participant.

> "There are classes offered but I get bored. What happens is that I lived a life full of intense work, I've been working since I was young. I was working my whole life, so until now I had not had time nor the opportunity to exercise because my

> life was only work. So, starting to exercise now… it would be more attractive to me to dance and not just exercising, and yes, I have tried [to exercise] but I leave because I'm not accustomed" (female participant).

This emphasizes that Latinos are not always used to formal types of PA, and that dance is a culturally-relevant type of PA. The winter weather in the U.S. Midwest was also mentioned as a barrier to engaging in PA, as most of the participants reported walking as a common type of PA. Even dancing participation can become difficult because commuting is need.

Lack of access to facilities to engage in PA was cited by one participant who stated she was not aware of places in her neighborhood where she could exercise: "I am not going to dance alone, I would need a group, the distance... it takes me 40 minutes to arrive here" (female participant).

Concerns

Fear of injury was a concern of PA engagement mentioned by two participants: "Our grandkids, our children say: 'don't do anything anymore dad because you are too old. Look, stay right there because you are going to injure yourself'" (male participant). Another participant said his doctor prohibited him from walking even though the participant was feeling healthy.

Technology

Beliefs/Attitudes

Most participants talked about how technology is necessary in one's daily life for various types of tasks throughout the day. They mentioned that they use cell phones, desktop computers, radio, television, games, email, watching videos, and mentioned some mobile applications such as Whatsapp and Facebook messenger. A few participants were very reluctant with the common habit of using the cell phone for most needs:

> "If you are going to use this [app] you just turn the television on and they will give everything you want. There are channels that tell you the temperature

> immediately, without using the phone. I just use the phone to receive and make calls" (male participant).

Some participants had strong emotional opinions against technology by mentioning how technology advancements are replacing labor employment opportunities. Some mentioned that using technology is a waste of time, and that they did not want to become slaves to technology.

> "I don't like technology, it does not help me because before there used to be a lot of work. And now with technology only those that have studied have a job. And those of us that didn't study have no job" (male participant).

Some participants were against its use in specific situations, and discussed how technology is being used inappropriately and it is changing social relationship, especially family interactions:

> "My son lives upstairs and he does not have a single moment to come say 'good morning, dad'... I do not want… for what… I spend more time in checking the phone, listening to 'beep, beep, beep' and seeing everything they wrote me there than in saying 'good morning. The communication is over" (male participant).

> "When my son had his child, he sent me a text message saying they were expecting a baby. I didn't reply. 'Pick up the phone and call me so I can hear the joy that you are feeling and so you know what I'm feeling. You texted me that and I didn't like that. I want to hear your voice telling me about your happiness and I can tell you about my excitement as well'" (female participant).

Many participants commented on how they dislike younger generations using their phones during family meals.

Benefits/facilitators

Participants discussed how cell phones and other technologies facilitate communication with family members who live far away, or even in daily situations when communicating with doctors' offices or arranging transportation. Participants reported that they like the fact that if they are busy at a moment, they can check and reply to messages later.

Keeping up to date was also another perceived benefit of technology usage, as they mentioned they would not be able to receive information about other countries without technology. They also stated that now they are able to search for health and medical

information before receiving medical attention, and that this way they can protect their health. They mentioned searching for information on diabetes, high blood pressure, medicines, counseling, alternative medicines, and even historical events. Participants stated that a few programs on television and YouTube videos had helped them to improve their eating habits. They mentioned how it is easy to become informed using technology

> "From my phone I can see my news, I can see the temperature, how the world is running in other parts. I remember that before one did not know what was happening in other parts of the world. And now one knows it immediately" (female participant).

An important benefit of technology cited was assistance with navigation, such as Google Maps, GPS, ride sharing apps, and other transportation apps. Participants stated they are aware and impressed with its features, and that they would like to learn how to use them:

> "It [technology] facilitates a lot. For example, the map, in google takes you to where you're going" (female participant).

> "When one doesn't know the exact direction or how to go [somewhere], it [Google Maps] will tell you where to go. And how much time, it even tells you the time. How much time you are going to make. This is a huge help. Or it gives you alerts when you are going to go, if there is an accident, to take some alternative route. This couldn't be done before" (female participant).

Barriers

The main barrier to technology usage mentioned was the lack of skills with modern devices, and how the constant advancements of technology makes the learning process more difficult for older Latinos. Participants cited that the need for using technological devices for daily tasks is increasing; however, they struggle to complete tasks as they are not confident on its usage. They said they do not know how to utilize a feature, and when they try to use it, they are afraid of doing something wrong, and they feel guilty for not knowing how to use technology devices.

> "I don't know how to use the computer that much. Sometimes I use it a little bit but I move something on the computer and I don't know how to go back. I move something around and I get in into other [sites]" (female participant).

With the exception of the participants who are strongly against technology, many were interested in learning how to use computers, how to use online banking, search for health information, send text messages, and use mobile apps. Participants said they would need someone in their family circle to assist them with using devices, but many of them live on their own and this creates a barrier for learning. They also mentioned that sometimes their adult children, or grandchildren are not patient enough to teach them how to use the device.

> "I need someone to teach me, to dedicate time to it. I need someone to teach me. That is one of my priorities. I do have the wish of learning, I was never instructed in anything and I found it a bit difficult. I have read all my life but electronics are difficult for me sometimes" (male participant).

The need to practice was also mentioned as a barrier to technology usage. Participants are aware they should practice to better understand the technology: "at my age I do not retain much. I forget. And I need to keep practicing so I can keep advancing. If not I do not advance" (female participant); however, some are not motivated enough to practice on their own, or they are afraid of trying alone.

Only one participant mentioned that technology is expensive, but the cost does not prevent him from adopting technology: "it is necessary to learn [how to use technology] because that way one has communications whenever they need it. Whether it is with a doctor or your family, or any given moment it is important. Although it is expensive" (male participant).

Concerns

Although most of participants mentioned the desire of learning more about technology devices, a few participants were concerned with the fact that they did not learn how to use the devices in their youth, stating they might not be able to learn and retain the information:

> “Technology is used because the man needs it to progress, but not all of us can intellectually have the capacity for it. I only went to school until middle school” (male participant).
> “Yes, it is difficult because we did not have this in our time when we were younger” (female participant).
> “It feel like one no longer has the capacity [to learn], right?” (female participant).

Vulnerability was stated as a main concern for technology adoption. As participants did not feel confident in using many technological devices and features, they expressed fear of being exposed to scams. One participant stated that technology is very dangerous but he thinks one should learn how to navigate it as it is needed nowadays. They had also talked about cyber bullying and how it sometimes lead to suicides. They reported that once the information is online, it can be used for various purposes. They stated that they do not know how these things happen, but they are aware of them.

Many times the discussion would lead to how children behave on the internet, and that adults do not have control of the type of content the children are having access to. They also said they are afraid of having their information stolen in online shopping, or getting a virus online. They said that because they do not know how to properly navigate the internet, they prefer not to use it so they do not expose themselves: “there is no privacy. If people want to investigate you, want to know about you, where you are at this time, they are going to know through the technology” (male participant).

Addiction was a concern among several participants. Addiction among younger generations was constantly cited, and how children always want to be playing on a device and do not want to go play without technology anymore. One participant said that there is a “new generation of technological slavery.”

> “Today’s youth are addicted and don’t know how to go out without their phones. Oh, and the day they go out without their phones they go back to retrieve them. It’s as if they missing their mother, and sometimes not even their mother” (male participant).

Participants also discussed how the constant use of technology can negatively affect health and memory. They noted that in the past they would memorize people's phone number and addresses, and how this technological dependency can affect thinking process. They also talked about how being constantly connected with information is overwhelming and leading to poor mental health, and the usage of cell phones in the dark can affect vision and the brain. Another participant stated with certainty that carrying the phone exposes people to radiation.

The increase in sedentary behavior with the use of technology was a theme that emerged from the discussion when participants were reflecting about technology addiction. Participants expressed concerns with technology use among children and how it leads to large amounts of sedentary time and overeating. They also discussed how devices and platforms make things more convenient such as using the television remote control or online banking, but it decrease PA and breaks in sedentary time are being avoided, thus creating unhealthy habits.

> "My daughter says to me 'you can pay your light bill, gas and all other bills [online] instead of walking everywhere.' However, that also takes away from doing exercise. Because we are no longer going to walk to get a money order, we are only going to be on the computer" (female participant).

They also mentioned that walking to complete errands is very common in Latin American countries, and in the U.S. people drive everywhere and this could contribute to overweight and obesity.

Text messages

Beliefs/Attitudes

Participants discussed how text messages can facilitate to communicate with others who are far away; however, texting in excess when others are around was reported as an anti-social behavior. Even though some participants were not interested in learning, many of them were willing to learn how to text.

> "Oh I do like them. The only thing is that I struggle a little bit. However, I do like it [texting]. I would like to learn more how to use it to be able to communicate easier and faster. And simply know how to use them" (female participant).

Benefits

The most cited benefit of text messages was the fact that it allow for a later reply. Many participants reported that text messages facilitate communication, mainly with their immediate family members who are at work and are unable to take a call at any time during the day, and in scheduling and agreeing on outings. They also said it is helpful for checking in with people who they were not able to reach.

> "I like texting. Because no one interrupts me. I can be eating and the phone can be ringing and ringing. They can be calling me and who knows who it is. Ok. And texting, also. They send me a text. I hear it, but I take my time [eating] and after a while I check to see who texted and then I reply. I find texting more convenient" (female participant).

> "My daughter is the one which sends me text messages because she works at night. We don't see each other. Sometimes she takes long to get out [*from work*]. She also texts me to find out where I'm at." (female participant).

Participants also cited that they like text messages as a form of keeping information for a further reference. "Sometimes I don't have a pen and paper and they send me a text with the directions and information" (female participant).

Barriers

The main barrier to adoption of text messages is that participants do not know how to text and navigation through the screen and different user interfaces can be challenging. They mentioned that if they receive a text message, they call the person back as they don't know how to reply back. "I try and try but then a 'letter' [on the keyboard on phone] goes away and I don't know how to do it. So I just call back" (female participant). Lack of skills with texting also limits

communication with grandchildren.

A potential barrier to use text messages was the perception that they reinforce impersonal communication. Participants expressed that they dislike receiving text messages when the message could be better stated by talking “I prefer to listen to the voice of people instead of seeing the letter. This is communication. The rest is rubbish. I am an enemy of the texts” (male participant).

> “Nowadays, you don’t send cards anymore, only text: "Happy Birthday!!" that’s it! Where is the communication? Nobody make calls anymore, it’s just reading. I do not know, I say that everything is no longer personal” (female participant).
>
> “My granddaughter calls me on the phone from the room where she is hidden. Where you do not know what she is writing or what she is seeing. What information she is getting, what kind of nonsense she is seeing on the computer ... And you are cooking…And she texted, 'Granny, give me my coffee.' 'Granny serve me a soup.' 'Granny do this and that’” (male participant).

Concerns

Car accidents due to distractions while texting and driving were stated as a danger for drivers and pedestrians: “one could get injured because of the young ladies, texting while driving” (male participant), “Now we will be charged more for car insurance because there are more car crashes due to being on the phone [texting while driving]” (female participant).

Wearable

Beliefs/Attitudes

Overall perceptions of a wearable PA tracker were positive, with the exception of those participants who were clearly against technology. For most participant the wearable was seen as a potential motivational tool due to the many features available in the mobile application that was also presented by the research team.

Two participants have already had a wearable device, and one of them explained that the device is able to track sleep time and quality and provided the group with some examples of how the wearable motivates her to engage in PA:

> "It tells me when I don't complete my 10,000 steps a day. Sometimes when I go to bed, I check to see how many steps I have to complete the 10,000 and I get up to complete them. [Moving feet in place]. It gets me moving and before I know it I'm done" (female participant).

A few participants were unsure about the utility of the wearable PA tracker as they stated that the wearable would only motivate them when they are wearing it, that it would not be useful in the winter, and that everybody knows what to eat and that one should drink water, so the device would not be useful for these purposes. Some participants mentioned the wearable would be appropriate for "lazy people" (female participant).

The participants who were against the widespread use of technology in general were also not favorable to the wearable technology saying it was unnecessary. They stated "my body tells me if I am sitting, walking, what I eat, my health. Before there was no such thing. This is just for the purpose of spending money" (female participant). One participant said "It is just consumerism. We already know how many hours we have to exercise and what we have to eat. So I would not spend on one of those. My body is telling me" (female participant).

Benefits/facilitators

Participants were surprised with the variety of features the wearable is capable of tracking. Many were interested in learning about their steps, water intake, calories burned, and sedentary time. They were also enthusiastic about the rewarding notifications Fitbit give them when a goal is accomplished and the reminders Fitbit provides to get up and move when engaging in long periods of sedentary behavior. Self-monitoring and tracking, awareness, and even learning components were mentioned as potential benefits of wearable usage as they

would then know the amount of time they should or should not be engaging in the behavior. Participants were interested in having control of their data.

> "That it is important, and probably essential because we generally have no idea, nor do we take time, nor do we worry about sitting three or four hours, or exercising. Then it would be a matter of becoming aware" (male participant).

The participants who owned a Fitbit mentioned how it can be used in a group setting, where participants would motivate each other by using the group competition feature from its app. One participant explained that she is part of a Zumba class and in the summer the instructor takes them out for a walk and encourage Zumba participants to wear their wearable so they can compare with each other.

One focus group participant that has a wearable similar to the one that was planned to be used in the intervention described her personal routine with using the wearable with the combination of dance classes:

> "When we dance here, we complete almost the 10,000 steps. Not all the 10,000 steps but whatever steps we don't complete, I finish at home. That's the typical exercise one should do. Everyday 10,000 steps" (female participant).

Barriers

After the research team presented the wearable, participants who were interested in purchasing asked in what stores they could find the device, and also asked the price of the Fitbit. Only one participant stated that the device was expensive, and no other comments were made.

Concerns

As the majority of participants were not very familiar with the device one major concern discussed by those who were against the idea of using the wearable was the potential lack of privacy.

> "I do not believe in that [wearable] because to start it has to put on the phone [download the app]. And the phone will be recording, I imagine they are for that, to record all the activities during the day. And I do not think that someone has to know what I do […] And another thing, I would feel like those puppies that get the chip put in them so that everyone knows where I am… what I am doing. I think that is not necessary, because for me private life is very important" (male participant).

E. Discussion

Participants reported engaging in LTPA mainly through dancing and walking. Motivators and barriers to engaging in LTPA were consistent with the literature (Biedenweg et al., 2014; Franco et al., 2015; Greaney et al, 2012). Participants emphasized the importance of an external motivator and social support to maintaining PA participation. Participants also recognized that SB is more prevalent with the increased use of technology in general. Fitbits were attractive for most participants as a possible motivational tool; however, a few were reluctant to use one. The main positive aspect cited was that the device can bring awareness about one's activities, and an important negative perception was about privacy concerns with a tracker that would be worn most of the time, and connected with their mobile phone.

Physical activity

Participants were aware of PA benefits and this sample was very active with 85% regularly engaging in PA. This might be due to the fact that the senior center where the discussion took place provides a great variety of PA classes, events, and health-related presentations, which could have contributed to the high levels of knowledge from this sample, thus less generalizable.

This study showed that even though participants were aware of PA benefits, some of them are not able to regularly engage in PA. A systematic review on older adult's perspectives of physical activity participation (Franco et al., 2015) also showed that some participants, although clearly acknowledging the benefits of physical activity, reported that low motivation

prevented their participation in PA. This reinforces the need to understand motivators and barriers to PA participation among older adults, especially older Latinos, as just knowing their benefits are not enough to start and maintain PA engagement.

Perceived physical, emotional and mental benefits from PA engagement mentioned by our participants were also cited in the same systematic review in which participants in 78% of studies (n = 103) believed that PA was important to maintain general health, to improve mood and relieve stress, and could effectively prevent mental illness (Franco et al., 2015). According to a recent systematic review there is consistent evidence in which enjoyment was a powerful determinant of later PA (Kelly et al., 2016). An important motivator for PA participation is enjoying being with others while exercising and desiring a routine that promoted accountability (Biedenweg et al., 2014). Social interactions may contribute to Latinos' preference for dancing.

One of the most common barriers in our study was lack of companion, which is also cited in the literature. Participants in 64% of studies (n = 84) in a systematic review reported that social support was a motivator for PA maintenance (Franco et al., 2015).

Another common barrier cited in our discussions was lack of motivation that was also encountered in three systematic reviews (Franco et al., 2015; Kelly et al., 2016; Olanrewaju et al., 2016). Interventionists should aim to understand if lack of motivation is associated to others barriers found in our study: lack of companion, lack of time, lack of access to facilities, and unfavorable weather.

Even though not many participants reported lack of time as a barrier to engage in PA, this is a common obstacle faced by Latinos due to the need to work long hours and multiple jobs (Greaney et al., 2012). It is important to note that 85% of our participants were not currently working. It is also known that older adults need an appropriate place to engage in PA, such that perceived neighborhood walkability is significantly associated with engaging in >150 min per week of physical activity (Silfee et al., 2016).

Fear of injury is not widely reported as a concern for PA engagement; nevertheless, 28% of studies in a systematic review (n = 37) stated that participants feared falling and sustaining serious injuries during physical activities (Franco et al., 2015).

Technology

Most participants recognized that technology usage is necessary nowadays. Another studies have shown that older adults had reported more positive attitudes towards technology than negative attitudes, contradicting common preconceived ideas that older adults are not interested in using technologies (Chen & Chan, 2013; Mitzner et al., 2010).

The excessive use of technology, especially by children and young relatives, which affects family interactions mentioned by some participants, was also found in another study (Vaportzis et al., 2017) and it affects Latinos as they often come from a collectivist culture where family and social ties are important and common (Silfee et al., 2016).

Older adults' perceived benefits of technology influence its usage (Chen & Chan, 2013; Wagner et al., 2010). In our focus group study participants mentioned the benefits of facilitating communication, especially with family members, and in daily situations such as finding information about health and other countries. Communication and searching for information are among the most common reason for usage of technology by older adults (Chen & Chan, 2013; Mitzner et al., 2010; Wagner et al., 2010; Ware et al., 2017).

Mobile technology was reported as an important tool to assist with navigation, and consequently building confidence and independent living. Participants mentioned how they were able to find directions for their destination easily or were able to communicate directions through text messages. Because participants noted that technology could provide this type of facilitation in their lives, they would explain that they would be more open to adopting new technologies. Spatial skills decline with age and so mobile devices are able to promote a secure commute with a public transportation application (Goodman, Brewster, & Gray, 2004).

The main barrier to technology usage cited was lack of skills, which was also demonstrated in other studies (Navabi, Ghaffari, & Jannat-Alipoor, 2016; Vaportzis et al., 2017; Wagner et al., 2010). A study compared Latinos, Filipinos, and non-Latino whites all non-users of health-related technologies. Latinos and Filipinos were significantly less likely than non-Latino whites to understand and use and electronic portal, even when they received assistance (70.1%, 73.5% vs 52.5%, respectively) (Gordon & Hornbrook, 2016). These findings imply that difficulties in technology usage are not only due to lack of experience, and that Latinos face digital disparities.

Most participants mentioned their willingness to learn how to navigate and understand technology devices, and the need for guidance and practice. These needs are also observed in other studies (Navabi et al., 2016; Vaportzis et al., 2017). Older adults usually encounter physical and cognitive obstacles and have lower familiarity with technology, so training should be specifically tailored to this group, coupled with technical social support, to increase older adults' technology self-efficacy and subsequently encourage its use (Lee et al., 2014).

Although cost was mentioned by only one participant, this is a frequently cited barrier for older adults' technology use (Chen & Chan, 2013; Navabi et al., 2016; Vaportzis et al., 2017). However, costs can be outweighed when older adults perceive the benefits of using technology (Mitzner et al., 2010).

Similar concerns on lack of ability to learn, related to aging or lack of early learning, can be observed in other studies (Chen & Chan, 2013; Navabi et al., 2016; Vaportzis et al., 2017) showing the importance of training and support to make older adults more confident in technology usage.

Vulnerability, the main concern for technology adoption cited by participants, is a common concern in other studies (Chen & Chan, 2013; Navabi et al., 2016; Ware et al., 2017). Therefore, it is also important to train older people how to securely use technologies.

Technology addiction was one of the reasons for negative attitudes among older adults toward gerontechnology (Chen & Chan, 2013), and has represented an important theme for research over the last decade (Kuss et al., 2014). The concern about the increase in sedentary behavior with the use of technology cited in this study is a real problem, as the excess of screen time has changed daily behaviors to contribute to convenience (Owen et al., 2010).

Text Messages

Many participants were willing to learn how to compose text messages. Digital disparities could be reduced by learning how to use a single feature as older adults who do not use mobile technology may miss important communications, such as public health emergencies messages (Gell et al., 2013). Text messages can also be practically used with older adults in reminders for health care appointments, and information from heath care providers.

In this focus group study the most cited benefit of text messages was the fact that it allows later reply, hence it does not interrupt what the person is doing. Contrarily, in another study participants reported the cell phone was inconvenient due to interruptions such as receiving unwanted calls in the household, and receiving calls at inappropriate times at work (Mitzner et al., 2010). Perceived benefits of text message could prevent the inconvenience of calls previously cited. Facilitating communication was another benefit cited in this study, especially with their family, showing again the strong family ties.

The main barrier to adoption of text messages was lack of skill to texting. Recent research has shown that even though older adults are gaining access to mobile technologies, many of them do not access the internet, nor use email or text messages (Gell et al., 2013; Pew Research Center, 2017). In another study, participants wanted to opt out of text messages and receive the health information by email or some other means (Weaver et al., 2015). This reinforces the concept that just providing this population with the technology without proper training might not produce the desired results.

Participants' perception that text messages reinforce impersonal communication was also found in a study that assessed how older adults would perceive text messages from their physician office, and the likelihood older adults would read the messages. It was found that some participants felt texts were impersonal and a poor substitute for face-to-face communication (Redfern et al., 2016).

Car accidents due to distractions while texting and driving was cited as a concern among participants. Recent statistics and research has shown an increase in injuries and fatalities due to texting and driving, as the driver is not able to multitask safely (Caird et al., 2014).

Wearables

For most of the participants the wearable was seen as a potential motivational tool, although a few stated they were against its use. In another study where 31% of the 1349 were adults over 65 years of age, 63% reported that the wearable could assist with PA engagement, and 74% of participants that had had a wearable before reported the wearable had helped them to become more active (Alley et al., 2016). Participants aged 55 and older accounted for 45% of those who have used a PA tracker; 39% of those were interested in using a PA tracker, and 60% of those were not interested in using a PA tracker. Of those participants who were not interested in the wearable 34% had reported they do not think the wearable would help them, and only 3% cited cost, and 1% cited being too old (Alley et al., 2016). Another study found that participants were unsure about wearables' accuracy and reported wearables to be uncomfortable at night (Fausset et al., 2013).

Behavioral interventions had used wearables to promote PA (Alley et al., 2016). A systematic review and meta-analysis have found small-to-moderate effect sizes for steps outcomes in PA interventions (Direito et al., 2016).

Wearables can also be financially advantageous for research because of their reasonable cost (Sullivan & Lachman, 2017). Additionally, older adults have reported needing someone to walk them through the process of using a new technology, specifically noting that

social learning is easier than learning alone through a manual (McMahon et al., 2016). Literature on older adults' acceptability of technology and wearables (Fausset et al., 2013; McMahon et al., 2016; Mitzner et al., 2010), and the needs of older Latinos with learning technologies (Burner et al., 2018; Burner et al, 2014; Collins et al., 2013) suggest that a mobile health intervention may be feasible with older Latinos. Assistance with teaching technology components of the intervention will be implemented.

Benefits

Participants stated that the information provided by the wearable can be very useful for creating awareness and understanding PA levels. Increased self-awareness motivates increased PA (Puri et al., 2017). A recent study about acceptance of wearables reported participants were interested in knowing the number of steps and found wearables useful in promoting self-awareness and motivation (Mercer et al., 2016). This is similar to identified themes in our focus groups in which participants wanted to be more aware of their activity levels. Tracking PA and bringing awareness were the main aspect participants report enjoying, especially tracking the number of floors climbed (Fausset et al., 2013).

Concerns

In our study participants mentioned that lack of privacy is a concern with the wearable use. Similarly, as noted in a recent study, patients and medical practitioners have concerns related to data storage and privacy (Piwek et al., 2016). Privacy was less of a concern in another study where participants reported that the PA tracker data (steps, PA levels, and HR) as not sensitive data that could be disclosed (Puri et al., 2017).

Although our results are similar to other studies targeting technology adoption by older adults, it is original in the focus of the Latino population. Similarly, to other minority groups, Latinos experienced digital disparities. Their experiences ultimately determine their need for learning new technologies.

Some limitations of this study were that the focus group moderator guide referred to technology as a broad term, so topics such as texting and driving and even car accidents were mentioned in the focus group. The study had a small sample size. Also, participants for this study could own any kind of mobile device, which could include a cell phone or a smartphone. Because of this, opinions on technology could have been skewed since cell phones and smartphones have different operations. Furthermore, to be able to obtain more accurate perceptions of the wearable, participants should have experienced the wearable device rather than just speculating; however, the focus groups were not initially designed for this purpose.

F. Conclusions

Older Latinos from our study reported being aware of the PA benefits and reinforced the idea that dance is a culturally-appropriate type of PA for older Latinos. Barriers for PA engagement were similar to other ethnic groups, except with the fact that Latinos are not used to engage in formal types of PA. Participants reported how technology makes things more convenient and efficient on a daily basis; however, they expressed serious concerns on how excessive use of technology is influencing people and leading to unhealthier lifestyle. Wearable devices appeared to be a possible motivational tool for older Latinos who are willing to learn new technologies. A PA intervention utilizing text messages and wearable devices appears to be feasible.

IV. FEASIBILITY OF A MOBILE HEALTH-INFUSED DANCE INTERVENTION FOR OLDER LATINOS

Isabela G. Marques, Spyros Kitisou, Ben S. Gerber, Susan W. Buchholz, Eduardo E. Bustamante, David X. Marquez

A. Abstract

More than 21 million Latinos 55 years and older live in the U.S. Older Latinos have low levels of leisure-time physical activity and high risk and prevalence of chronic disease. Dance is a culturally relevant form of physical activity to address these risks. Also, mobile technology ownership is increasing among older Latinos; therefore, mobile health could be an appropriate strategy to promote physical activity among this population. The purpose of this study was to assess the feasibility of a mobile health-infused dance program (BAILA TECH) for middle-aged and older Latinos. A single group feasibility trial was conducted for 16 weeks. Mobile health components (wearable device, mobile application, and text messages) were added to an already existing, evidence-based dance program that our team has developed (BAILAMOS©). Classes were held twice a week for two hours each session. The first 30 minutes were devoted to an mHealth technology class, followed by one hour of the BAILAMOS© Latin dance program, and an extra 30 minutes of technology practice. Participants wore a wrist-bases physical activity tracker (Fitbit Charge 2) for 19 weeks (16 weeks of the program + two baseline weeks and one post testing week) and received weekly text messages for the last 12 weeks of the program. Feasibility was assessed by recruitment capability (e.g., recruitment strategies); acceptability and suitability (e.g., enjoyment); and resources (e.g., monetary costs). Feasibility metrics were tracked and descriptive statistics are presented. Focus groups were conducted during the intervention to assess acceptability of the program. Thematic analysis was conducted. Recruitment was conducted for eight weeks. The main recruitment strategies were

announcements at the host senior center, and having the study announcement printed in Catholic churches' weekly bulletins. Fifty-one middle-aged and older Latinos who owned a smartphone were assessed for eligibility, 28 participants (55%) were eligible, and 20 participants (39%) started the intervention (female n=15, M age = 67 years old, SD = 7.11). Twenty participants (100%) wore the wearable for the 18 weeks and completed post intervention data collection, and 17 participants (85%) completed the dance program. In the focus groups at the monthly discussion sessions, participants reported great enjoyment of the program and stated that it was too short. Participants reported that the most valuable components of the intervention were the dance and technology classes, and the support provided by the instructors that taught the technology classes. Costs for the intervention was $9,572 (i.e., costs for dance instructor, Fitbits, text messages, participant compensation, and data collector) Personnel costs were not included. A mobile health-infused dance program appears feasible for middle-aged and older Latinos.

B. Introduction

Middle-aged and older Latinos are a significant proportion of the U.S. population, with more than 21 million Latinos aged 55 and older living in the U.S. (Bureau, 2015). Older Latinos have high risk of developing chronic diseases (Daviglus et al., 2012) and they traditionally report lower levels of leisure-time physical activity (LTPA) compared to non-Latino whites (Marquez, Neighbors, & Bustamante, 2010), even though there is a large evidence base of the benefits of LTPA on health outcomes (Chodzko-Zajko et al., 2009).

Mobile health (mHealth) includes the application of mobile computing and communication technologies, such as text messaging, smartphone applications (apps), and PA trackeing devices (wearables), used to promote healthy lifestyle (Alley et al., 2016; Wang et al., 2015, 2016). Interventions using mHealth as a delivery method suggest that its use has positive

outcomes in behavioral change and can increase adherence to physical activity (PA) interventions (Fjeldsoe et al., 2009; Hyun Kim & Glanz, 2013) even for middle-aged and older adults (Mercer et al., 2016).

Most PA studies using mHealth have involved non-Latino participants (Buchholz et al., 2013); however, Latinos are starting to be included in mHealth research (Bender et al., 2016). It has been demonstrated that the use of text messaging to motivate PA participation among older Latinos is feasible (Collins et al., 2013). Additionally, 98% of the Latino population in the US owns a cell phone, 75% own smartphones, and its ownership is growing among those with low income and older adults (64 and 74%, respectively) (Pew Research Center, 2017). Thus, mHealth may be an appropriate strategy to promote PA engagement in older Latinos.

Older Latinos do not commonly engage in traditional types of LTPA, and those who do commonly walk and/or dance (Marquez et al., 2015; Marquez et al., 2010).To address the public health needs to promote LTPA among older Latinos, a culturally- and age- relevant dance program (BAILAMOS©) was developed by our group (Marquez et al., 2014) as a way to initiate and increase PA engagement. BAILAMOS© is a 4-month Latin dance program that instructs merengue, bachata, cha cha cha, and salsa (Marquez et al., 2014). The program challenges participants cognitively to remember the dance steps, and promotes social interactions (Marquez et al., 2014). As participation in the BAILAMOS© program is not enough to meet the PA guidelines of 150 minutes of LTPA the BAILA TECH program was developed to motivate participants to engage in PA outside of the dance classes. The BAILA TECH program consists of the traditional BAILAMOS© dance program with the addition of a PA wearable tracker (Fitbit Charge 2), Fitbit mobile application, text messages, and mHealth technology education classes.

Our formative qualitative study with 27 older Latinos suggested that older Latinos would be willing to participate in a mHealth-infused dance program and helped inform the design of BAILA TECH, based on participants' willingness to learn new mobile technologies. Therefore, a

small-scale feasibility trial was needed in order to test the study protocol, procedures, and to determine the acceptability (Lancaster et al., 2004) of the BAILA TECH intervention. Thus, the purpose of this study was to assess the feasibility of an mHealth dance intervention for older Latinos in terms of recruitment capability, acceptability and suitability, and resources and management.

C. Methods

Recruitment

Participants were recruited at a pre-selected senior center in a Latino neighborhood (the study site), senior housing facilities, local businesses (e.g., grocery shops) and churches in Chicago. Potential participants were screened for eligibility by bilingual and bicultural Latino research assistants, and were scheduled for baseline testing. Inclusion criteria were: age $\geq$ 55 years old; (2) self-identification as Latino/Hispanic; (3) ability to speak Spanish; (4) adequate cognitive status as assessed by the Mini Mental State Examination (MMSE) (>14/21) (Folstein et al., 1975); (5) no plans to leave the U.S. > two weeks during the study; (6) have a smartphone (with internet access and capability to run apps) with data plan; (7) danced < 2 times/month over the past 12 months; (8) be available on dates when classes would occur; (9) not have had a PA wearable tracker in the past 6 months. Exclusion criteria included: (1) presence of uncontrolled cardiovascular disease or uncontrolled diabetes mellitus; (2) stroke within the last 12 months; (3) severe chronic obstructive pulmonary disease; (4) recent healing or unhealed fracture(s) (in the last 6 months); (5) had recurrent falls in the past 12 months; (6) regular use of assistance to walk (e.g., cane); (7) had participated in prior BAILAMOS© trials.

Design

This study was approved by the University of Illinoi at Chicago Institutional Review Board. This single-group feasibility study assigned all participants to the BAILA TECH

intervention for 16 weeks. Participants underwent data collection at baseline, and post-intervention.

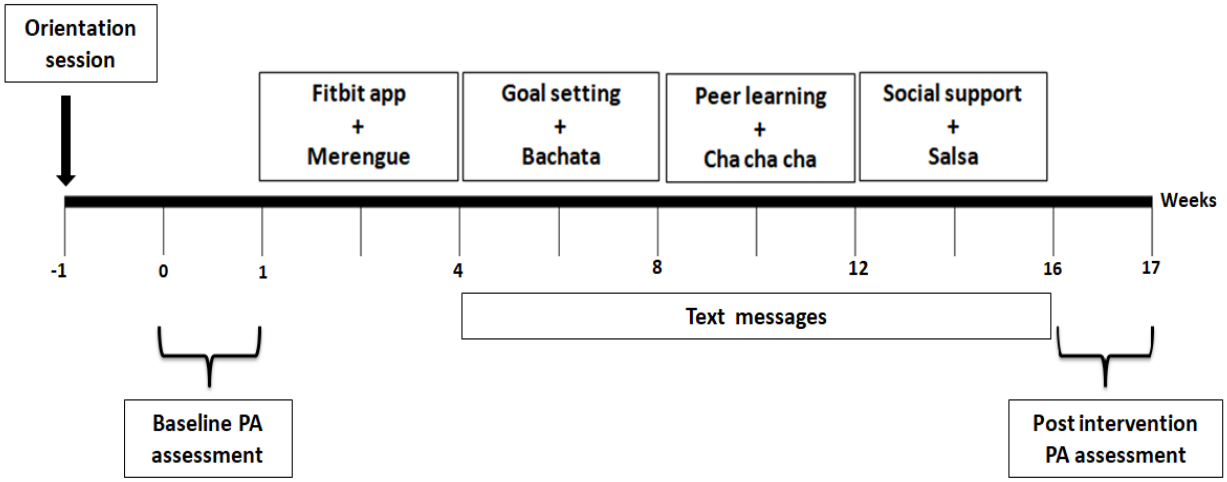

Figure 1. BAILA TECH design

Data Collection

Prior to the intervention and at the end of the 4-month program, participants were tested. Testing took place at the senior center where the intervention was conducted. At the testing a research assistant explained the study and read the Informed Consent to the participant. After

participants agreed to participate, they signed the Informed Consent. Questionnaires and measures were administered. All measures were valid and available in Spanish or English, and participants chose the language. All measures were administered between 40-60 minutes. Then the research assistant explained the Fitbit and its mobile application, and paired the Fitbit with the participants' cell phone. Participants were compensated with $10 for their participation at testing.

Orientation session and Fitbit usage

After our desired sample size (n=20) was met, a 2-hour orientation session was scheduled where participants received the PA wearable tracker Fitbit® Charge 2™ and were taught how to use the Fitbit application (app). Participants received a short manual about the Fitbit (how to wear, clean, charge, and sync the device). The manual was created in Spanish at a 6th grade level from the official Fitbit website. Participants were asked to wear the Fitbit on their wrist for the 16 weeks intervention program, for at least 10 hours per day, for at least 5 days of the week, to assess lifestyle PA and sedentary behavior (SB).The first week of Fitbit data was considered as the trial week and it was not included in the analysis as it has been reported that participants might exhibit reactivity and increase their PA shortly after receiving the wearable. The second week was included as participants' PA baseline. The intervention started two weeks after the orientation session. Classes were held twice a week for two hours each session. Sessions were divided into three parts: mHealth technology session, dance class, and technology practice.

Intervention components

Fitbit PA tracker and mobile application

Fitbits were used for PA data collection at baseline and post-intervention (week 17), and also for PA data collection throughout the 16 weeks dance program. During the intervention

Fitbits were also used for tracking participants' PA to provide feedback on participants' PA levels. Fitbits were used as they are the most common PA tracker on the market (Diaz et al., 2015). Fitbit activity trackers have been tested in various validity studies and shown to be accurate in measuring PA, exercise, and sedentary time(Evenson et al., 2015). The Fitbit Charge 2 is a wrist-based wearable device that uses a three dimensional accelerometer and an optical HR sensor to monitor intensity-specific minutes of PA, SB, HR, sleep, and caloric expenditure, among other outcomes. Daily activity measures (step counts, intensity of PA, and exercise sessions) were transmitted to the Fitbit cloud server and from there to the iCardia research system hosted in a HIPAA-compliant server at the University of Illinois at Chicago (UIC). The iCardia platform incorporates Fitbit PA trackers, smartphones, and text messages (Kitsiou et al., 2017). The iCardia platform is able to determine Fitbit wear time based on Fitbit's heart rate (HR) sensor. The Fitbit mobile application was also used during the intervention. Participants were taught how to navigate the application at the mHealth technology sessions. The research team created study email accounts and Fitbit accounts for each participant using coded email accounts and names/usernames for confidentiality purposes. After the intervention was completed, participants kept the device as an incentive, and the email accounts were disabled.

mHealth technology sessions

Before each dance class 30-minute mHealth technology sessions were offered to assist participants with troubleshooting with the Fitbit device, app, and usual cell phone usage. The technology sessions were initially planned to be informal and optional; however, the research team had to develop formal sessions as per participants' requests and needs to learn about the Fitbit mobile application. The sessions were then developed to instruct participants on the use of the Fitbit features in a detailed manner including several practice activities. Half-way through the

program participants were placed in small groups based on their daily steps to promote peer-learning.

BAILAMOS© dance program

Technology sessions were followed by the dance program. BAILAMOS© is a 4-month, twice-weekly program. Every dance session is one hour in length and includes warm-up, stretching, instruction for single dancing, partner dancing, and cool-down. Each month a new dance style is introduced by a professional dance instructor. BAILAMOS© encompasses four dance styles: Merengue, Cha Cha Cha, Bachata, and Salsa. For more details please see a previous publication (Marquez et al., 2014). The BAILAMOS© dance program includes montlhy 1-hour discussion sessions based on the Social Cognitive Framework (Bandura, 1997) aiming to promote PA participation outside of the program, to inform about the positive effects of an active lifestyle and the detrimental effects of sedentary behavior, and to discuss the barriers and facilitators to engaging in PA. Participants' perceptions of the text messages and experiences and barriers with the Fitbit were also discussed. The program also offers biweekly dance parties "fiestas de baile" in which there is no dance instruction and participants are able to practice dance steps learned and to socialize.

Technology practice

After each dance class the research team was also available for 30 minutes in case participants needed more assistance for troubleshooting technological issues. These sessions were meant to be participant-lead and unstructured, as participants had various needs and questions on different features of the cell phone or applications. Participants were encouraged to attend the technological troubleshooting sessions so that they could experience the majority of the technological features provided. Peer learning was encouraged, aiming to create and strengthen social support to assist with engagement of the technology, the dance sessions, and PA.

Text messages

Participants received motivational text messages in Spanish to encourage PA engagement on non-intervention days. Frequency ranged from twice a week to six times a week. Timing ranged from 10 AM to 7 PM. Frequency and timing were modified throughout the program based on participants' request and feedback. Most text messages were retrieved from a validated text messages database on motivating participants to walk created by study collaborator Dr. Buchholz (Buchholz et al., 2015), and the remaining messages were developed by the trilingual and bicultural research team about dancing, and based on the content taught at the technology sessions. The database was translated to Spanish, validated for accuracy translation and cultural appropriateness, and successfully used in a trial (Buchholz et al., 2015). The research team categorized the text messages by content in 10 categories. At baseline testing participants selected the categories of content of the text messages that they would like to receive, and were offered the opportunity to write their own text messages that they believed would motivate them. Participants were compensated $10 for each month of completion in the intervention for potential costs of receiving text messages

Feasibility metrics

Feasibility metrics, assessment strategy and methods are presented in table 5. Feasibility metrics were retrieved from recent feasibility literature (Craig et al., 2008; Lancaster, 2015; Lancaster et al., 2004; Learmonth et al., 2017; Orsmond & Cohn, 2015; Thabane et al., 2010).

Table 5**.** Feasibility metrics, assessment strategy and methods

Feasibility Metric	Assessment strategy	Assessment method
1. Recruitment capability	1.1. Recruitment length (Lancaster et al., 2004; Orsmond & Cohn, 2015; Thabane et al., 2010)	Recruitment length was reported as the length of time it took to recruit the desired sample size (n=20)
	1.2. Recruitment strategies and barriers (Orsmond & Cohn, 2015; Learmonth et al., 2017)	Active and passive recruitment strategies were assessed. Active recruitment was defined as an active effort from the research team in going out into the community. Data was tracked on number of flyers handed out, interest sheets signed, and phone calls made. Passive recruitment included participants getting in contact with the research team, learning about the study from a research flyer and contacting the research team and word of mouth. Data was tracked on phone calls and emails received. Recruitment barriers were identified and reported. Barriers were categorized into organization level and environmental obstacles.
	1.3. Recruitment rates and eligibility criteria (Lancaster, 2015; Lancaster et al., 2004; Orsmond & Cohn, 2015; Thabane et al., 2010; Learmonth et al., 2017)	Recruitment rates were reported as the number of people interested, screened, eligible, not eligible, and not screened. Reasons for ineligibility were recorded.
2. Acceptability and suitability	2.1. Adherence (Orsmond & Cohn, 2015; Thabane et al., 2010)	Adherence was calculated as the number of dance sessions attended divided by the total number of dance sessions offered, multiplied by one hundred. Participants were categorized into three groups: high adherents (attended >70% of classes), moderate adherents (Attended between 50% to 70% of classes), and low adherents (attended <50% of classes). Fitbit daily usage data was retrieved using the iCardia platform. Fitbit usage was calculated as the number of days Fitbit was worn at least 10 hours/day, divided by the number of days from when participant received the Fitbit, to post testing. Participants were categorized into three groups: high adherents (wore the device >70% of days), moderate adherents (wore the device between 50% to 70% of days), and low adherents (wore the device <50% of days)
	2.2. Retention (Orsmond & Cohn, 2015; Thabane et al., 2010; Learmonth et al., 2017)	Retention rate was calculated as the number of participants who completed post testing subtracted from those who were enrolled in the intervention. Participants were categorized into two groups: those who completed both dance classes and used technology components, (b) those who wore the Fitbit during the program but did not complete the dance classes

	2.3. Engagement (Orsmond & Cohn, 2015)	Engagement was assessed with individual participant dance logs from each dance class. Dance logs recorded the number of minutes danced, ratings of perceived exertion (Borg, 1985), and feeling scale (Hardy & Rejeski, 1989)
	2.4. Text messages delivery and content appropriateness (Susan W. Buchholz et al., 2016)	Text message delivery was measured as the number of text messages successfully delivered in relation to the number of planned text messages to be sent. Content appropriateness was assessed by feedback provided by participants during the monthly discussion sessions.
	2.5. Acceptability and enjoyment (Lancaster, 2015; Lancaster et al., 2004; Thabane et al., 2010; Learmonth et al., 2017)	Enjoyment was assessed on the dance logs from each dance session using a Likert scale, and was reported as mean and standard deviation. Acceptability and enjoyment of the intervention were assessed by participants' feedback during the monthly discussion sessions, from the program evaluation, and at post testing.
	2.6. Complaints and concerns (Orsmond & Cohn, 2015; Thabane et al., 2010; Learmonth et al., 2017)	Complaints and concerns about the program (e.g., discomfort/rashes from the Fitbits) were recorded when participants or the dance instructor reported them to the research team. Participants were asked about minor events at post testing.
3. Resources and management	3.1. Personnel requirements (Orsmond & Cohn, 2015; Thabane et al., 2010; Learmonth et al., 2017)	Research team needs were reported as the number and responsibilities of the research team personnel.
	3.2. Time requirements (Orsmond & Cohn, 2015; Thabane et al., 2010; Learmonth et al., 2017)	Time requirements were calculated as total time for the research team to conduct the study (e.g., planning meetings, preparing materials, recruitment, screening, testing, preparing for sessions)
	3.3. Monetary and equipment requirements (Orsmond & Cohn, 2015; Thabane et al., 2010; Learmonth et al., 2017)	Monetary requirements were calculated for the intervention costs: dance instructor, Fitbits PA tracker devices, iCardia delivery platform, and text messages

Data analysis

Descriptive statistics (absolute and relative frequencies) were used to assess feasibility metrics. For the monthly discussion sessions, program evaluation, and post testing qualitative data two research assistants coded verbatim transcripts using thematic analysis to generate themes (Braun & Clarke, 2006). Two researchers read and listened to the transcripts and audio to become familiarized with the data. Then generated initial themes; coded all transcripts, revised, collated, and renamed themes; met and agreed on the next set of codes; and recoded all the data. Coding was done with the assistance of NVivo software.

D. Results

Twenty middle-aged and older Latinos enrolled in the intervention. Mean age was 67.0 years old (SD = 7.11 years), range 55-82 years old. Fifteen participants (75%) were female, 16 participants were currently not working (n=11 retired, n=3 housewives, n=2 disabled), two participants worked for housekeeping companies, one as a hair stylist, and one as a community health worker on immigration issues. Seventeen participants (85%) were born in Mexico, two were born in the U.S. (10%), and one (5%) in Ecuador. Years lived in the U.S. ranged from 17 to 61 years (mean = 42, SD = 12.9). Eleven participants (55%) reported annual income of less than $15,000.

1. Recruitment capability

1.1 Recruitment length

Recruitment started on June 22, 2017 and ended on August 06, 2017. Twenty-seven hours over 11 days were dedicated to planning and preparing for recruitment. The length of time to recruit 20 participants was 6 weeks and 3 days (45 consecutive days, 169 hours). Eighty

hours were devoted to 12 days of active recruitment in the community. Sixty-two hours over 20 days were spent in screening for eligible participants (Table 6).

Table 6. Recruitment length and time

	Days	Hours
Planning and preparing recruitment	11	27
Recruiting	12	80
Screening	20	62
Total recruitment time	45	169

1.2 Recruitment strategies and barriers

Based on the most successful recruitment strategies of older Latinos in our previous research trials, our recruitment strategies were to make announcements at the end of masses at Catholic churches, go to senior centers, health fairs, local businesses, and parks. Seventy-seven potential participants expressed interest for the study, 43 (56%) signed an interest sheet (active recruitment), and 34 (44%) contacted the research team (passive recruitment).

Active recruitment

Twenty-five churches were found in a 2 mile ratio from the senior center intervention site; however, only 12 churches offered Spanish masses. The research team was able to reach seven Catholic churches, but only two churches agreed with recruitment. The research team attended mass in each church and made an announcement at the end of the mass. The research team also recruited at the intervention site (the senior center), four housing facilities, and local businesses such as grocery stores, bakeries, restaurants, coffee shops, and a butcher store, and gave out 81 study flyers to potential participants. Recruitment also occurred at one health fair where 134 study flyers were included in the welcome packet for people who participated in the event. The research team went to two parks in the neighborhood but was not successful in recruiting participants from the parks. Out of the 43 people who actively signed up for the study, 40% (n=17) were recruited at Catholic churches, 28% (n=12) from local business in the neighborhood, 23% (n=10) at the senior center, 7% (n=3) at a health fair, and 2% (n=1) at a senior housing facility. Three hundred and eleven calls were made to screen potential participants.

Passive recruitment

Thirty-nine study flyers were posted and left at the senior center, local businesses, and churches, and 220 study flyers were posted at four senior housing facilities. One church posted a study announcement in their weekly church bulletin. Of the 34 people who contacted the research team, 50% (n=17) were referred to the study by word of mouth, 29% (n=10) saw the study announcement at the church bulletin, 18% (n=6) were informed about the study by the flyer, and 3% (n=1) emailed the research team referred by the study flyer.

Organizational level

Even though churches were located in the primarily Latino neighborhood, only 12 offered masses in Spanish. Spanish-speaking Latinos were the target group for this intervention as the

program is offered in Spanish to reach those with lower levels of acculturation, which usually is associated with lower education levels and income, and poorer health outcomes compared to bilingual or monolingual English foreign-born Latinos. Our research group had recruited older Latinos from Catholic churches in that neighborhood over the past four years; however, most churches were not favorable to allow our team to recruit after masses or even to announce the study in the bulletin, but no reasons were given.

Environmental barriers

Recruitment occurred during the summer, and the high temperatures likely influenced older Latinos' willingness to go out, as the research team reported meeting few older adults in the neighborhood or at the health fair. Younger generations were more present in local coffee shops. Gentrification is happening in the community and the research team felt that older Latinos were distrustful of people they do not commonly see in the neighborhood. Some local business were not familiar with research and were hesitant with the request to leave or post flyers in the businesses. Also, immigration scams had been brought to people's attention, as the intervention happened as the administration was changing over, and many people were concerned with government involvement.

1. 3 Recruitment rates and eligibility criteria

Recruitment and enrollment rates are presented in Figure 1. Of the 77 people interested in the study, 36.4% were eligible, 29.9% were not eligible, and 33.8% were not screened as the study had reached its capacity. Of the 51 people who were screened, 54.9% (n=28) were eligible. Most common reasons for ineligibility were: 21.7% (n=5) too active (>150 minutes of exercise per week), 21.7% (n=5) not interested, 17.4% (n=4) no smartphone, and 17.4% (n=4) study schedule conflicted with work. Enrollment rate was 71.4% (n=20 of 28).

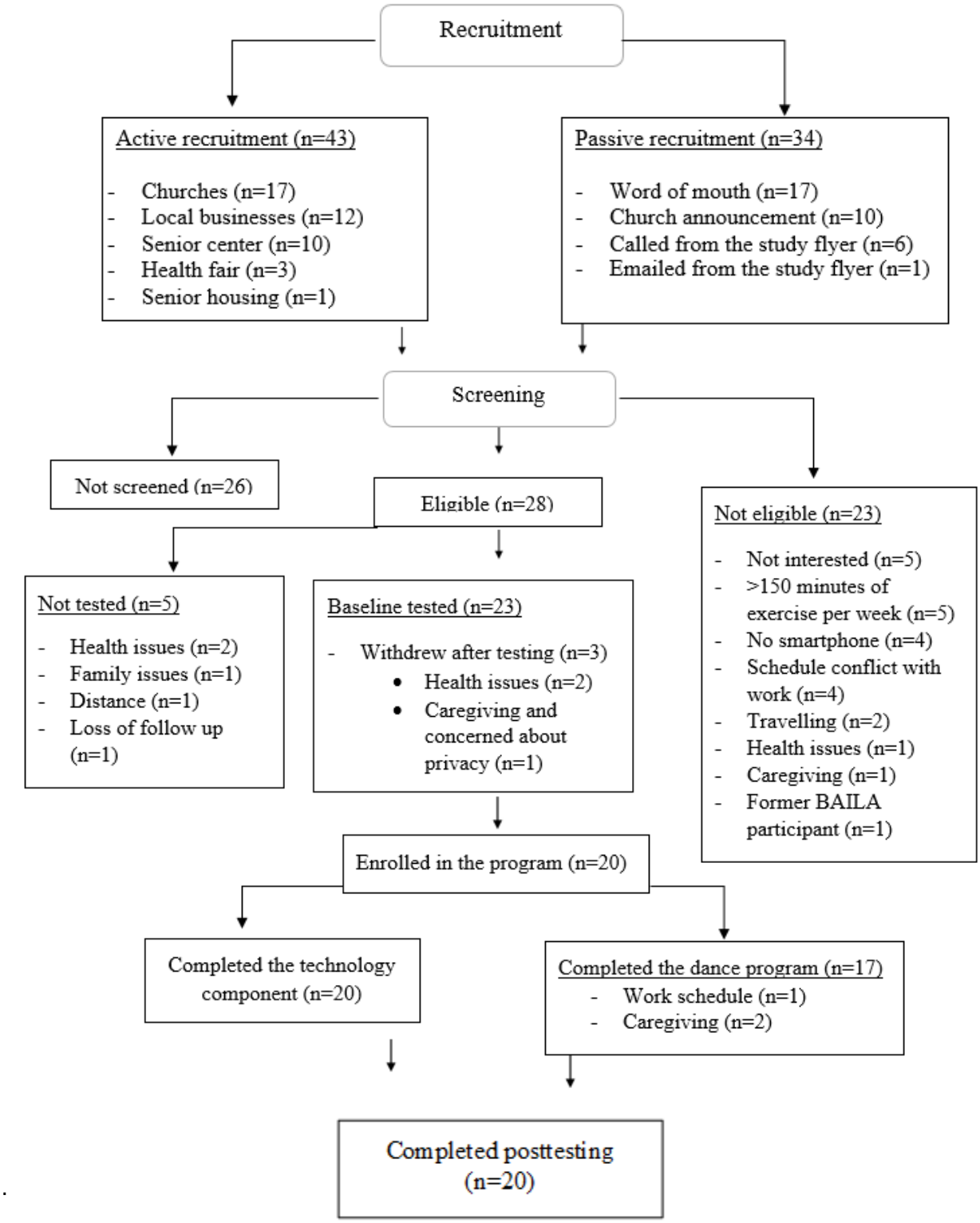

Figure 2. CONSORT flow diagram

2. Acceptability and suitability

2.1 Adherence

Thirteen participants (65%) had high adherence (>70%) to the technology sessions, attending an average of 91% of the sessions. Fourteen participants (70%) had high adherence to the dance classes, attending an average of 91% of the classes. Four participants (23%) had high adherence to the mHealth technology practice sessions (which were not required), attending an average of 76% of the sessions (Table 7).

Fitbit usage

Participants were asked to wear the Fitbit starting on the orientation day to two weeks after the intervention finished, for a total of 133 days for at least 10 hours per day. Sixteen participants (80%) had high adherence to the wearable, three participants (15%) had moderate adherence, and one participant (5%) had low adherence (Table 8).

Table 7. Adherence to the intervention

Technology sessions adherence with all participants (30 sessions in total)			
	average % classes	N	% participants
High adherents (>70%)	91	13	65
Moderate adherents (50% to 70%)	57	5	25
Low adherents (<50%)	25	2	10
		20	100
Dance sessions adherence with all participants (32 sessions in total)			
	average % classes	N	% participants
High adherents (>70%)	91	14	70
Moderate adherents (50% to 70%)	61	4	20
Low adherents (<50%)	23	2	10
		20	100
Technology practice sessions with all participants (total 20 sessions)			
	average % classes	N	% participants
High adherents (>70%)	76	4	20
Moderate adherents (50% to 70%)	62	6	30
Low adherents (<50%)	22	10	50
		20	100

Table 8. Fitbit wear time

Fitbit wear time (20 participants)			
	average % days	N	% participants
High adherents (>70%)	87.5	16	80%
Moderate adherents (50% to 70%)	65.2	3	15%
Low adherents (<50%)	49.6	1	5%
Total	82.3	20	100%

2.2 Retention

Of the 23 participants that completed baseline testing, 13% (n=3) dropped out before the intervention started, and 87% (n=20) started the program. All the 20 participants completed the technology component of the program (wearing the Fitbit and receiving the text messages). During the intervention three participants (15%) dropped out form the dance program due to conflicts with work schedule (n=1) and caregiving (n=2). Seventeen participants (85%) completed the dance program. All 20 participants completed post testing.

2.3 Engagement

Participants reported dancing for 50 minutes of the 60 minute classes. Participants reported feeling “very good” before, during, and after the dance class. Mean ratings of perceived exertion was 11.9 on a 6-20 RPE scale, of light-moderate intensity.

2.4 Text messages delivery and content appropriateness

A total of 43 text messages were delivered. The initial plan was to send 48 text messages; however, a few participants needed training on how to open text messages on their mobile phones. The text messages started on week 5 of the intervention, lasting for 12 weeks.

As this study had limited personnel during the intervention delivery phase, the research team was not able to individualize text messages, tailor messages with participants' names, nor base the messages on individual Fitbit data; or tailor messages based on participants' preferred days/times to receive the messages. In the beginning of the intervention the research team sent messages in cases of lack of compliance in wearing the Fitbit; however, the team realized participants would prefer to talk to the research assistants before or during the technology sessions to see the device, as they were not able to explain or understand the problem via text. We were not able to offer 2-way communication using the text message system.

One other barrier faced was that the text messages database used to retrieve the messages from was too large with 268 messages, making it very difficult for the research team to choose appropriate messages. The research team tried an organization strategy by separating the messages into nine categories so that participants could select the category they wanted to receive; however, the content of the messages was not entirely appropriate for this study as the messages *only* encouraged walking. The most commonly chosen text messages category was motivational messages (n=18 participants) and general health (n=17 participants). However, in the first few weeks of the program, the research team found some messages to be repetitive and to sound demanding. In the mid-program discussion session participants mentioned the messages sounded similar in just encouraging walking, and that general messages were not helpful.

Additional messages were created with content on dance, Fitbit, steps and dance, music, weather/weekend/holiday, SB, general health, and class reminders:

> “Did your Fitbit vibrate because you were sedentary for too long? Try to notice it and move before it vibrates again”
>
> “Have you tried an individual Fitbit challenge? The hiking in the mountains is a great one”
>
> “Guess how many steps you can take during one song. Tell us the result tomorrow”
>
> “Marc Antony is looking for salsa dancers! Why don’t you try some salsa steps now?”
>
> “Everyone aiming to achieve your goal! Pasito a pasito, suave, suavecito ☺”

Most commonly sent text messages were dance messages to encourage participants to dance at another times (n=15 messages), Fitbit-related (n=5 messages), and class reminders (n=4 messages). A total of 13 messages was used from the original database; however, the research team tried to tailor messages according to the weather: “try to relax with a light walk today. Don’t forget to put your jacket on”.

Forty-nine messages were scheduled and 43 text messages were delivered. Eight messages were not delivered due to an error while entering participants’ information in the iCardia platform that did not allow messages to be scheduled for a later time. At posttest all 20 participants reported that they had received the messages during the intervention, 18 participants (90%) read the messages and thought the frequency of about four messages per week was appropriate, and 17 (85%) participants reported the messages motivated them to exercise. The two participants that did not read the messages stated at the end of the intervention that they still did not know how to read text messages, and one stated he does not have the capacity to understand it.

In the qualitative portion of post testing participants cited that the timing of the messages was not always appropriate, as a motivational message would come right after they had walked. Participants mentioned that the text messages were necessary as they would feel committed to their PA goals and the group. Participants also said the text messages were efficient reminders

to achieve their step goals set in the technology sessions. Participants' preferred messages were the dance ones, the ones tailored based on the weather and proposing alternative options to exercise, messages referring back to the technology sessions or dance classes, giving ideas on how to take more steps. Participants wanted to receive messages about nutrition.

Table 9. Text messages categories

Category of text messages retrieved from the text messages database	Chosen by participants	Messages scheduled	Messages sent
Motivational messages	18	3	3
Exercise tips	16	2	2
Alternatives to exercise	14	3	2
Exercise with family	6	0	0
Exercise with others	6	0	0
Suggestions to move	15	3	2
Mental health	13	2	2
Self-care	11	1	1
Nature and exploring	11	2	1
General health	17	3	2
Total messages from the database		19	15
Messages developed by the research team			
Weather/weekend/holiday	N/A	3	3
Fitbit	N/A	5	5
Dance	N/A	15	13
Classes reminders	N/A	4	4
Music	N/A	1	1
Dance + Fitbit	N/A	2	2
Total messages developed during the program Total messages		30 49	28 43

2.5 Acceptability and enjoyment

Classes were viewed as enjoyable (mean=6.6, SD = 0.4) on a 7-point Likert scale (ranging from 1= did not enjoyed to 7=enjoyed a lot). Qualitative data was collected and recorded in focus groups at the monthly discussion sessions, program evaluation, and at post testing. Participants stated that the program provided physical, mental, and emotional help, two other participants wanted more days of the intervention, and many participants requested the program to continue after the intervention was done.

> "The program was great, very motivating, many important things were taught about health, motivation, overall we learned about our goals and challenges. Thanks for the program, come back soon" (female participant).

At post testing participants were asked what intervention component was most valuable for them, and people responded that the group setting, the dance and the technology were important. Several participants said both the dance and the technology were equally important.

Dance

About half of the participants reported in the focus groups that they joined the program due to the dance classes. Some participants reported they did not enjoy some dance styles; however, they stated that the variety of styles was good. Two participants suggested that the dance to be done in the morning.

> "The dancing is good because it keeps one's mind occupied" (female participant)

> "The dancing helps to stay energized" (female participant).

Fitbit

In the focus groups participants reported great acceptability on the adoption of the Fitbit, mentioning the technology sessions helped with learning progressively. Participants reported

enjoying how Fitbit provides feedback, assists self-monitoring and PA tracking. Participants were encouraged to set step goals and track their PA thought the week. Some people mentioned that they became used to wearing the device first thing in the morning so it would track all the steps, and how Fitbit challenges (games) were very useful in motivating themselves by comparing to their peers. One participant reported he bought his wife a Fitbit.

> "I liked completing goals of steps and increasing it" (male participant)

> "I like the measures because one can know what is happening with oneself" (female participant)

> "The most important component was the daily reminder to move that being the Fitbit or the text message" (female participant).

Text messages

Text messages were also mentioned as an important motivational tool. Messages tailored to the weather forecast, goal setting, and referring to the content learned in the technology sessions were reported as very useful. Participants also stated the text messages were great reminders and that they could sense the technology session instructors were sending the messages.

> "I liked when they would give us ideas on how to walk more. For example, go to the stores, go to the garden, walk around the garden, those were always motivating and gave us good ideas" (female participant).

> "One messages was: if it is snowing or it is cold outside you can put music and dance even if you are in the same place, your steps count. There were useful text messages" (female participant).

> "Sometimes the messages made me laugh because it was very appropriate at certain times, and I said: "ayyy, it seems like they are watching us" and yes, they do help a lot and they motivate, personally they are pleasant to receive and make one smile"" (female participant).

> "For me what was important was the message, not the content of the message. They could send me a series of words without any meaning and I would know that they sent them, that is to remind me that I form part of a group, a program and I have responsibilities" (female participant).

Group setting

Participants stated that being part of a group (participants and the instructors) was one of the most important components of the program to motivate them to engage in PA. They mentioned how they felt commitment to attend classes, and accomplish their PA goal. Peer modeling was mentioned as a benefit of having the in-person sessions so that new bonds were created and peers would motivate each other.

> "Being with all the people, also knowing that I wasn't even doing 1,000 steps a day. I mean, I think I knew but realizing that it wasn't much Wow! I'm not moving, I'm not doing much. And being in contact with all the people there they are doing extremely well. 100,000 something [100,000 steps per week] Wow! In my dreams, you know. But that has helped me a lot" (female participant).

> "I think that spending time with the other members, that for me was the most valuable component. To meet new people, we have made friendships between us, so for me it's very valuable" (female participant).

> "The Fitbit is important, but for me human contact is more important. The support that we got from the instructors was also an important component for me. The Fitbit is an important instrument for me but for me the friendship and spending time with others was more valuable" (female participant).

Technology instructors

Participants were grateful for having two technology instructors as it allowed for activities in small groups. Participants also cited that the technology instructors were very patient and helpful.

> "Everything was interesting, everything, every week or every time that the instructors gave us an explanation it was always so we would learn something,

> motivation, then a program that really was worth it and would not like it to end" (female participant).

> "They taught us to send the message because me on the phone there only "hi" and "bye" and I learned to send messages with them" (female participant).

Program feedback

Participants provided great overall feedback by mentioning that the various components of the program were important to ensuring they had the tools to engage in healthy behaviors. Participants initiated a discussion on how the program or group could be maintained once the intervention was over. They brainstormed and discussed suggestions on how to transition the intensive intervention to a non-research setting. A volunteer service started to be offered at the senior center after the intervention had finished.

> "This program has been excellent. I have learned about Fitbit and something about technology. Everything was very good except that it (the program) was too short. If it would be longer it would be much better" (female participant).

> "The program was good for me. Dancing with the Fitbit and all the exercises and technology – I learned something different. I would like for the program to continue" (male participant).

> "I am very grateful for this program and your support and I would appreciate it if this programs could somehow continue. It has motivated me to get out of my daily routine and I am very thankful for you giving me that opportunity" (female participant).

2.6 Complaints and concerns

There were no adverse events during the dance classes. A few participants had issues with pairing the Fitbit device with the app, and syncing. Some participants would be logged off the app and would not be able to log back in on their own. Most people had difficulties in

understanding the need of keeping the Bluetooth enabled at all times, and its usage in relation to Fitbit for syncing; however, the majority of them were able to navigate these features throughout the intervention.

Participants reported minor concerns in regards to the Fitbit such as discomfort with using the wearable, and a rash on the wrist due to constant wear of the device. As this participant wanted to track her sleep quality, the research team advised her to wear the device on the other wrist during the night. Another participant said that when she started wearing the Fitbit her hand was sore, but after a week she got used to it as it was a new watch she was wearing. One participant reported that the wearable would make her sweat a lot, but then she would remove and clean it.

Some participants complained that sometimes the Fitbit would not count their steps and it would get stuck, the research team was not able to solve the issue. Participants stated this was “unfair”. They also mentioned that sometimes there was a delay in syncing their steps with the app and that a few days those steps were never synced. They also complained that the Fitbit does not track steps when participants are carrying a stroller or shopping cart. They were told to wear it on their pocket during these walks.

Two participants had travelled to countries in Latin America (Ecuador and El Salvador) and did not bring the Fitbit to their trip as they were advised by family members that the device could attract unwanted attention for potential robberies. Another participant was not able to properly sync her Fitbit when she was in Mexico; Fitbit was working normally when she was back to the U.S. One participant wore in Vietnam and was able to sync it normally. One participant was concerned about his privacy in creating the account and the type of information the Fitbit app would disclose. The research team limited the amount of information inserted in the Fitbit account, as for example, for birth date the research team added January 1st for all participants, and just the correct year of birth. At the end of the intervention, a few participants

reported they did not fully understand how to navigate the Fitbit app; however, they were still wearing and checking the device.

In regards to the BAILAMOS© dance program, a few people commented that a few other dance styles could be added to the program. They mentioned that the music could be changed more often, but liked the fact that the music was modern. Two participants reported that the language used in the text messages and messages from Fitbit was not formal and proper Spanish. Participants also reported that some punctuation and accentuation symbols were not properly displayed in the messages, probably due to the fact that the iCardia platform was not designed to deliver messages in Spanish, or the phone provider, or mobile phone.

Participants commented the fact that they would like to have written information during the technology sessions. The technology instructors provided a few handouts and created a booklet so participants could track their PA but no formal written material was handed out. To try to overcome learning difficulties, the technology instructors used iPads to explain the step-by-step participants should follow on their Fitbit app.

3. Resources and management

3.1 Personnel requirement

Fourteen people were involved in the intervention, and eleven people formed the main research team. Eleven people were involved in recruitment and two research assistants led recruitment planning and setting up. Three research assistants assessed eligibility of potential participants. The professional dance instructor that co-created the BAILAMOS© dance program lead the dance sessions. Two research assistants delivered the technology portion of the intervention. The professor that created the iCardia platform (SK) regularly checked data

coming from Fitbit and solved issues when necessary. Two external research assistants collected the data.

3.2 Time requirements

Total time requirements for the intervention was 382 hours. Planning and preparing recruitment required 27 hours over 11 days; recruitment required 80 hours over 12 days; screening required 62 hours over 20 days; data collection required 88 hours over 21 days; preparing the technology sessions required 40 hours over 35 days; delivering the intervention required 64 hours over 32 days. Time for checking Fitbit data was not included.

3.3 Monetary and equipment requirements

Total costs for the study was $9,572, which do not include costs with personnel. Intervention-related costs were: $3,000 for the Fitbit Charge 2 monitors, $2,400 for the professional dance instructor, $100 for sending the text messages. Research-related costs included $800 for participants' compensation for potential costs of receiving text messages, $435 for participants' compensation for completing data collection, $1,440 for the data collectors, and $1,444 for the iCardia platform. The platform used to retrieve Fitbit data and send the text messages were provided by a study collaborator (SK) and for this reason costs for the platform are not described or included. Future studies should budget for this tool.

E. Discussion

To the best of our knowledge this was the first mHealth-infused dance trial for older Latinos, and it was feasible according to the feasibility metrics assessed. Participants expressed interest in the dance classes, but also in the opportunity to learn how to use Fitbit technology to track activity-related parameters. The technology sessions provided information, technical and social support that was desired by participants.

Recruitment capability

The present trial had a recruitment rate of 71.4%, which was better than previous BAILAMOS© trials. This number might be due to the innovation of the technology component added to a culturally-relevant dance program.

Eligibility rate was 36.4%. All potential exclusion criteria were specified in the study flier, so participants who signed up for the study were very interested in it. During week two of recruitment it was brought to our attention that a potential participant that had a flip phone and a tablet could be eligible for the program, as these two devices could be used in place of a smartphone. We adopted the suggestion; however, this change was not made in the research flier, and even the research team presenting this alternative option for a smartphone, some older Latinos self-excluded from the program if they did not meet the original inclusion criteria. This modification in the eligibility criteria of having a flip phone for the text messages, and a tablet for the Fitbit application can enlarge the reach of the program in future studies.

Recruitment length was shorter than expected from our previous dance trials. This could be due to the fact that the present study had less exclusion criteria than previous BAILAMOS© trials, and the fact that the days and times of the program were established before recruitment started and so participants would sign up for the study if they perceived themselves to be eligible. Even though recruitment at churches was not easy, this was our most successful recruitment strategy, both announcing at masses and at churches' weekly bulletins. One of the most efficient recruitment strategies was word of mouth. The study announcement was posted only once in one church's bulletin yet referred 12% (n=10) of potential participants.

We had success recruiting participants through Catholic churches; however, we experienced more recruitment barriers than expected in the BAILA TECH trial. In the present trial, churches did not allow us to make announcements after the mass, even though the research team emphasized that the program could benefit members from the church. A few

reasons might be the fact that church staff had changed in the past years and so secretaries or the priests were not familiar with our programs, and did not think it could benefit people from the church. The secretaries mediated the communication with the priest, and in many cases our message did not reach the priests. A few other reasons might be perceived lack of connection from the university with the churches, perceived burden in allowing the research team to reach the church community in less than 2 years from the previous trial, or lack of trust with the research team in times of political concern within the Latino community.

Acceptability and suitability

Adherence to the dance classes was very good. Many participants had to miss classes for reasons such as conflicts with work, the need of caring for a relative, health-related reasons, and travelling. However, most participants attended most dance classes.

Participants were very adherent to wearing the Fitbit device for 20 or more hours per day, four or more days per week. Participants had technical issues in the first weeks of the program, but after better understanding the device and its functions, fully adopted the wearable; nevertheless, some participants were not able to understand the wearable after the entire 4 months program. This might be due to a cognitive decline that was not detected by the MMSE, or a lack of previous experience with technology, which made the experience challenging.

Retention rates for the technology component were impressive. All 20 participants completed the 4 months wearing the Fitbit, charging, and syncing regularly. Some participants might not have fully understood the Fitbit mobile app features; however, they kept wearing the tracker and checking the steps in the wearable.

Participants' qualitative feedback during the monthly discussion sessions and at post testing demonstrated great acceptability of the intervention. The high rate of completers of the entire dance and technology program reinforce the feasibility of the program. Participants

reported enjoying the dance classes and the technology sessions, and stated they received the support needed to keep them motivated to learn and change behaviors. Minor events were reported with only two participants. Rashes and discomfort can happen while wearing the Fitbit, especially if worn for several hours. Participants were told to switch the hand they were wearing during the night as participants wanted to keep track of their sleep.

Resources and management

Community-based research requires a large research team, however, as recruitment was shorter than planned, the research team efforts were directed towards preparing the delivery of the intervention. The presence of two research assistants at the senior center at every class was essential. Participants felt that they had technical and social support to assist them, which was clearly an important component if the intervention. Future interventions could address this matter by using *promotoras*, or with inter-generational program with tech savvy young adults.

Monetary requirements were reasonable, as the wearables are at an accessible price for a one-time purchase. The rates for the dance instructor likely vary in other regions. Costs for assisting participants with the cell phone data plan can add up to a large sum, which has to be considered in large-scale interventions.

The strengths of the present study include the innovation in combining technology components with a culturally-relevant dance program for older Latinos, and the essential piece of providing the technology classes to assist with learning how to handle the new device, the cell phone application, in providing goal-setting strategies, encouragement and rewards, and facilitating social support among peers. Limitations of this study include the qualitative data collected at the focus group discussion was subject to social desirability bias. Also, this was a multi-component intervention that limits our capability to determine the essential components

given its study design. This intervention had an intense time and personnel support provided by the research team; however, the text messages can be automated to send tailored text messages based on incoming Fitbit data. This could improve scalability of intervention delivery as it would minimize the time researchers would check the data and program messages. According to the design of feasibility studies, this study had a small sample size and no control group. As this is a feasibility trial to test the intervention protocol, a pilot study would be needed to test the modifications made to the intervention protocol.

F. Conclusion

Older Latinos accepted and were enthusiastic about the technological components added to a dance program. Future studies should provide more synergy between the dance and the Fitbit, such as promoting activities that involve step counting during the dance sessions, and tailoring the text messages based on step count data from the Fitbit. As the wearable device was a complex technology added to the program, much of the effort of the technology sessions was devoted to teaching, clarifying, and assisting participants in understanding and adopting the technology, and to promote social support. The technology sessions added to cost/effort; however, it was perceived by the research team as a needed component for intervention success. When the messages about dance and the wearable were incorporated in the mid-program evaluation, participants reported more enjoyment of the messages. Towards the end of the intervention, once participants were more confident in handling the wearable, some activities using the wearable during the dance class were introduced. The feasibility design allowed flexibility in the intervention design and modifications in the protocol occurred when needed, as recommended by feasibility experts. The combination of the in-person dance and technology classes, wearable, and text messages was successful; however, very intensive. Future studies should aim empower participants to understand and fully adopt mobile health.

V. DEVELOPMENT AND IMPACT OF A MOBILE HEALTH-INFUSED DANCE PROGRAM ON HEALTH OUTCOMES FOR COMMUNITY-DWELLING OLDER LATINOS

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A. Abstract

Only one in three older adults meet the physical activity (PA) guidelines and mobile health technologies (mHealth) is increasingly being used as a tool to promote PA. Interventions using wearable trackers and text messages have been conducted with older adults; however, there is little research with Spanish speaking older Latinos. A Latin dance intervention was developed targeting older Latinos (BAILAMOS©); however, participants' PA levels do not reach PA guidelines mainly for lack of activity in non-dance days. The present study extended and adapted the initial BAILAMOS© program by adding mobile health technologies. This single group pre-post study aimed to (1) describe the development of an mHealth-infused dance program, with the addition of wearables and text messages incorporated to the BAILAMOS© dance program; and (2) assess the impact of the intervention on PA and health outcomes in older Latinos. Older Latinos (n=20, m age 76.0 ±7.11, female n=15, 75%) were enrolled in a 4-month dance program held twice a week. Participants received a PA wearable tracker to wear for PA assessment before, during, and after the intervention. A mobile health technology platform (iCardia) was used to remotely collect Fitbit data from participants' devices and deliver weekly motivational and informational text messages. At baseline (week 0) and post-intervention (week 17) participants completed questionnaires about PA, sedentary behavior, PA social support, PA self-efficacy, cardiorespiratory function, and executive function. Cohens'*d* was calculated for pre-post questionnaires. Mobile technology education sessions were

developed to assist with participants' understanding and promote utilization of the PA wearable tracker and associated mobile application. Delivery of classes was modified according to participants' requests. Participants were divided into small groups based on PA levels and activities encouraged peer learning and social support. Large effect sizes were observed for self-reported light PA (*d* = .93), moderate PA (*d* = 1.19), and moderate-vigorous PA (*d* = 1.05). Medium effect sizes were observed for device-assessed moderate-vigorous PA (*d* = .69), and small effect sizes for device-assessed steps (*d* = .45). These preliminary data demonstrated the potential of a mHealth-infused dance intervention to increase older Latinos' PA levels. A pilot trial with a control group should be conducted using the technology components developed in this trial, and potentially lead to an adequate powered randomized controlled trial.

B. Introduction

Latinos are the fastest growing minority group in the US, and older Latinos are the fastest growing segment of older adults (Department of Health and Human Services, 2017). Physical activity (PA) is encouraged to prevent chronic disease among older adults (Sun et al., 2013); however, only one in three older adults meet the physical activity (PA) guidelines (U.S. Department of Health and Human Services, 2008) of engaging in 150 min/week of moderate PA (Troiano et al., 2008). In addition to the deleterious effects of aging and lack of physical activity, research has shown that even for active people, sedentary behavior (SB) is an additional health risk (Evenson et al., 2012). Older Latinos spend eight hours per day on average in sedentary time (Evenson et al., 2012).

Research has shown that Latinos consider walking and dancing as culturally-relevant types of PA (Marquez et al., 2010a). Our group has developed a Latin dance program targeting older Latinos (BAILAMOS©), focusing on motor and cognitive tasks, and to provide social engagement (Marquez et al., 2015). BAILAMOS© is a 4-month Latin dance program that is held

for one hour each session, twice a week. The program engages participants with motor and cognitive tasks for the dance steps, and promotes a social and enjoyable environment (Marquez et al., 2014). Evidence from a feasibility pilot and a small randomized controlled trial provide preliminary support for the impact of BAILAMOS© on PA and cognitive functioning (Marquez et al., 2017). Although BAILAMOS© offers an age- and culturally-relevant type of PA for older Latinos, participants who only participate in PA via the dance program do not meet the 2008 Guidelines for PA, mainly because of lack of PA on non-dance session days.

Technological strategies to increase adherence to PA interventions, and to promote PA engagement remotely are being promoted (O'Reilly & Spruijt-Metz, 2013), and such interventions suggest that its use has positive outcomes on behavior change (Fjeldsoe et al., 2009). Even among middle-aged and older adults, various types of mHealth technologies, such as text messaging and PA wearable trackers, are being implemented in behavior change interventions for assessment of, and prompting of, PA; and are showing promising results (Sullivan & Lachman, 2017).

Text message prompts are assisting middle-aged and older adults to engage in PA (Lilje et al., 2017); and wearable devices, such as the Fitbit® (Fitbit, Inc., San Francisco, California, USA), automatically track step counts and allow participants to monitor their PA participation using a smartphone application (Diaz et al., 2015). There is evidence to support the validity of Fitbit PA wearables trackers on step counts and energy expenditure, mainly in activities such as walking and running (Diaz et al., 2015; Evenson et al., 2015a). Wearables are reported to be acceptable and useful for middle-aged and older adults (Mercer et al., 2016; O'Brien et al., 2015). Another study affirmed that older adults perceived wearables to be easy to use (Siobhan K McMahon et al., 2016).

The Latino population has been gaining access to technologies, and is familiar with text messaging, although low education levels, low literacy and age-related disabilities are barriers to the use of technologies, especially among older Latinos (Bender et al., 2016; Gell et al.,

2013; Victorson et al., 2014). These barriers reinforce the need for developing mobile health interventions for the Latino population, so that age, language, culture, and literacy concerns are targeted. Small amount of text and more images are among the cited strategies to use in mobile health with the Latino population (Bender et al., 2016). mHealth interventions targeting the Latino population should also incorporate important Latino cultural values, such as the importance and role of family and religion, and gender roles (Victorson et al., 2014).

Based on the literature with older adults and technology (Lilje et al., 2017; Siobhan K McMahon et al., 2016; Mercer et al., 2016; O'Brien et al., 2015) we believe that incorporating technological components – Fitbit and text messages – with the BAILAMOS© dance program can increase PA engagement on non-dance session days. Our formative study with focus groups also support the implementation of these new components to the BAILAMOS© program.

Thus, the purpose of this study was to describe the development of a mobile health-infused dance program (BAILA TECH) for older Latinos, and determine the preliminary impact of the intervention on older Latinos' device-assessed and self-reported PA and SB, and self-reported outcomes, including: cardiorespiratory fitness (CRF), PA self-efficacy, PA social support from friends and family, physical and mental health, and executive function. We hypothesize the intervention would yield small-medium effect sizes reflecting improvements in pre- and post-intervention measures of PA and SB (self-report and device-assessed), CRF, PA self-efficacy and social support, physical and mental health, and executive function.

C. Methods

Recruitment

Recruitment occurred at Catholic churches, a senior center, local businesses, and health fairs in a predominantly Latino neighborhood in Chicago, IL. Detailed recruitment strategies are described elsewhere (feasibility paper). Screening for eligibility was done over the phone with potential participants. Inclusion criteria were: (1) age $\geq$ 55 years old; (2) self-identification as

Latino/Hispanic; (3) ability to speak Spanish; (4) adequate cognitive status as assessed by the Mini Mental State Examination (MMSE) (>14/21) (Folstein et al., 1975); (5) no plans to leave the U.S. > two weeks during the study; (6) have a smartphone (with internet access and capability to run apps) with data and text plan; (7) danced < 2 times/month over the past 12 months. Participants were excluded during screening if they had: (1) presence of uncontrolled cardiovascular disease or uncontrolled diabetes mellitus (2) stroke within the last 12 months; (3) severe chronic obstructive pulmonary disease (COPD); (4) recent healing or unhealed fracture(s) (in the last 6 months); (5) recurrent falls in the past 12 months; (6) regular use of assistive device to walk (e.g., cane); (7) participated in previous BAILAMOS© trials.

Study design

This single-group pre-post study assigned all participants to the BAILA TECH dance program that was delivered for 16 weeks at the Pilsen Satellite Senior Center at Casa Maravilla. Intervention sessions were divided into three parts: 30 minutes for a technology session, 1-hour of the BAILAMOS© dance program, and 30 minutes for technology practice time. Classes were held twice a week.

Data collection

Technology sessions development

Data from the development of the technology components and modifications to the BAILAMOS© program were obtained by the research assistants during the program planning and execution. All data were recorded in daily reports.

Testing sessions

A 2-hour baseline testing was scheduled for eligible participants where they signed an Informed Consent, completed interview-style questionnaires in Spanish or English about engagement in PA and SB, physical and mental health, social support for PA, PA self-efficacy,

and an executive function test. The data collector provided information about the procedures in regards to the technology components of the study. Daily activity measures (step counts, intensity of PA, and exercise sessions) were securely transmitted to the Fitbit cloud server and from there to the iCardia research system hosted in a HIPAA-compliant server within the Secure Research Environment of Academic Computing and Communications Center, at the University of Illinois at Chicago (Kitsiou et al., 2017).

Fitbit procedures

The research team created study email accounts, and then created study Fitbit accounts to be associated with participants' Fitbit mobile application. Real names or birth dates were not used to create email or Fitbit accounts. At baseline testing (week 0) the data collector briefly explained about the Fitbit® Charge 2™ device and mobile application, its features, the type of information that Fitbit tracks, and how the information is displayed. Participants were not yet taught how to use the Fitbit step-by step, as this would be done later at the group orientation session. The data collector also paired and synced the Fitbit with the participants' cell phone. The Fitbit was not given to participants at baseline testing because participants were not yet fully instructed about the Fitbit, and also because we wanted all participants to receive the Fitbit at the same time so that the research team would be able to identify and remove the first week of usage due to potential reactivity that could lead to increased PA. Pairing and syncing the Fitbit was done at baseline testing and not at the orientation session as a way to avoid the issue of Bluetooth identifying multiple devices. Participants were informed that they would receive more details about the Fitbit at the orientation session, which was scheduled once all 20 participants had completed baseline testing. After the program ended (week 16), participants were invited for post testing (week 17). A $10 cash compensation was given to participants for each baseline and post testing session completed. Fitbit data collection was also done one week after the intervention had finished. After the intervention was done, participants kept the

device as an incentive. Study email and Fitbit accounts were deleted shortly after the program ended. The research team explained how to create a personal Fitbit account.

Intervention components

Orientation session

At the orientation session participants received their email and Fitbit accounts and passwords. Participants also received the Fitbit and a short manual about the device and app.

Technology sessions

The first hour of each class of the intervention was devoted to technology sessions where participants were taught about the Fitbit device and app. The development of the sessions is described below.

BAILAMOS© dance program

BAILAMOS© is a 4-month Latin dance program designed for older Latinos, held twice a week. Every dance session is one hour in length. Each month a new dance style is introduced by a professional dance instructor. Dance styles taught follow a gradual level of complexity, beginning with Merengue as the easiest and most popular style among Latinos, followed by Cha Cha Cha, Bachata, and Salsa (Marquez et al., 2015). At the beginning of each month an additional 1-hour discussion session is conducted to inform and debate about the benefits of PA, the deleterious effects of SB, barriers of PA engagement, and strategies to overcome barriers. The detailed development of the BAILAMOS© intervention is described elsewhere (Marquez et al., 2015). There were 32 dance sessions during the intervention.

Text messages

Motivational text messages were intended to reinforce content and strategies learned in the technology sessions and content from the monthly discussion sessions on strategies to increase PA, reduced SB, aiming to improve wellbeing. Frequency varied from twice a week to

six times a week. Timing varied from 10 AM to 7 PM. Messages sent were on motivation messages to engage in PA, about general health, messages related to the Fitbit features, suggestions to accumulate extra steps, and messages to encourage do dance during the day. Details about motivational text messages can be found elsewhere (feasibility paper). Participants received motivational text messages for 12 weeks (from week 5 to week 16) of the program because some participants needed training on how to open and read messages on their smartphone.

Measures

Physical activity

Device-assessed PA. At the orientation session participants received a Fitbit Charge 2 (Fitbit Inc., San Francisco, CA) and were told to wear it on their non-dominant wrist for at least 10 hours per day in a 24-hour period (Ward, Evenson, Vaughn, Rodgers, & Troiano, 2005) for the four months of the intervention. Instructions were given to not to wear it when swimming or bathing. Fitbits are small and lightweight PA trackers that uses triaxial accelerometers technology and are increasingly being used in research to assess PA and they provide high validity of steps (Evenson et al., 2015). PA data was divided in number of steps, light PA (LPA), moderate PA (MPA), vigorous PA (VPA), and moderate-vigorous PA (MVPA). Wear time was calculate using the iCardia platform that uses the heart rate Fitbit sensor to disregard non wear time (Kitsiou et al., 2017). Valid days were considered if the Fitbit displayed more than 600 minutes of data in a 24-hour period. Wear time is reported in minutes.

Self-reported PA. The CHAMPS Physical Activity Questionnaire for Older Adults (Stewart, Mills, King, & Haskell, 2001) assesses domains PA commonly engaged by older adults, for example, leisure time, and household PA. Self-reported PA questionnaires are important to classify the PA domains, as Latinos commonly engage in work-related PA (Arredondo et al., 2015). The CHAMPS questionnaire had been translated into Spanish

(Rosario, Vázquez, Cruz, & Ortiz, 2008) and has adequate validity and reliability (Stewart et al., 2001).

Sedentary behavior

Device assessed SB. Sedentary behavior was also assessed using Fitbit Charge 2 (Fitbit Inc., San Francisco, CA) at baseline, during the 4-month intervention, and post intervention. Fitbit Charge 2 has reminders to break sedentary time that warns participant if <250 steps/hour. The iCardia platform displays all sedentary time, and adjusted sedentary time. Adjusted sedentary time is calculated as the total sedentary time minus non-wear time (that is calculated based on the absence of heart rate data). Adjusted sedentary time is presented in minutes.

Self-reported SB. The Sedentary Behavior Questionnaire (SBQ) (Rosenberg et al., 2010) has been translated to Spanish and has acceptable reliability (Munguía-Izquierdo et al., 2013). The SBQ assesses 9 behaviors in weekdays and weekends, separately, and it includes active and passive SB.

Cardio respiratory fitness (CRF)

CRF was measured using a non-exercise validated questionnaire (Jurca et al., 2005) validated for older adults (Mailey et al., 2010). It is a field test that estimates CRF by using a regression equation including gender, age, body mass index, arresting heart rate, and self-reported PA (Jurca et al., 2005).

Physical and mental health

The SF-12 Health Survey (Ware Jr, Kosinski, & Keller, 1996) is a generic, brief, reliable measure of overall health. It is a 12-item survey with questions selected from the SF-36 Health Survey. The survey assesses eight domains of health, and results include perceptions of mental and physical health, and overall quality of life.

PA social support

The Social Support for Exercise (Sallis et al., 1987) scale assesses the level of support participants report to receive from family and friends.

PA self-efficacy

The Physical Activity Self-Efficacy Scale (McAuley, 1993) assesses participants' beliefs in their ability to be physically active twice per week at moderate intensities for 50+ min per session over incremental week periods for 16 weeks. This measure has adequate validity and reliability (McAuley, Konopack, Morris, Motl, & Hu, 2006). The PA self-efficacy scale is divided in two parts: barriers self-efficacy (BARSE) and lifestyle self-efficacy (LSE). BARSE assesses the confidence in overcoming barriers to PA, and LSE assessed the confidence in maintain PA for the next six months.

Executive Function

To assess executive function the Color task of the short form (Wilson et al., 2005) of the Stroop Neuropsychological Screening Test (Trenerry, Crosson, DeBoe, & Leber, 1989) was used. The test consists of naming colors that are printed in incompatible ink colors. In the first test participants just name the words. The second task is the Color–Word task participants are asked to name the color of the ink, rather than the word (Wilson et al., 2005).

Data analysis

Intervention development was described according to the research assistants' experiences during the intervention, and daily reports from every debriefing and planning session.

To determine the preliminary impact of the BAILA TECH program effect sizes (Cohen's *d*) were computed to examine changes in device-assessed and self-reported PA and SB, self-reported outcomes: CRF, physical and mental health, PA social support from family and friends, PA self-efficacy (BARSE and LSE), and executive function (color task and color-word) as a

result of participating in the program. Descriptive statistics (means, standard deviation, frequency) were conducted.

D. Results

Development of technology components of the intervention

Fitbit manual

The research team developed a manual containing basic information about Fitbit (how to wear, clean, charge, and sync the device) using information from the official Fitbit website; however, it was adapted specifically for this population, being developed in Spanish and targeting low education levels. All the procedures described in the manual were elaborated in short and clear sentences and presented in one large image.

The manual was developed by the research team by brainstorming on possible mistakes that participant might make. Most of the details added to the basic information available at the official website were related to charging and syncing the device. One strategy to develop clear instructions was to give the device to a research assistant that was unfamiliar with it, provide little information about the procedure and observe how the research assistant conducted the procedures, and then modify instructions for better understanding of the procedures. For example, the research assistant charged the device by connecting the charger to the screen, so additional information was added: “connect the charger with the green flashing lights, and make sure that the golden pins fit the golden marks, and that the button is placed in the opening. Move the charger a little bit until you hear a click, the Fitbit vibrates and you are able to see a battery charging icon on the screen.” As the Fitbit Charge 2 does not come with a wall block charger, participants were asked if they had one, and were instructed to use the wall block charger from their mobile phones. The manual was used at the orientation session and participants kept a copy to refer back to when needed.

Orientation session

The orientation session was scheduled two weeks before the intervention started. At this session participants were given their study email account and password, as well as their Fitbit account email and password. Participants were asked not to change their password or settings in their Fitbit account during their participation in the study.

Participants received the Fitbit Charge 2 and a welcome packet with the research team contact information, information about the classes dates, times and location, a detailed schedule of the BAILAMOS© dance program (described below), and a short manual with the basic information about the Fitbit.

The research team explained and demonstrated the procedures described in the manual (how to wear, clean, charge, and sync the Fitbit), and provided individual assistance for each participant. As the Fitbit is a very complex device itself, participants were not given details about the features of the device at the orientation session. A brief explanation about the Fitbit app and the Bluetooth feature was given as participants had to be able to sync the device with the app. Participants were told that the research team would explain the other Fitbit features (sedentary behavior and sleep tracking) during the weekly technology sessions.

Technology sessions development

These sessions were initially planned as an informal time where participants would be encouraged to attend if they had questions, concerns, or problems with using the Fitbit, syncing, or if they needed assistance with reading text messages. Some participants who were not able to sync their Fitbit on their own requested the assistance of a research assistant during the technology sessions; however, the research team had to develop formal instructions about the Fitbit due to the complexity of the Fitbit mobile app, but also due to the wide range in level of education and previous experience with technology of participants. The research team planned the technology session to gradually increase the content complexity about the Fitbit.

In order to keep track of the development process of the intervention every research assistant involved in the intervention delivery was required to keep daily reports of the intervention delivery, modifications needed, and modifications implemented, from the orientation session until the last day of the intervention. Before each technology session, the two research assistants that instructed the technology classes would read each other's reports, and debrief about the previous session, difficulties faced by participants, strategies to overcome the difficulties, and modifications needed.

Table 10. Technology sessions timeline

	Tuesday	**Thursday**
Week 01	- *Discussion session 01* - *Experience using the Fitbit*	- Ask participants' suggestions for the sessions
Week 02	- Goal setting based upon baseline PA	- SB feature on Fitbit app
Week 03	- Update step goals - Participants received a booklet for goal setting	- Water tracking feature on Fitbit app
Week 04	- Update step goals - Strategies to set goals (SMART* goals)	- Exploring graphics for steps, floors, MVPA**, heart rate
Week 05	- Update step goals - *Discussion session 02*	- Sleep feature on Fitbit app - Try in small group setting
Week 06	- Update step goals - *Achievement board* - Feedback on motivational text messages	- Importance of social support for PA engagement and maintenance
Week 07	- Update step goals - Bluetooth, log in and log out the app -	- Add friends to the Fitbit app - Handed out the monthly senior center activities calendar
Week 08	- Update step goals - Weekly MVPA goals	- Reintroduce participants to encourage social support
Week 09	- Update step goals - *Discussion session 03*	- Add friends to the Fitbit app - Introduce Fitbit challenges (games)
Week 10	- Update step goals - *Small groups were formed**** - Social support was promoted within their groups	- Explained all Fitbit challenges - Group chose what challenge they would participate
Week 11	- Update step goals - Social support was encouraged though the challenges	- Fitbit feed, posting achievements, trophies, and badges, cheering and commenting
Week 12	- Update step goals - Activity on guessing how many steps they would take during the dance class (bachata)	- Difference between PA and SB
Week 13	- Update step goals - *Discussion session 04 – PA, SB, and technology*	- Activity on guessing how many steps they would take during the dance class (salsa)
Week 14	- Update step goals - Maintaining group, Fitbit and text messages	- Senior Center event; No technology session
Week 15	- Update step goals - Activity on guessing how many steps they would take during the dance class (salsa)	- Make sure participants are comfortable with their Fitbit so they can continue using it on their own (Bluetooth, log in, log out, sync, and using features)
Week 16	- Update step goals - Creating personal Fitbit account	- Fiesta - No technology session

*SMART specific, measurable, attainable, realistic, timely
**MVPA moderate-vigorous physical activity
*** Small groups were formed based on participants' PA level and small group setting was maintained for the following technology sessions

At the beginning of the program many participants were logged off the app, and were not able to log back in. The research team had to change their password to a less complex one as many participants were having difficulties understanding the concepts of an email account and password. In the first couple weeks of the program participants tried to use and understand the app on their own, but they had difficulties. For example, one participant inadvertently had nine Fitbit shortcuts on her cell phone home screen. Some of these attempts to use the app likely had caused problems with connecting participants' Fitbits with the iCardia platform in the beginning of the intervention. Several participants had their Bluetooth turned off for many days, and for this reason, understanding the Bluetooth function was emphasized during the intervention.

Also at the beginning of the intervention a few participants were not meeting the 10 hours of minimum wear time per day, and two participants reported they work in housekeeping and so they remove the device when handling water, so wear time was not high enough. They were encouraged to wear it for a few more minutes when not working to achieve the minimum of 600 minutes of wear time.

The research team had decided to plan structured technology sessions based on some participants' difficulties in understanding and handling technology observed in the orientation session. Participants were asked for suggestions to guide the development of the technology sessions.

Goal setting as a behavior change technique was encouraged from the beginning by using a booklet to track and set PA goals. Goals were updated weekly, and for most of the intervention step goals were used; however, some participants chose MVPA, floors, or sedentary breaks. Participants reported that they preferred to set goals with the assistance of the research team as this way they would feel more committed to accomplishing the goal, compared to if they had set it on their own. Every Tuesday participants would update their PA goal in their booklet, and in the Fitbit app. The research team also used an achievement board

as a strategy to acknowledge participants who achieved their PA goal. Participants were the ones who claimed if they achieved the goal or not; it was not verified by study staff.

As participants were also interested in learning the other features of the Fitbit app, the technology sessions were planned to explain most of the features available. Other features explored included tracking: sedentary behavior, water intake, MVPA, floors climbed, reminders to move (Fitbit reminders to break sedentary behavior of <250 steps in an hour), and sleep. Participants were not required to use all features of the app; however, they were encouraged to experience all the data visualization to enhance their experience with the wearable.

All technology sessions were held in the room where the dance classes took place. Chairs were placed in a big circle, and two research assistants were the technology session instructors. One instructor would explain the content, and the other would walk around the circle attending to individual questions. This initial setting was not very successful, as some participants would have questions or issues that would require a lot of time to be solved, and the instructors were not able to assist everyone who needed help. At the time, giving advice and support to their peers was not encouraged. For these reasons, the technology sessions setting was changed mid-program. The instructors arranged participants in four small groups (4-6 people) based on their weekly average steps. The research team also made sure that there was at least one person with a good understanding of technology in each group. This way each of the two technology session instructors would assist two groups. Each group would also have a peer that could assist with technology questions, participants had the opportunity to interact with each other, share experiences with the Fitbit, and engage in peer learning. Participants were encouraged to create group names so they would feel like they belonged to the small group. The instructors started to use iPads to demonstrate the activity being done; and then they would encourage participants to assist each other.

Once participants were familiar with the Fitbit about mid-program, more social support activities were encouraged. One technology session on week 08 was devoted to participants

reintroducing themselves, and sharing experiences and difficulties with technology. The research team started to encourage participants to engage in activities at the senior center, and engage in physical activity or social interactions outside of the intervention. The senior center activity coordinators also started to promote activities for study participants, such as providing free tickets for an opera rehearsal and inviting them to painting workshops.

When participants were placed in small groups with people with similar levels of PA, the instructors taught them how to use Fitbit challenges. These challenges invite others to see who can get more steps over a given period of time. They are done individually or with up to 30 people, and from one day to several days. They can have a winner, or just be used to motivate each other. The less active groups were very receptive to this feature as a motivational tool; however, the very active groups did not use this feature so much. There were 30 technology sessions during the intervention.

Technology practice

In previous BAILAMOS© trials participants had provided feedback that the dance sessions were too short, and they would like to have extra time to dance. Based on this feedback the senior center had allowed participants to use the space to continue dancing after the instructor had finalized the 1-hour dance session. The research assistants encouraged participants to continue dancing on their own once the instructor had left; however, participants were more interested in asking technology-related questions. As the technology sessions had become formal instruction about the Fitbit, the research team decided to use 30 minutes after the dance classes ended to assist participants with questions in a more individualized setting. This way we were able to dedicate more time with participants who had more difficulty and concerns with technology. The most common questions during the technology practice sessions were on how to read, compose, or delete text messages; how to download apps; how to search

for health apps; and how to search for health information online, and even how to check voicemail. There were 20 technology practice sessions during the intervention.

Modifications to the BAILAMOS© dance program

The BAILAMOS© dance sessions were not altered. The only adaptation to the BAILAMOS© dance program was in the discussion sessions. Since the discussion sessions provided time and space for participants to talk about their experiences with PA, technology, and the program, technology-related content was added to the discussion guide. Participants discussed their initial perception of the Fitbit, their experiences with the Fitbit app, barriers for PA engagement, how technology can influence PA and SB, and participants also started asking for strategies to maintain the program after it officially would end.

Intervention impact on health outcomes

Participant characteristics

Twenty participants started the intervention (female n = 15, 75%), four participants were currently working (housekeeping n = 2, community health worker n = 1, hair stylist n = 1). Seventeen (85%) were born in Mexico, thirteen (65%) did not speak English, and eleven (55%) reported having a low income (Table 13).

Table 11. Participant characteristics (n=20)

Demographics	Mean / n	SD / %
Age	67 (m)	7.11 ±
BMI	31 (m)	4.59 ±
Married	7 (n)	35 %
Country of birth		
Mexico	17 (n)	85 %
U.S. (parents born in Mexico)	2 (n)	10 %
Ecuador	1 (n)	5 %
Years lived in the U.S.	40 (m)	12 ±
Annual income <$15,000	11 (n)	55 %
Years of education	9 (m)	10 ±

Cohen's d from device-assessed measures

Effect sizes demonstrated medium effect size for device-assessed MVPA (*d* = .69), and small effect sizes for device-assessed steps (*d* = .45), and device-assessed adjusted SB (*d* = .21).

Cohen's d from self-reported measures

Small effect sizes were observed for self-reported household LPA (*d* = -.27), household MPA (*d* = -.23), physical (d = .32) and mental health (d = -.29). Medium effect sizes were observed for PA barriers self-efficacy (*d* = -.69), and PA lifestyle self-efficacy (*d* = -.52).

Large effect sizes were observed for the following PA domains from the PA self-reported questionnaire: self-reported LPA (*d* = .93), LPA leisure (*d* = 1.51), MPA (*d* = 1.19), MPA leisure (*d* = 1.62), MVPA (*d* = 1.05), MVPA leisure (*d* = 1.55). Large effect sizes were also observed for CRF (*d* = 1.09); and social support from family (*d* = .82), and social support from friends (*d* = .94).

Table 12. Changes from baseline to post intervention (n=20)

Variable	**Baseline (week 0)**		**Post intervention (week 17)**		
	Mean	**Sd**	**Mean**	**sd**	**Cohen's d**
Device-assessed PA and SB					
Steps	8013.52	4088.37	10528.39	6673.93	0.45*
LPA[1]	237.89	86.31	241.29	95.24	0.04
MVPA[4]	26.62	25.29	61.3	65.99	0.69**
Adjusted SB	493.18	125.74	517.79	113.33	0.21*
Self-reported PA and SB					
LPA	336.75	305.53	639	343.76	0.93***
LPA leisure	131.25	152.26	489.75	299.97	1.51***
LPA household	205.5	246.28	149.25	157.8	-0.27*
MPA[2]	62.25	143.89	267.75	198.24	1.19***
MPA leisure	16.5	37.34	246	196.93	1.62***
MPA household	45.75	138.03	21.75	57.68	-0.23*
VPA[3]	14.25	57.06	18	32.5	0.08
MVPA	76.5	196.48	285.75	201.33	1.05***
MVPA leisure	30.75	70.44	264	200.44	1.55***
MVPA household	251.25	291.91	171	196.81	-0.32*
SB weekday	5.9	2.08	6.22	2.3	0.15
SB weekend	4.16	3.13	4.55	1.65	0.16
BMI	31.97	4.59	31.67	4.91	-0.06
Other self-reported outcomes					
CRF	5.81	1.86	7.94	2.05	1.09***
Physical health	42.74	6.55	44.7	5.77	0.32*
Mental health	34.05	6.88	31.94	7.61	-0.29*
PA social support from family	16.3	6.79	21.95	7.01	0.82***
PA social support from friends	15.05	4.31	20.1	6.22	0.94***
PA self-efficacy BARSE	87.65	13.28	77.57	15.98	-0.69**
PA self-efficacy LSE	94.5	7.15	88.75	13.95	-0.52**
Executive function color task	57.25	11.15	55.05	11.51	-0.19
Executive function color-word	18	8.44	20.2	6.24	0.3*

*small effect size
**medium effect size
***large effect size

[1] LPA light physical activity
[2] MPA moderate physical activity
[3] VPA vigorous physical activity

[4] MVPA moderate-vigorous physical activity

Device-assessed physical activity and sedentary behavior

At baseline assessment, wear time ranged from 618 to 1438 minutes per day, and at post intervention assessment, wear time ranged from 613 to 1432 minutes per day. There was great variation in baseline steps, ranging from 2,402 to 15,499 average steps per day at baseline week. Changes in steps, LPA, MPA, VPA, MVPA, adjusted SB, and Fitbit wear time are demonstrated below. Eighteen weeks represent baseline, 16-week intervention, and post intervention week.

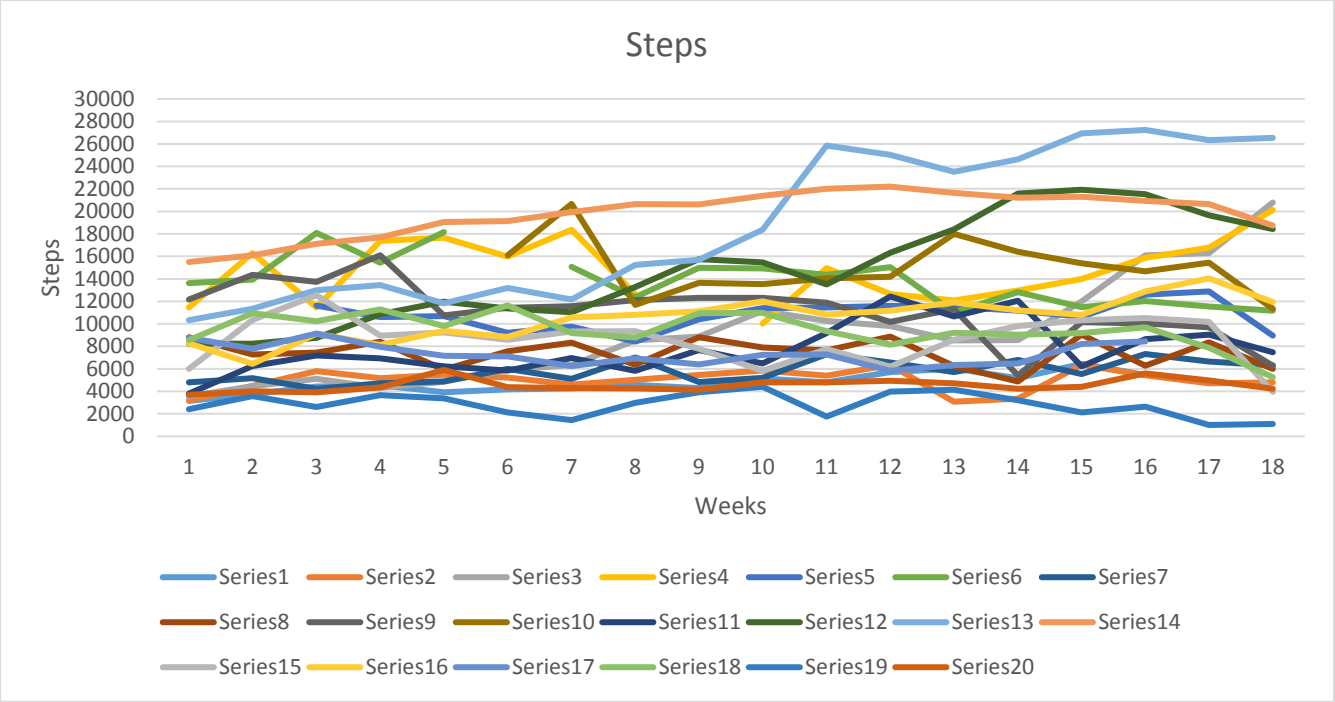

Figure 3. Changes in steps during the intervention

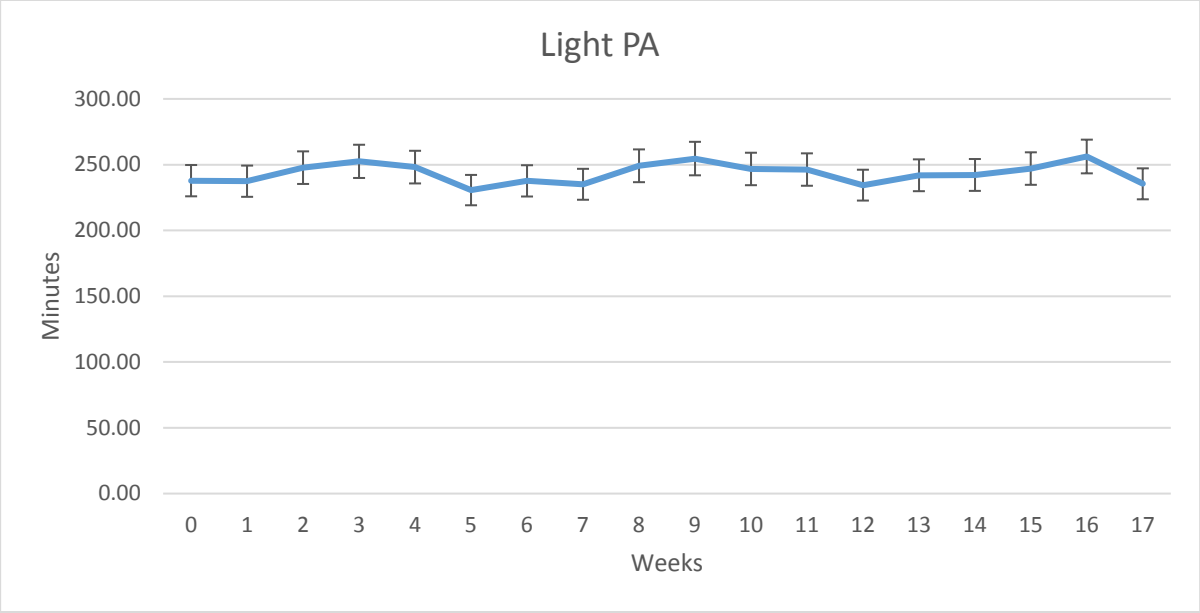

Figure 4. Changes in minutes of light physical activity

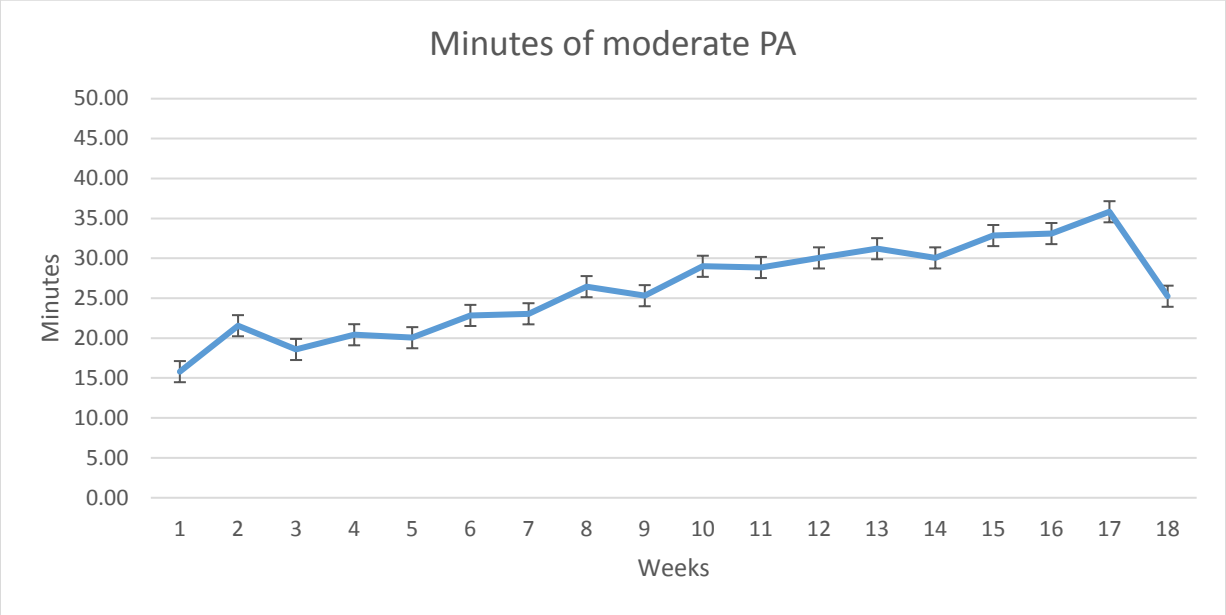

Figure 5. Changes in minutes of moderate physical activity

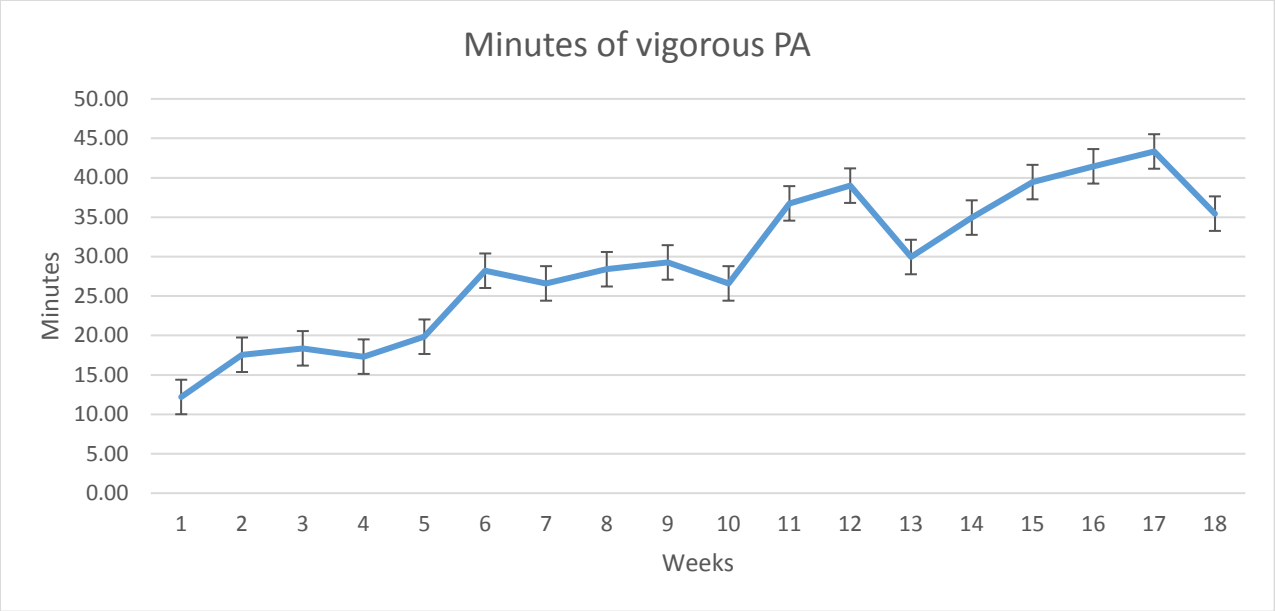

Figure 6. Changes in minutes of vigorous physical activity

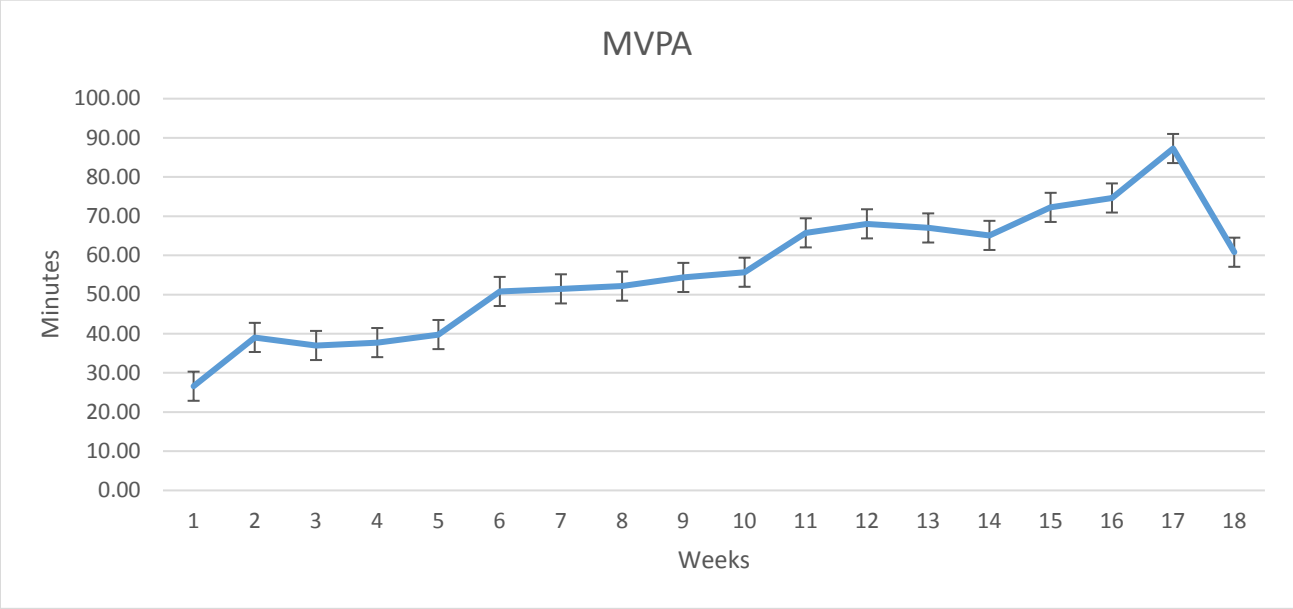

Figure 7. Changes in minutes of moderate-vigorous physical activity

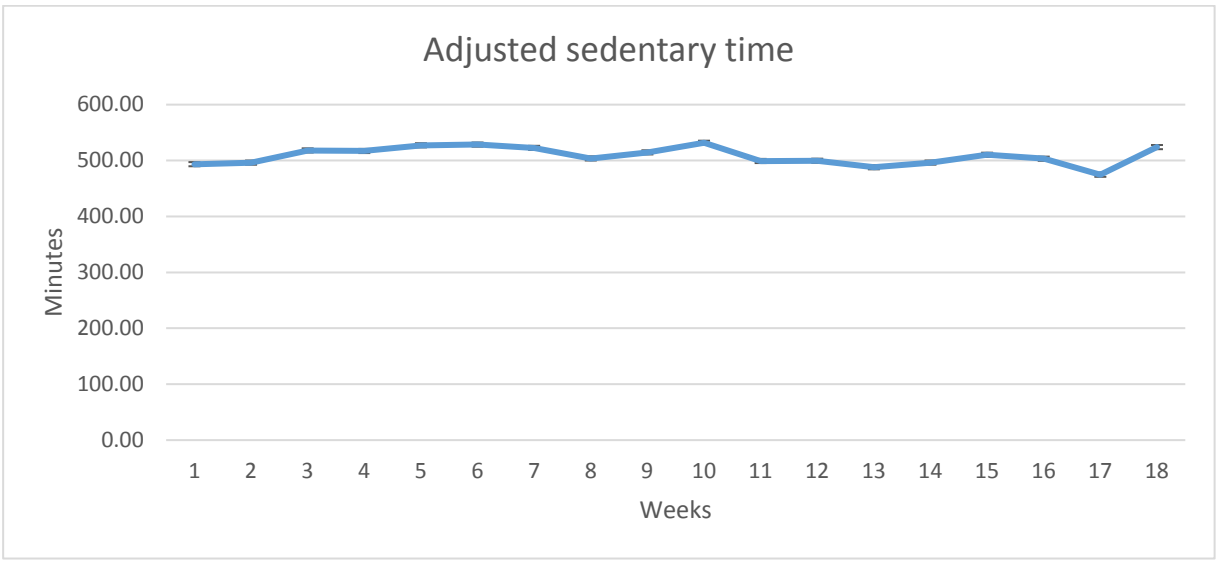

Figure 8. Changes in sedentary time

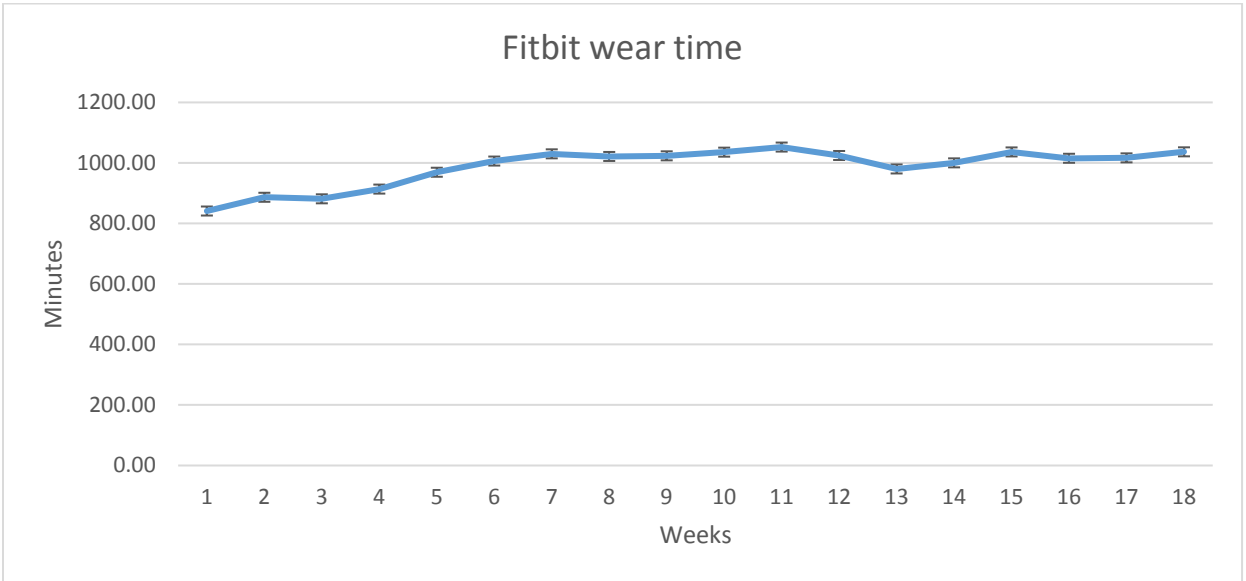

Figure 9. Fitbit wear time (valid wear time >600 minutes)

E. Discussion

Development of technology components of the intervention

This study described the development of a mobile health-infused dance program (BAILA TECH) for older Latinos, showing the intensive work to plan and execute the addition of the technology components to an existing dance program. Results show that participants are willing to learn how to use mobile health technologies for PA self-monitoring by the high numbers of adherence to the not mandatory sessions. Technology classes and practices aimed to cover participants' lack of confidence and skills with handling a new PA wearable tracker. Hence, the mobile technology education sessions targeted to address participants' needs by taking into account each participant abilities and limitations to learn. The technology components added to dance classes have provided opportunity of gaining technology knowledge and having social interaction.

Older adults can present cognitive and physical decline which is perceived as a barrier to technology use (Peek et al., 2016) and they also have lower overall familiarity with technology than younger people. Moreover, older adults might have difficulties in remembering facts, retaining information, and absorbing knowledge (Chen & Chan, 2013). Also the environment where older adults are do not usually allow them to observe others using technologies and learn from others (Tsai, Shillair, & Cotten, 2017).

One common reason preventing older adults from using technology is not understanding how to use/how to properly function the technological devices, including cell phones, computers, tablets, and E-readers (Gitlow, 2014) Lack of skills, mentioned in this study, was also found in several studies performed with older adults. They expressed concern regarding lack of familiarity with text messaging, and even those people with adequate health literacy are not regular text message users (Redfern et al., 2016). The inability to upgrade the mobile software or make other software changes was the second greatest barrier to mobile phone use (Navabi et al.,

2016). Limited familiarity with technology terminology, such as “link with Bluetooth,” is another barrier to technology use in this age group (Mercer et al., 2016). These examples show some topics to be considered when planning technology courses tailored to older adults, and most of them were addressed during technology sessions and technology practices in this study, according to the participants needs.

Lack of instructions and guidance is one of the barriers to the technology use (Vaportzis et al., 2017). Older adults usually face difficulties in maneuvering technology by themselves, and learning how to use any device just reading its manual is challenging, mainly because its inappropriate content for older adults: too complex, technology terminology, and small font size (McMahon et al., 2016). So the adaptation of the manual used in this study was important to wearable use, and also to make them know that someone was aware about their specific needs. Previous studies have shown the need of providing formal technology training in interventions (McMahon et al., 2016), and so the intervention was informed by needs identified in the literature and in our focus groups.. The literature also states that training should be tailored specifically to older adults, and associated to technical e social support, to increase older adults’ technology self-efficacy and encourage its use (Lee & Coughlin, 2015). In our intervention we also targeted essential behaviors for successful technology learning such as encouraging willingness to explore, providing time and space for repetition of recently learned skills, and providing assistance when necessary (Tsai et al., 2017).

Complementing self-reported PA assessment with device-based measures is important as questionnaires are subject to social desirability bias (Taber et al., 2009). Wearables can contribute to PA assessment but are mainly for PA self-monitoring.

Intervention impact on health outcomes

There were medium effect sizes for device-assessed MVPA, and self-reported LPA, MPA, and large effect size for self-reported MVPA. There was great variation at participants’

baseline steps and the average steps at baseline was high for older adults, seven participants were categorized as sedentary (< 5,000 steps/day), and three participants were highly active (>12,500 steps/day) (Tudor-Locke et al., 2008). High levels of PA could be due to work-related PA commonly reported by Latinos (Arredondo et al., 2015).

Increases in SB could possibly represent compensation for engaging in PA; however, the increase was not large. Negative values for self-reported LPA and MPA household could demonstrate that once participants started the intervention they became engaged in other activities outside the home environment. Negative results for mental health could be related to the fact that post testing occurred in December in the beginning of the winter, and two participants were suffering from serious health issues. Negative self-efficacy values could be due to the fact that after the program participants had a better understanding of the difficulties in maintaining PA, and they were asked about the future, when they knew the official program would be ending. Also the weather might have impacted participants' PA self-efficacy.

Even though PA guidelines are commonly translated to accumulating 10,000 steps per day, recent research has suggested to recommend about 7,100 steps/day, or a "something is better than nothing" approach for older adults (Tudor-Locke et al., 2011).

The effectiveness of mHealth interventions for the promotion of physical activity in older adults was also verified in another systematic review (Muellmann et al., 2018). Studies were included if the main intervention component was delivered via computer, telephone or smartphone (i.e text messaging, mobile application) or tablet. Compared with non-mHealth intervention, text messaging-based interventions showed significant differences in the number of steps at six-week follow-up, or significantly increased PA at four and 12-week follow-ups, but this effect was no longer observed at 24-week follow-up. In five of the seven studies that measured PA with objective or a combination of device-assessed and self-reported methods, results suggest that participants who received an mHealth intervention increased significantly PA levels when compared to participants who received no intervention or a non-mHealth

intervention. It was concluded that mHealth interventions can effectively promote PA in older adults aged 55 years and older in the short-term, while evidence for long-term effects is lacking (Muellmann et al., 2018).

Even though PA trackers can promote increase PA levels, providing additional support can assist in maintaining the usage of the PA tracker after the initial enthusiasm of a new device reduces, hence promoting prolonged use of the tracker, and thus maintaining an active lifestyle (Alley et al., 2016). Another study assessed older adults' experiences with PA tracker and most participants reported that the wearable was useful, easy to use, and acceptable for self-tracking their PA, at 10 weeks and 8 months (McMahon et al., 2016).

The strengths of this study were the tailored mobile technology training, and the use of device-assessed and self-report PA and SB measures, and high adherence to wearing the Fitbit and good adherence to the dance program. This study was designed as a formative study to develop the protocol and test its feasibility. I was meant to have a small sample size and no control group. Due to these limitations the present study cannot demonstrate cause and effect.

E. Conclusion

The preliminary data of our study demonstrate the potential of a mHealth-infused dance intervention to increase older Latinos' PA levels. A rigorous pilot trial should be conducted following the technology components developed in this trial, and potentially lead to a large randomized controlled trial.

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APPENDICES

Appendix A

UNIVERSITY OF ILLINOIS
AT CHICAGO

Office for the Protection of Research Subjects (OPRS)
Office of the Vice Chancellor for Research (MC 672)
203 Administrative Office Building
1737 West Polk Street
Chicago, Illinois 60612-7227

Approval Notice
Initial Review (Response To Modifications)

June 9, 2016

Isabela Gouveia Marques
Department of Kinesiology and Nutrition
1919 W. Taylor

RE: Protocol # 2015-1269
"Perceptions and Use of Technology by Older Latinos"

Dear Ms. Gouveia Marques:

Please note that stamped and approved .pdfs of all recruitment and consent documents will be forwarded as an attachment to a separate email. OPRS/IRB no longer issues paper letters and stamped/approved documents, so it will be necessary to retain the emailed documents for your files for auditing purposes.

Your Initial Review (Response To Modifications) was reviewed and approved by the Expedited review process on May 18, 2016. You may now begin your research

Please note the following information about your approved research protocol:

Protocol Approval Period: May 18, 2016 - May 18, 2017
Approved Subject Enrollment #: 50
Additional Determinations for Research Involving Minors: These determinations have not been made for this study since it has not been approved for enrollment of minors.
Performance Sites: UIC, Alivio Medical Center
Sponsor: Departmental
PAF#: Not applicable
Research Protocol(s):

a) PUTOL; Version 1; 12/07/2015

Recruitment Material(s):

a) Permission to Contact Form-English; Version 1; 12/07/2015
b) Permission to Contact Form-Spanish; Version 1; 12/07/2015
c) Telephone Script-English; Version 3; 04/19/2016
d) Telephone Script-Spanish; Version 3; 04/19/2016
e) Email Script-English; Version 3; 04/19/2016
f) Email Script-Spanish; Version 3; 04/19/2016
g) Recruitment Script-Spanish; Version 3; 04/19/2016
h) Introduction and Screening-English; Version 3; 04/19/2016
i) Introduction and Screening-Spanish; Version 3; 04/19/2016
j) Flyer-Spanish; Version 3; 04/19/2016
k) Flyer-English; Version 3; 04/19/2016
l) Recruitment Script-English; Version 3; 04/19/2016
m) MMSE-English (no footer)
n) MMSE-Spanish (no footer)

Informed Consent(s):

a) Consent Form-English; Version 2; 02/10/2016
b) Consent Form-Spanish; Version 2; 02/10/2016
c) A waiver of consent has been granted under 45 CFR 46.116(d) for recruitment (for release of subject contact information) purposes only; minimal risk; written consent will be obtained at enrollment.
d) A waiver of documentation of informed consent has been granted under 45 CFR 46.117 and an alteration of consent has been granted under 45 CFR 46.116(d) for recruitment purposes only (minimal risk; verbal consent to screening/eligibility questions will be obtained; written consent/ will be obtained at enrollment)

Your research meets the criteria for expedited review as defined in 45 CFR 46.110(b)(1) under the following specific category(ies):

(6) Collection of data from voice, video, digital, or image recordings made for research purposes., (7) Research on individual or group characteristics or behavior (including but not limited to research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Please note the Review History of this submission:

Receipt Date	Submission Type	Review Process	Review Date	Review Action

12/07/2015	Initial Review	Expedited	12/10/2015	Modifications Required
02/22/2016	Response To Modifications	Expedited	03/10/2016	Modifications Required
05/13/2016	Response To Modifications	Expedited	05/18/2016	Approved

Please remember to:

→ Use your **research protocol number** (2015-1269) on any documents or correspondence with the IRB concerning your research protocol.

→ Review and comply with all requirements on the OPRS website at,

"**UIC Investigator Responsibilities, Protection of Human Research Subjects**"
(http://tigger.uic.edu/depts/ovcr/research/protocolreview/irb/policies/0924.pdf)

"JBVAMC Investigator Responsibilities for Performing Research Involving Human Subjects"

Please note that the UIC IRB has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Please be aware that if the scope of work in the grant/project changes, the protocol must be amended and approved by the UIC IRB before the initiation of the change.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact OPRS at (312) 996-1711 or me at (312) 355-0816.

Sincerely,

Alison Santiago, MSW, MJ

Assistant Director, IRB # 2

Office for the Protection of Research Subjects

Enclosure(s) will be sent in a separate email:

1. **Informed Consent Document(s):**
   a) Consent Form-Spanish; Version 2; 02/10/2016
   b) Consent Form-English; Version 2; 02/10/2016
2. **Recruiting Material(s):**
   a) Permission to Contact Form-English; Version 1; 12/07/2015
   b) Permission to Contact Form-Spanish; Version 1; 12/07/2015
   c) Telephone Script-English; Version 3; 04/19/2016
   d) Telephone Script-Spanish; Version 3; 04/19/2016
   e) Email Script-English; Version 3; 04/19/2016
   f) Email Script-Spanish; Version 3; 04/19/2016
   g) Recruitment Script-Spanish; Version 3; 04/19/2016
   h) Introduction and Screening-English; Version 3; 04/19/2016
   i) Introduction and Screening-Spanish; Version 3; 04/19/2016
   j) Flyer-Spanish; Version 3; 04/19/2016
   k) Flyer-English; Version 3; 04/19/2016
   l) Recruitment Script-English; Version 3; 04/19/2016
   m) MMSE-English (no footer)
   n) MMSE-Spanish (no footer)

cc: Charles B. Walter, Department of Kinesiology and Nutrition, M/C 517
David Xavier Marquez (Faculty Sponsor), Kinesiology and Nutrition M/C 994

Appendix B

Focus groups moderator guide

Technology

1. When I say the word “technology” what does it make you think of?

2. How do you feel about technology?
    a. What do you like about it?
    b. What do you dislike about it?
    c. What aspects of one’s life has changed due to technology?

3. How do you use technology in a daily basis?
    a. In what situations do you use technology
    b. In what ways do you think technology can be helpful?

4. What are the barriers for you not to use technology?
    a. In what ways does technology make life more difficult for you?

5. Would you like to try new technology?
    a. Are you learning how to use a cell phone? (Smartphone? GPS? Google maps? Skype? Any other app?)

Healthy behaviors

1. How do you think technology can impact one’s health
    a. How does technology make it easier for people to be healthier?
    b. How does technology make it more difficult for people to be healthier?

2. How do you think technology can impact one’s physical activity?
    a. How does technology make it easier for people to participate in physical activity?
    b. How does technology make it more difficult for people to participate in physical activity?

3. Do you participate in physical activity in your leisure time?

a. If not as much as you would like to, what are the barriers to participate?

BAILA TECH protocol

[Present and explain about the wearable]

4. What do you think about the wearable?
    a. Would you use it? Why? Why not?

5. How do you think technology can be added to a Latin dance program for older Latinos?
    a. How can a Latin dance program for older Latinos use technology?

6. What do you think about a physical activity intervention using text messages with informational and motivational content?
    a. What may be the main difficulties?
    b. What do think may be positive about it?

7. What kind of information would you like to receive?
8. What about frequency of the messages? And timing?

Appendix C

UNIVERSITY OF ILLINOIS
AT CHICAGO

Office for the Protection of Research Subjects (OPRS)
Office of the Vice Chancellor for Research (MC 672)
203 Administrative Office Building
1737 West Polk Street
Chicago, Illinois 60612-7227

Approval Notice

Initial Review (Response To Modifications)

June 20, 2017

Isabela Gouveia Marques, BS
Kinesiology and Nutrition
1919 W. Taylor, Room 613
M/C 994
Phone: (312) 413-1268 / Fax: (312) 413-0319

RE: Protocol # 2017-0414
"BAILA TECH - Tecnologia y Ejercicio en la Comunidad Hispana"

Dear Ms. Gouveia Marques:

Your Initial Review (Response To Modifications) was reviewed and approved by the Expedited review process on June 16, 2017. You may now begin your research

Please note the following information about your approved research protocol:

Protocol Approval Period: June 16, 2017 - June 16, 2018
Approved Subject Enrollment #: 50
Additional Determinations for Research Involving Minors: These determinations have not been made for this study since it has not been approved for enrollment of minors.
Performance Sites: UIC
Sponsor: None
Research Protocol(s):

b) BAILA TECH – Tecnologia y Ejercicio en la Comunidad Hispana; Version 2; 05/17/2017

Recruitment Material(s):

o) Introduction and Screening (English); Version 2; 05/17/2017
p) Introduction and Screening (Spanish); Version 2; 05/17/2017
q) Flyer (English); Version 2; 05/17/2017
r) Flyer (Spanish); Version 2; 05/17/2017
s) Email script (Spanish); Version 2; 05/17/2017

t) Recruitment script (Spanish); Version 2; 05/17/2017
u) Telephone script (English); Version 2; 05/17/2017
v) Telephone script (Spanish); Version 2; 05/17/2017
w) Email script (English); Version 2; 05/17/2017
x) Recruitment script (English); Version 2; 05/17/2017

Informed Consent(s):

e) Permission to contact form (Spanish); Version 1; 03/24/2017
f) Permission to contact form (English); Version 1; 03/24/2017
g) Consent Form (English); Version 2; 05/17/2017
h) Consent Form (Spanish); Version 2; 05/17/2017
i) A waiver of documentation of informed consent and alteration of consent has been granted under 45 CFR 46.117 and 45 CFR 46.116(d), respectively, for recruitment screening; minimal risk.

Your research meets the criteria for expedited review as defined in 45 CFR 46.110(b)(1) under the following specific category(ies):

(**4**) Collection of data through noninvasive procedures (not involving general anesthesia or sedation) routinely employed in clinical practice, excluding procedures involving X-rays or microwaves. Where medical devices are employed, they must be cleared/approved for marketing. (Studies intended to evaluate the safety and effectiveness of the medical device are not generally eligible for expedited review, including studies of cleared medical devices for new indications.)

Examples: (a) physical sensors that are applied either to the surface of the body or at a distance and do not involve input of significant amounts of energy into the subject or an invasion of the subject's privacy; (b) weighing or testing sensory acuity; (c) magnetic resonance imaging; (d) electrocardiography, electroencephalography, thermography, detection of naturally occurring radioactivity, electroretinography, ultrasound, diagnostic infrared imaging, doppler blood flow, and echocardiography; (e) moderate exercise, muscular strength testing, body composition assessment, and flexibility testing where appropriate given the age, weight, and health of the individual.,
(**6**) Collection of data from voice, video, digital, or image recordings made for research purposes.,
(**7**) Research on individual or group characteristics or behavior (including but not limited to research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Please note the Review History of this submission:

Receipt Date	Submission Type	Review Process	Review Date	Review Action

04/12/2017	Initial Review	Expedited	05/05/2017	Modifications Required
05/23/2017	Response To Modifications	Expedited	06/16/2017	Approved

Please remember to:

→ Use your **research protocol number** (2017-0414) on any documents or correspondence with the IRB concerning your research protocol.

→ Review and comply with all requirements on the guidance:

"UIC Investigator Responsibilities, Protection of Human Research Subjects"
(http://research.uic.edu/irb/investigators-research-staff/investigator-responsibilities)

Please note that the UIC IRB has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Please be aware that if the scope of work in the grant/project changes, the protocol must be amended and approved by the UIC IRB before the initiation of the change.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact OPRS at (312) 996-1711 or me at (312) 996-9299. Please send any correspondence about this protocol to OPRS at 203 AOB, M/C 672.

Sincerely,

Allison A. Brown, PhD

IRB Coordinator, IRB # 2

Office for the Protection of Research Subjects

Please note that stamped and approved *.pdf files of all recruitment and consent documents will be forwarded as an attachment to a separate email. OPRS/IRB no longer issues paper letters and stamped/approved documents, so it will be necessary to retain these emailed documents for your files for auditing purposes.

Enclosure(s): Sent as separate email attachment

3. UIC Investigator Responsibilities, Protection of Human Research Subjects
4. Informed Consent Document(s):
c) Permission to contact form (English); Version 1; 03/24/2017
d) Permission to contact form (Spanish); Version 1; 03/24/2017
e) Consent Form (English); Version 2; 05/17/2017
f) Consent Form (Spanish); Version 2; 05/17/2017
5. Recruiting Material(s):
o) Introduction and Screening (English); Version 2; 05/17/2017
p) Introduction and Screening (Spanish); Version 2; 05/17/2017
q) Flyer (English); Version 2; 05/17/2017
r) Flyer (Spanish); Version 2; 05/17/2017
s) Email script (Spanish); Version 2; 05/17/2017
t) Recruitment script (Spanish); Version 2; 05/17/2017
u) Telephone script (English); Version 2; 05/17/2017
v) Telephone script (Spanish); Version 2; 05/17/2017
w) Email script (English); Version 2; 05/17/2017
x) Recruitment script (English); Version 2; 05/17/2017

cc: Ross A. Arena, Kinesiology and Nutrition, M/C 898
David Xavier Marquez, (Faculty Sponsor) Kinesiology and Nutrition, M/C 994

VITA

Isabela Gouveia Marques

PhD Candidate
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University of Illinois at Chicago
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E-mail: imarqu5@uic.edu
Website: http://epl.ahslabs.uic.edu/
CAPES Foundation, Ministry of Education of Brazil

EDUCATION

2014-Present **University of Illinois at Chicago, USA**
PhD in Kinesiology, Nutrition, and Rehabilitation Sciences
Emphasis: Exercise Psychology
Advisor: David X. Marquez, PhD
Doctoral defense planned for spring 2018

2013-2014 **University Estacio de Sa, Brazil**
Post-Baccalaureate degree in Adapted Physical Activity and Health

2012-2013 **State University of Maringa, Brazil**
Bachelor of Education in Physical Education

2008-2012 **State University of Maringa, Brazil**
Bachelor of Science in Kinesiology

2010-2010 **University of Porto, Portugal**
Undergraduate Exchange Student in Sport Science

2010-2010 **University of Coimbra, Portugal**
Undergraduate Exchange Student in Sport Science and Physical Education

RESEARCH EXPERIENCE

2017-Present **BAILA TECH - Tecnología y Ejercicio en la Comunidad Hispana/ Technology and Exercise in the Hispanic Community**

University of Illinois at Chicago, USA
Funding: Department of Kinesiology and Nutrition
PI: Isabela G. Marques, Mentor Dr. David X. Marquez

Principal Investigator of an intervention that assesses the feasibility of the 4-month BAILAMOS© dance program combined with mobile health components (Fitbit® wearable devices and text messages) to promote physical activity, and social support, and to reduce sedentary behavior. Responsible for study design, Institutional Review Board submissions, translation of recruitment materials, recruitment, screening, scheduling, data collection, intervention planning and delivery, teaching technology classes, conducting dance fidelity checks, data processing and analysis, and dissemination of findings.

2016-Present **PUTOL: Perceptions and Usage of Technology among Older Latinos**

University of Illinois at Chicago, USA
Funding: Department of Kinesiology and Nutrition
PI: Isabela G. Marques, Mentor Dr. David X. Marquez

Principal Investigator of a formative qualitative study using focus groups that examines older Latinos' perceptions and usage of technology, including smartphones, text messages, and wearable physical activity trackers. Responsible for study design, Institutional Review Board submissions, recruitment, screening, scheduling, assisting with conducting focus groups, supervising transcription and translation processes, data analysis, and dissemination of findings.

2015-2016 **iBAILA - Investigating Brains & Activity to Improve Latino Aging**
University of Illinois at Chicago, USA
Funding: Midwest Roybal Center for Health Promotion and Translation
PI: Dr. David X. Marquez

Project coordinator in a 4-month intervention study that examines the impact of BAILAMOS© dance program on older Latinos' on brain network functional connectivity of older Latinos using MR; lifestyle physical activity; cognitive function and quality of life. Primary responsibilities included overseeing and assisting with recruitment, screening, testing, and data processing and collection.

2014-2016 **BAILA: Being Active, Increasing Latinos Healthy Aging program**
University of Illinois at Chicago, USA
Funding: National Institute for Nursing Research, 1 R01 NR01315101
PI: Dr. David X. Marquez

Graduate research assistant in a randomized-controlled trial that tests the impact of the revised BAILAMOS© program on lifestyle physical activity, self-efficacy, cognitive and physical function, and health outcomes at 4 months and BAILAMOS© maintenance activities at 8 months. Primary responsibilities included assisting with recruitment, screening, testing, and data collection.

2014-2016 **The Influence of Multicomponent Factors in the Experience of the Latino Caregiver**
University of Illinois at Chicago, USA
Funding: Department of Kinesiology and Nutrition
PI: Dr. David X. Marquez

Graduate research assistant in a qualitative study using individualized interviews that examines the experiences of Latino caregivers caring for a relative with Alzheimer's disease or related dementia and the interrelationships between caregiver and care recipient, caregiver burden, coping strategies, social support, cultural values, and lifestyle behaviors, such as physical activity. Primary responsibilities included assisting with transcriptions, translations, qualitative data analysis of interviews, and dissemination of findings.

2012-2013 **Relations between motor stimulations in childhood and fundamental motor skills in adults with Down syndrome**
State University of Maringa, Brazil
Funding: Araucaria Foundation
PI: Dr. Decio Calegari, CO-I: Dr. Gizeli Alencar

Graduate research assistant in a qualitative study using individualized interviews that examines the experiences of parents of adult children with Down syndrome and the conceptualization of the disability, the childhood of the child with disability, difficulties in raising the child, motor stimulations and experiences during childhood and adolescence, and the experience of raising an adult with disability. Observation of the adult children was performed to assess gross and fine motor skills, and the Body Coordination Test for Children Körperkoordinationstest Für Kinder – *KTK was used to assess gross motor control coordination*. Primary responsibilities included recruitment, screening, performing observations of motor skills, conducting the interviews, transcribing, conducting qualitative data analysis, and dissemination of findings.

TEACHING EXPERIENCE

2014-2017 **University of Illinois at Chicago, USA**
Graduate instructor - KN 396 Independent Study in Kinesiology
Taught scientific writing, qualitative data analysis, conducting literature reviews, data management, and recruitment strategies in community-based research

2016 **University of Illinois at Chicago, USA**
Guest lecturer - KN 594 Program Design and Evaluation across the Lifespan
Taught lecture on Culture & Adaptation of Health Behavior Programs

2016 **University of Illinois at Chicago, USA**
Guest lecturer - KN 335 Exercise Psychology
Taught lecture on Physical Activity and Well Being

2015 **West Suburban Senior Center, USA**
Guest lecturer - Health Education group from the BAILA NIH Grant
Taught lecture on Self-esteem and Stress Management

2015 **Northwest Copernicus Senior Regional Center, USA**
Guest lecturer - Health Education group from the BAILA NIH Grant
Taught lecture on Food Labels and Nutrients

2015-2016 **University of Illinois at Chicago, USA**
Teaching Assistant - KN 335 Exercise Psychology
Attended lectures, learned course material, held office hours, graded assignments and examinations, and proctored examinations

2013 **State University of Maringa, Brazil**
Undergraduate Teaching Assistant - Physical Activity for Special Population
Held office hours, graded assignments and examinations, and proctored examinations

2013 **State University of Maringa, Brazil**
Undergraduate Teaching Assistant - Adapted Physical Education
Held office hours, graded assignments and examinations, and proctored examinations

2011-2013 **State University of Maringa, Brazil**
Undergraduate Physical Activity Lecturer - Leisure Studies Group
Taught lectures on health promotion, safety and group engagement in adventure sports; and climbing techniques, rappelling, and orienteering for undergraduate students

2009 **State University of Maringa, Brazil**
Undergraduate Teaching Assistant - Human Anatomy
Held office hours in the human anatomy laboratory and assisted kinesiology and nursing students to identify anatomic parts in the human body, mainly in the skeletal, muscular, and nervous systems

SCHOLARSHIPS AND AWARDS

2017 **Midwest Regional Chapter of the American College of Sports Medicine**
Level 2 Participant in MWACSM Leadership and Mentoring Program
Mentor: Dr. Christopher Dondzila, Grand Valley State University

2017 **Society of Behavioral Medicine**
Outstanding Oral Abstract Submission in the Student Award Category
Ethnic Minority and Multicultural Health Special Interest Group

2015-2017 **Society of Behavioral Medicine**
Underrepresented Minority Conference Award
Award to assist underrepresented minority graduate students to attend the Annual Meeting of the Society of Behavioral Medicine. Funding available thru the National Institutes of Health R13 Research Conference Grant (number 3R13HL137236-01S1)

2017 **Graduate College University of Illinois at Chicago**

Award to assist graduate students presenting research at national conferences in meeting travel-related expenses

2016-2017 **Graduate Student Council University of Illinois at Chicago**

Award to assist graduate students presenting research at national conferences in meeting travel-related expenses

2016 **Department of Kinesiology and Nutrition University of Illinois at Chicago**
Department of Kinesiology and Nutrition Discretionary Funding
Funding to conduct qualitative formative study for doctoral dissertation

2016 **Society of Behavioral Medicine**
Society of Behavioral Medicine's Education, Training & Career Development (ETCD) Council's Poster Mentoring Program. 37th Annual Meeting and Scientific Sessions of the Society of Behavioral Medicine. Mentor: Dr. Claudio R. Nigg, University of Hawaii at Manoa

2014-Present **Academic and Professional Programs for the Americas / Brazilian Federal Agency for Support and Evaluation of Graduate Education (CAPES)**
Fellowship from the Science without Borders Program from the Brazilian Government. Funded for 4 years to pursue the PhD in the United States.

2012-2013 **Araucaria Foundation**
Fellowship awarded to fund the undergraduate capstone research project

SCHOLARLY ACTIVITY

Book Chapters

Marquez, D.X., Aguiñaga, S., Vasquez, P., **Marques, I.G.**, Martinez, M. (2017). Physical activity interventions in Latino populations. In Physical activity in diverse populations: Examining the evidence and strategies for practice (Melissa Bopp, Editor). Taylor and Francis, London. ISBN-10: 1138674575.

Articles in Refereed Journals

Salkas, K., Magaña, S., **Marques, I.**, & Mirza, M. (2016). Spirituality in Latino families of children with Autism spectrum disorder. *Journal of Family Social Work, 19*(1), 38-55.

Manuscripts in preparation

Marques, I.G., Cantoral, J., Munguia, B., Kitsiou, S., Gerber, B., Bustamante, E.E., Buchholz, S.W., Marquez, D.X. (To be submitted to *Preventing Chronic Disease*). Older Latinos perceptions of technology.

Marques, I.G., Cantoral, J., Marquez, D.X. (To be submitted to *Health Education and Health Behavior*). Older Latinos experiences of tracking their physical activity.

Marques, I.G., Kitsiou, S., Gerber, B., Bustamante, E.E., Buchholz, S.W., Marquez, D.X. (To be submitted to *Journal of Aging and Health*). Feasibility of a mobile health-infused dance intervention for older Latinos.

Marques, I.G., Kitsiou, S., Aguinaga, S., Gerber, B., Bustamante, E.E., Buchholz, S.W., Marquez, D.X. (In preparation). Development and impact of a mobile health-infused dance program on health outcomes for community-dwelling older Latinos.

Aguinaga, S., **Marques, I.G.,** Marquez, D.X. (In preparation). Replacing sedentary time with physical activity or sleep and its effect in health in older Latinos.

Refereed Presentations

Marques, I.G., Cantoral, J., Marquez, D.X. The Influence of Technology on Sedentary Behavior: Older Latinos' Perceptions. Paper presented at the Midwest Regional Chapter of the American College of Sports Medicine, Grand Rapids, MI, November, 2017

Marques, I.G., Older Latinos' Perceptions of Technology and Physical Activity, presented as part of the Symposium Perceptions of Physical Activity of Middle-aged and Older Latinos. Presented at the Midwest Regional Chapter of the American College of Sports Medicine, Grand Rapids, MI, November, 2017

Marques, I.G., Gomez, A.A., Magallanes, M., Garcia, M., Rocha, J. S., Marquez, D. X. Perceptions of Latino Cultural Values Related to Caregiving. Poster presented at the 21st IAGG World Congress of Gerontology and Geriatrics, San Francisco, CA, July, 2017.

Marques, I.G., Balbim, G. M., Magallanes, M., Rocha, J. S., Marquez, D. X. Perceived Barriers to Physical Activity among Latino Caregivers. Poster to be presented at the Annual Meeting and World Congress on Exercise is Medicine®, and World Congress on the Basic Science of Exercise and the Brain of the American College of Sports Medicine, Denver, CO, June, 2017.

Balbim, G. M., **Marques, I.G.**, Magallanes, M., Rocha, J. S., Marquez, D. X. Motivators for Physical Activity in Older Latino Caregivers. Poster to be presented at the Annual Meeting and World Congress on Exercise is Medicine®, and World Congress on the Basic Science of Exercise and the Brain of the American College of Sports Medicine, Denver, CO, June, 2017.

Marques, I.G., Balbim, G. M., Magallanes, M., Rocha, J. S., Marquez, D. X. Social Support for Latino Caregivers. Paper presented at the 38th Annual Meeting and Scientific Sessions of the Society of Behavioral Medicine, San Diego, CA, March, 2017.

Balbim, G. M., **Marques, I.G.**, Magallanes, M., Rocha, J. S., Marquez, D. X. Coping Strategies among Older Latino Caregivers. Poster presented at the 38th Annual Meeting and Scientific Sessions of the Society of Behavioral Medicine, San Diego, CA, March, 2017

Aguiñaga, S., **Marques, I.G.**, Griffith, M., Janicek, S.J., Wilcox, S., & Marquez, D.X**.** Older Latinos' Perceptions of Cognitive Health and the Role of Physical Activity and Nutrition. Symposium presented at the Annual Meeting of the Society of Behavioral Medicine, Washington, DC, March, 2016.

Marques, I.G., Magallanes, M., Garcia, M., Rocha, J. S., Marquez, D. X. Factors that Influence Health Behavior Adoption Among Older Latino Caregivers. Poster presented at the Annual Meeting of the Society of Behavioral Medicine, Washington, DC, March, 2016.

Marques, I.G., Magallanes, M., Garcia, M., Rocha, J. S., Marquez, D. X. Leisure Time Physical Activity as a Coping Strategy among Latino Caregivers. Poster presented at the 2016 Annual Meeting, World Congress on Exercise is Medicine®, and World Congress on the Basic Science of Energy Balance of the American College of Sports Medicine, Boston, MA, May, 2016. Medicine and Science in Sports and Exercise, Volume 48:5 Supplement.

Marques, I.G., Bellusci, T.B., Alencar, G.A.R. Adults with Intellectual Disabilities and Motor Activities. Poster presented at the Brazilian Conference of Special Education, Sao Carlos, 2012

Marques, I.G., Bellusci, T.B., Goncalves, L.C., Natali, P.M. Leisure and Free Time for the Military Police. Poster presented at the 6th Parana Leisure Meeting, Maringa, 2012

Marques, I.G., Goncalves, L.C., Camacho, E.P. Handmade Toy and Its Contributions for a Balanced Diet. Poster presented at the 6th Parana Leisure Meeting, Maringa, 2012

Marques, I.G., Marchi, M.G.A. Joy at the Hospital. Paper presented at the 5th Parana Leisure Meeting, Curitiba, 2011

Marques, I.G., Bellusci, T.B., Noda, L.M., Bastos, T.L., Corredeira, R., Pimentel, G.G.A. Climbing for Amputees: an Exploratory Study. Paper presented at the 6th Brazilian Conference of Adventure Sports, Pelotas, 2011

Invited Presentations

Marquez, D. X., **Marques, I. G**. Physical Activity, Cognition, and Alzheimer's disease In: Nutrition, Exercise and Lifestyle, Alzheimer's Association Greater Illinois Chapter Annual Research Symposium, Oakbrook, IL, October, 2015.

Aguinaga, S., **Marques, I.G.**, Vazquez, P., Caceres, M.L., Marquez, D..X. Conducting Research at the Exercise Psychology Laboratory: Laboratory Etiquette, Study Procedures, Cognitive and Physical Assessment. Biannual UIC EPL training, Chicago, 2015, 2016, 2017

Marques, I.G., Bellusci, T.B., Alencar, G.A.R. Psychomotor Activities and Educational Games for the Global Development of Children in the School Environment. Invited by the City of Cruzeiro do Oeste as part of their annual training for teachers, Cruzeiro do Oeste, 2012

PROFESSIONAL SOCIETIES

2015-Present	American College of Sports Medicine (ACSM)
2015-Present	Society of Behavioral Medicine (SBM)
2015-Present	Gerontological Society of America (GSA)
2017-Present	International Society of Physical Activity and Health (ISPAH)

CERTIFICATIONS AND TRAININGS

Adult and Pediatric First Aid/CPR/AED
July 2017 (6 hours)
American Red Cross, Chicago, USA

Sedentary Behavior Measurements
November 2016 (4 hours)
University of Illinois at Chicago, USA

Advanced Research Course on Physical Activity and Public Health
July 2015 (40 hours)
National Institute of Public Health, Cuernavaca, Mexico

Vital Signs in Clinical Research Training
March 2015 (3 hours)
University of Illinois at Chicago, USA

Effective Scientific Writing
March 2015 (8 hours)
BioScience Writers, Chicago, USA

Data Management Workshop

February 2015 (4 hours)
University of Illinois at Chicago, USA

Cognitive Tests in Research
September 2014 (6 hours)
Rush Alzheimer's Disease Center, Chicago, USA

Physical Activity and Health in Aging
November 2012 (12 hours)
Graduate Excellence, Maringá, Brazil

Introduction to Paralympic Sports
September 2012 (35 hours)
Brazilian Paralympic Committee, Maringa, Brazil

COMMUNITY SERVICE

2017-Present **Volunteer**
Grupo Maravilla, Pilsen Satellite Senior Center at Casa Maravilla, USA
Volunteer responsible for providing former BAILA TECH participants with assistance in using mobile phone, such as text messages, applications, GPS, Youtube, and support with using the Fitbit wearable device and application. Also helped with searching and learning technological tools to improve health, and aided older Latinos who were not part of the program with questions regarding technology. Suggested movements to and exercises to break sedentary time, increase physical activity, and enhance motor coordination

2013 **Physical Education Teaching Assistant**
Early childhood Education Center Susanna Wesley
Municipal School Dr. Osvaldo Cruz, Brazil
Internship for the BEd in Physical Education. Taught PE classes for one semester for 6 classes from kindergarten, preschool, and 2nd grade

2013 **Physical Education Teacher**
State School Ipiranga
State School Branca da Motta Fernandes
State School Dr. José Gerardo Braga, Brazil
Internship for the BEd in Physical Education. Taught PE classes for one semester for 6 classes from middle-school, high-school and adult education

2011-2013 **Physical Activity Teacher**
Alternative Activities for People with Special Needs
State University of Maringa, Brazil
Responsible for teaching psychomotor classes, gymnastic, water aerobics, dance,

climbing, and orienteering for adults with intellectual disabilities, cerebral palsy and pervasive development disorder

2011-2013 **Paralympic Coach**
Adapted Physical Activity Program
Brazilian Paralympic Committee, Brazil
Responsible for teaching swimming for children with intellectual disabilities, handball for teenagers with intellectual disabilities, and training the Maringa Paralympic Volleyball team, and the Maringa Wheelchair handball team. National Boccia Referee

2012 **Exercise Instructor**
University of the Third Age
State University of Maringa, Brazil
Volunteer responsible for teaching water aerobics classes, functional training, group fitness, and resistance training for older adults

2012 **Personal Trainer for Older Adults**
Center of Excellence in Physical Activity Community Gym
State University of Maringa, Brazil
Volunteer responsible for physical assessment, anamnesis, body mass, anthropometric measurements, fat percentage, posture assessment, flexibility evaluation, prescription and monitor in exercise programs

2012 **Technical Committee Member**
XX Parana Special Olympics, Brazil
Volunteer teacher responsible for coordinating students with disabilities during sport competitions

2011 **Assistant Exercise Instructor**
UNIMED Preventive Medicine, Brazil
Internship for the BS in Kinesiology. Accompanied and assisted during exercise functional training classes for older adults and special populations

2010 **Physical Education Teaching Assistant**
Paranhos School, Faculty of Sports University of Porto, Portugal
Internship for the Undergraduate Exchange Program in Sport Science. Taught climbing and orienteering classes for elementary grades

2010 **Assistant Coach**
Porto Sport Club, Portugal
Volunteer acrobatic gymnastics coach

2009 **Hospital Clowning Volunteer**
Hospital Santa Casa da Misericordia de Maringa, Brazil
Volunteer program focused on playing with children in the pediatrics department

LANGUAGE SKILLS

English (Fluent)
Spanish (Fluent)
Italian (Basic)
Portuguese (Native speaker)