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Examination of Latin American Community-Based Interventions to Promote Physical Activity in Public Spaces: Analyzing Effectiveness, Applicability and Transferability Across National Contexts

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EXAMINATION OF LATIN AMERICAN COMMUNITY-BASED INTERVENTIONS TO PROMOTE PHYSICAL ACTIVITY IN PUBLIC SPACES: ANALYZING EFFECTIVENESS, APPLICABILITY AND TRANSFERABILITY ACROSS NATIONAL CONTEXTS

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EXAMINATION OF LATIN AMERICAN COMMUNITY-BASED INTERVENTIONS TO PROMOTE PA IN PUBLIC SPACES: ANALYZING EFFECTIVENESS, APPLICABILITY AND TRANSFERABILITY ACROSS NATIONAL CONTEXTS

by

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Table of Contents

Abbreviations and Acronyms

ABBREVIATIONS AND ACRONYMS	
Non-communicable diseases	NCD's
Body Mass Index	BMI
Physical activity	PA
Leisure-time physical activity	LTPA
Cardiorespiratory fitness	CRF
Moderate-intensity physical activity	MPA
Vigorous intensity physical activity	VPA
Moderate-to-vigorous physical activity	MVPA
light-intensity or short bouts of moderate-to-vigorous physical activity	LSBPA
Atlanta Streets Alive	ASA
Academia da Cidade program	ACP
Socioeconomic strata	SES
International Physical Activity Questionnaire	IPAQ
System for Observing Play and Recreation in Communities	SOPARC

Glossary

- **Ciclovias (Open Streets)**: Multisectoral community-based programs that promote the use of public space by closing streets to motorized vehicles temporarily and to open them to people, allowing free, unrestricted access to various forms of physical activity, recreation and socialization.[1,2] Ciclovias have been called Open Streets in the US.

- **Recreovia:** Community-based program conducted in the city of Bogota, Colombia in which PA classes (e.g., aerobics, dance, yoga) are provided for free by trained instructors in public spaces, especially at public parks.

- **Academia da Cidade program (ACP):** A government-funded community-based program in the city of Recife, in northeastern Brazil, that provides supervised leisure-time physical activity for community members in public spaces (e.g., parks, beaches, and recreation centers).

- **Accelerometer:** Device that records body acceleration minute to minute, providing detailed information about the frequency, duration, intensity, and patterns of movement. Counts from accelerometers are used to estimate energy expenditure. An accelerometer records acceleration 30 times per second, which is then converted to electrical signals representing the volume and intensity of movement or COUNTS.

- **Epoch:** The accelerometer collects (samples) acceleration data 30 times every second and subsequently sums them across a period of time, referred to as an "epoch." A 60s epoch means that the device will sum the acceleration signal counts collected over 1 minute (30 times per second x 60 seconds = 1800 counts) and output that value as a COUNT. It is recommended to use 60 second epochs for adults and seniors.[3]

- **Applicability of public health interventions:** The extent to which the implementation of an intervention is feasible in specific settings and contexts. Synonym of **feasibility**.

- **Transferability of public health interventions:** The extent to which an applicable intervention is effective in specific settings and contexts.
- **Translation of public health interventions:** defined as the adaptation and integration of an intervention to suit the needs of a new setting.

Chapter 1: Introduction and Statement of Purpose

Background and Problem Statement

Physical inactivity has become a pandemic, with extensive negative health, economic, environmental, and social consequences globally.[4] Evidence has shown that physical inactivity is a leading cause of death worldwide and contributes significantly to the burden of non-communicable diseases (NCDs).[4,5] It is estimated that 6–10% of the major NCDs including coronary heart disease, type 2 diabetes, and breast and colon cancers can be attributed to inactivity worldwide.[5] In the US, NCDs are the leading causes of death and disability, affecting half of the adult population.[6] Ethnic minorities such as Hispanics are disproportionally affected by NCDs in the US.[7] In contrast to the so-called "Hispanic Paradox", a term used to describe Hispanics' projected longer life expectancy and lower overall mortality despite potential barriers to good health,[8] Hispanics living in the US have higher death rates from diabetes, chronic liver disease, hypertension, and hypertensive renal disease than Whites.[8] Hispanics in the US have the second highest prevalence of obesity (39%) after Blacks.[7] Although recent studies have shown that mortality in Hispanics living in the US remains lower compared to other ethnicities, morbidity is higher, especially rates of comorbid conditions including high cholesterol, obesity, and hypertension.[9,10] Emerging evidence suggests that the perception that Hispanics are less susceptible to NCDs and their risk factors is misleading.[11]

Despite growing evidence on the importance of physical inactivity, its prevalence remains high worldwide.[4,12]. The region of the Americas has the highest levels of physical inactivity in the world, with notable differences in magnitude and prevalence among countries in this region.[13] For instance, surveillance data from the US indicates that 79% of adults do not engage in

sufficient physical activity (PA) to obtain health benefits,[14] and 30% of them do not engage in any leisure-time physical activity (LTPA).[15] Surveillance data from two countries in Latin America, Colombia and Brazil, indicate that 47% and 23% of adults, respectively, do not engage in sufficient overall PA, and 81% and 77%, respectively, do not engage in adequate LTPA.[16,17] Regardless of the differences in the magnitude of inactivity by domain (i.e., LTPA, occupational, transportation, and overall PA) among countries in the region, the US, Colombia, and Brazil share important disparities when population subgroups are compared. Among these three nations, inactivity disproportionally affects the poor, the less educated, and women.[16,18,19] Disparities in the burden of physical inactivity are also present, whereby ethnic minorities in the US, such as Hispanics, are disproportionally affected.[7] Compared to Whites, a greater proportion of Hispanics (57%) do not meet the PA recommendations[15] (accumulation of at least 150 minutes of moderate activity, or 75 minutes of vigorous activity, or an equivalent combination of moderate-to-vigorous physical activity (MVPA), per week).[23] Furthermore, Hispanics have the highest level of self-reported inactivity during leisure time (39%).[15] Hispanic women have the highest prevalence of self-reported inactivity in leisure time among all ethnic groups.[20] Thus, despite the higher level of self-reported LTPA in the US population, Hispanics in the US show a more similar pattern of LTPA to those observed in Colombia and Brazil.

In contrast to self-reported data, results from recent studies [21,22 ,23] have found that a subgroup of Hispanics in the US, Mexican-Americans, have higher PA counts by minute compared to any other ethnicity, making them the most active subgroup of all ethnicities when PA is assessed objectively with accelerometers.[21,22,23] Nonetheless, almost the entire variance in activity counts for Mexican-Americans is due to differences in light-intensity or short bouts of moderate-to-vigorous PA (LSBPA),[23] which is attributed to occupational PA.[23] LSBPA may be associated

with less sedentary time and may therefore provide some health benefits, but it may not represent sufficient intensity to increase cardiorespiratory fitness (CRF).[23] Research has consistently established an inverse association between high levels of CRF and major adverse health outcomes including cardiovascular disease mortality, coronary heart disease, and hypertension.[24] [25,26] Such an inverse association has been found to have a steep dose-response gradient across fitness groups, [27] indicating greater benefits for higher levels of CRF. In addition to age, sex, and genetics, PA and exercise training are primary determinants of CRF in addition to other factors.[26]

Literature Review

Physical activity to obtain health benefits. Given the strong epidemiologic evidence on the benefits of regular PA, scientists from the US,[28] UK,[29] Australia,[30] and the World Health Organization[31] have issued PA guidelines stating that significant health benefits can be accrued through the accumulation of at least 150 minutes of moderate activity, or 75 minutes of vigorous activity, or an equivalent combination of MVPA, per week.[32] Individuals can engage in the recommended amount of MVPA in different domains including occupation, transportation, and leisure time.[33] Some evidence suggests that greater benefits can be obtained with leisure-time physical activity (LTPA) compared to other domains, especially in outcomes such as all-cause mortality[34] and coronary heart disease.[33] For instance, results from a large cohort study revealed a greater reduction in mortality for individuals engaging in vigorous exercise and moderate-to-vigorous LTPA than for those engaging in moderate activities of daily living, transportation, and walking.[34] LTPA has also been associated with additional health and psychosocial benefits including improved mental health[35] and quality of life,[35] and increased social interactions, social, and social cohesion.[36,37]

Interventions to promote PA in whole populations. The expanding evidence on the importance of PA for population health, has been accompanied by public health efforts to increase PA in whole populations through the dissemination and implementation of PA programs and strategies.[38,39,40] Systematic reviews on PA interventions, such as the US Guide to Community Preventive Services (Community Guide),[39] have demonstrated strong evidence on the effectiveness of community-based PA interventions, including behavioral and social interventions, campaigns and informational approaches, and policy and environmental modifications.[38,39] Given that community-based interventions are implemented population-wide, they are inclusive, can reach individuals at different levels of risk, and can be designed to affect environmental and social conditions beyond the reach of clinical services and outside of an individual's control.[41]

Community-based interventions in public spaces. The concept of public open space comprises a variety of spaces within the urban environment that are readily and freely accessible to the wider community, and are intended primarily for recreation purposes.[42] Examples of public open spaces include parks, green areas, squares or plazas, main streets and beaches.[42,43]Access and quality to public spaces are associated with social and health benefits including the improvement of aspects of social capital such as social cohesion and social interaction, and social inclusion,[44] equity,[44] physical and mental health.[45] Public spaces contribute to creating a sense of attachment of individuals to their locality and facilitate the development of community ties by providing opportunities for people to mixing with others.[44] Public spaces also provide a platform of not only personal and cultural exchange, but also economic exchange of goods and services which promote sustainable and vibrant cities.[44]

Public open spaces can influence transportation and recreation physical activity by providing access and opportunity for individuals to engage in various types of leisure-time physical activity and in active travel (walking, cycling, or using public transport).[43]Specific attributes of public spaces have been associated with increased physical activity. Some of these attributes include proximity, attractiveness,[46] larger size,[46] safety, amenities, and aesthetics.[43] Thus, the implementation of community-based interventions to increase PA in adequate public spaces can greatly impact not only health-related outcomes but also important social outcomes that are critical, especially for vulnerable communities.

Scholars in Latin America have increasingly focused on the implementation and evaluation of the effectiveness of community-based interventions to increase PA in public spaces. As an example, recent systematic reviews of PA interventions have assessed the applicability of the US Community Guide in this region.[40,47] The reviews identified innovative and promising community-based approaches to increase PA that combined the use of available environmental resources such as public spaces, community-wide planning and policy interventions, and social support approaches.[47,48] Two of the promising programs identified in this review include: (1) Ciclovias and (2) physical activity classes in public spaces (PA classes).

Ciclovias (Open Streets). Ciclovias are multi-sectoral community-based programs that promote the use of public space by temporarily closing streets to motorized vehicles and opening them to people, allowing free, unrestricted access to various forms of physical activity, recreation, and social interaction.[1,2] Preliminary evidence has demonstrated a positive association between Ciclovias and public health outcomes including increased PA,[1,49,50] improved social capital,[49] better air quality,[1] enhanced perceptions of safety, and increased equity in access to recreational activities by low-income populations.[49] Ciclovias have also been shown to be cost-

beneficial (having greater savings in direct medical costs than dollars invested in the program).[51] Regular Ciclovias in Latin America have been classified as a type of environmental and policy intervention in which community-wide planning efforts and policies are implemented to increase PA levels.[1] The Ciclovias movement has grown exponentially[1] into what has been described as a "healthy epidemic."[52] In 2012, over 350 Ciclovias were documented in the Americas.[52] The popularity of Ciclovias has grown rapidly over the past five years in the US, where they have been called "Open Streets."[45]

PA Classes in community settings. PA classes in community settings were one of three new intervention categories reflected in the aforementioned systematic review conducted in Latin America.[47] PA classes are free classes conducted by trained instructors and offered in existing public spaces such as parks, community centers, and shopping centers.[48] Examples of these interventions include the Academia da Cidade program (ACP) in the city of Recife, in northeastern Brazil,[53] and the Recreovia program in the city of Bogota, in Colombia.[48] Despite the limited evidence on the effectiveness of the PA classes (low internal validity),[47,48] results of some emerging studies have revealed significant associations between participation in these programs and increased LTPA.[53,54] Moreover, such studies have also indicated that PA-classes programs are reaching vulnerable populations including low-income individuals and women, both of which are in need of increased levels of LTPA and its numerous benefits beyond physical health. [48, 55]

Applicability and transferability of Ciclovias and PA-classes programs in community settings. Both Ciclovias and PA classes have expanded rapidly within Latin America and in communities within Canada, the US, and Europe, despite sociocultural and geopolitical variability between these regions.[38] For instance, more than 100 "Open Streets"

events have been hosted in various US cities over the past 10 years.[56] Early findings from these initiatives in US cities demonstrate their potential to increase physical activity,[57,58,59,60] promote social cohesion,[57,60] stimulate neighborhood economies,[57,60] and focus attention on inadequate infrastructure for active transportation.[57,60,61]

PA classes have multiplied rapidly in Latin America. For example, the ACP has been expanded to all 185 municipalities in the State of Pernambuco, in the Northeast region of Brazil.[62] The ACP has also been used as a model for a national PA-classes program in Brazil, with an ongoing expansion planned in 4,000 cities.[63] Likewise, in Colombia, PA classes have been implemented in 32 departments of the country.[48] The PA-classes programs have also spread to the US. For example, The ACP was adapted and implemented in Latino Communities in San Diego, California,[64] and PA classes have been implemented in other interventions for Latino women in the US.[65] Furthermore, following the model of the Ciclovias programs in Latin America, many Open Streets programs in the US have incorporated PA classes as associated activity hubs into their routes.[45] The addition of PA classes serves not only to provide access to places to cycle, walk, and jog, but also to offer participants opportunities to engage in less common modes of PA such as yoga and dance classes.[57]

The rapid dissemination of both the Ciclovias and the PA classes suggests that these programs have a high level of applicability (their implementation is feasible in other settings and contexts).[66] These programs represent a unique opportunity to inform the translation of research into practice[48] and to accumulate research-based evidence on existing interventions that already have extensive practice-based evidence.[48] Practice-based evidence refers to new approaches that are promising because they are feasible, acceptable, and potentially effective in real-world practice settings.[67] Thus, they are worthy of future investments in rigorous research to assess

their effectiveness (research-based evidence).[68] The applicability of the Ciclovias and the PA-classes programs and their extensive practice-based evidence illustrate the importance of building evidence on the effectiveness and transferability of these interventions into other regions, specifically from Latin America to the US. For the purpose of this manuscript, transferability is defined as "the extent to which the measured effectiveness of an applicable intervention could be achieved in another setting".[66] The growing evidence on the impact of Ciclovias and PA-classes programs in promoting PA in Latin America make them promising for Hispanic populations living in the US, who would benefit from culturally adapted interventions.[8,69] Preliminary data on Open Streets have shown a substantial participation of ethnic minorities in addition to Non-Hispanic Whites,[58,59,60] indicating that these initiatives can potentially reach all ethnic groups in the US.

The need of effectiveness and translation research for community-based interventions. With the growing implementation of community-based interventions on PA, the body of literature assessing their impact has also increased.[70] Whilst rigorous research methods that maximize internal validity are important to determine intervention success, there is also a need to assess whether interventions work in the real world (external validity).[70] Achieving a balance between internal and external validity is imperative to bridge the gap between research and practice, ensuring that research investments and findings are relevant to practice and policy.[70, 71] A combination of evaluation approaches and methodologies assessing community-based interventions at different stages are necessary to attain this balance. Specifically, for Ciclovias and PA classes, the combination of evaluation approaches should address documented gaps in the literature including:

(1) *Lack of evidence of intervention effectiveness.* Most of the emerging evidence of intervention impact are based on cross-sectional studies.[55] This dissertation will address this gap by incorporating analysis on pre-and post-measures, and on comparable control groups resulting from a natural experiment. Natural experiments are ideal to examine the effectiveness of existing interventions, especially those that have been implemented for years in large community settings that cannot be manipulated by the researcher.[70]

(2) *Limited research on implementation and external validity (applicability in the real world).* To address this gap, this dissertation will assess and document individual and setting-level elements of external validity such as reach, representativeness, adoption, and maintenance[71] using the RE-AIM framework. The RE-AIM framework is an evaluation approach that enables balance between internal and external validity elements[72] by utilizing five factors to assess the impact of a community-based intervention: Reach, Effectiveness, Adoption, Implementation, and Maintenance.[73]

(3) *Need for additional studies documenting translation efforts to inform the applicability of interventions in new contexts, countries, and regions*.[71] This dissertation will assess and document the translation and adaptation of community-based interventions in public spaces, specifically Open Streets and PA-classes programs. Such assessment and documentation are needed given the naturally occurring and ongoing expansion of these initiatives among in the US.[38] Evaluations are crucial to ascertain the applicability of community-based PA interventions that have been increasingly adapted from Latin America and implemented in the US.

Purpose

The purpose of this dissertation is to examine the impact of two types of community-based interventions to promote LTPA in public spaces and their applicability and transferability from the Latin American to the US context. Specifically, three LTPA programs in public spaces will be examined: (1) Atlanta Streets Alive (ASA) (the Open Streets initiative inspired by the Bogota Ciclovia, hosted in the city of Atlanta, Georgia, US); (2) the Bogota Recreovia (free PA classes in community settings in the city of Bogota, Colombia); and, (3) Academia Fit (the PA-classes in community settings program adapted from the Brazilian ACP for Latino Communities in San Diego, California, US).

Despite the growth of the Open Streets initiatives in the US, little is known about their impact.[57] Scholars have reiterated the need to conduct consistent evaluations in order to learn more about the implementation of these initiatives in the US and to identify correlates for public health outcomes.[57-60] The proposed study will contribute to the growing knowledge base on Open Streets initiatives in the US by evaluating ASA and, consistent with other Open Streets initiatives in the US,[58-60] the outcomes associated with participation in the events including participants' sociodemographic characteristics, PA, and perceptions of safety and neighborhood social capital during the events.

In addition, this dissertation will address a significant research gap regarding the effectiveness of PA classes in community settings.[47,48] There have been increasing efforts to assess the association between PA-classes programs in Latin America and PA outcomes; however, these studies have used cross-sectional data and have relied on self-reported measures of PA.[53,74,54] The proposed study on the Recreovia program improves upon such methodological limitations by implementing the first effectiveness evaluation of a PA-classes program in Latin America with rigorous design and methodology. The methodology incorporates: (1) the use of pre and

post measures; (2) a natural experiment to compare multiple groups including intervention, control, and communities where the program has been implemented for more than 10 years; and, (3) the use of accelerometer to obtain objective measures of PA.

Additionally, this dissertation advances the knowledge base regarding the implementation, translation, and transferability of community-based interventions in public spaces from Latin America into the US through the use of an evidence-based approach such as the RE-AIM framework to assess the translation of the Academia Fit program.

This dissertation will provide important lessons obtained from a variety of evaluation methods used in three community-based programs to increase PA in public spaces. These programs were implemented in three different contexts, geographical locations, and target populations, and during different implementation stages.

Chapter 2: Atlanta Streets Alive: A Movement Building a Culture of Health in an Urban Environment

Andrea Torres, John Steward, Sheryl Strasser, Rodney Lyn, Rebecca Serna, and Christine Stauber. JPAH, Volume 13, Issue 1, January 2016

Abstract:

Background

Open Streets are community-based programs that promote the use of public space for physical activity, recreation and socialization by closing streets temporarily to motorized vehicles, allowing access to pedestrians. The city of Atlanta hosted its first Open Streets event, Atlanta Streets Alive (ASA), in May 2010. An evaluation of the first five ASA events from May 2010 to May 2012 was conducted. The purpose was to learn about the characteristics of ASA participants, the influence of the event on their physical activity, and perceptions of safety and neighborhood social capital.

Methods

ASA's evaluation had two components: participant counts and a participant survey. Characteristics of participation were compared among the three different events in which surveys were conducted using the Pearson $\chi 2$ test and F-test as appropriate.

Results

The estimated participation at ASA increased from nearly 3,500 (ASA 1-4) to 12,520 (ASA 5). The number of events increased to 3 per year for a total of 10 events until 2014. Overall, 19.4 percent of participants met the weekly PA recommendation during one event.

Conclusions

The expanding diversity of routes, participants, and sponsorships highlights the potential promise such programming offers in terms of establishing an urban culture of health.

Introduction

Physical inactivity is the fourth leading risk factor for mortality worldwide[1] and has recently been recognized as a pandemic with extensive adverse health, economic, environmental, and social consequences.[2] Strong epidemiological evidence has shown the high prevalence of physical inactivity globally and its major impact on human health.[2] Estimates indicate that physical inactivity causes 6–10% of the major non-communicable diseases and 9% of premature mortality.[3] Despite the growing efforts to promote physical activity (PA) at the population level, the challenge of substantially increasing PA around the world persists.[2,4] Specifically in the city of Atlanta, Georgia (GA) in the U.S., 53.8% of the adult population in metropolitan Atlanta reported not being physically active at least moderately,[79] 19% reported no PA in the last 30 days,[80] 60.9% were overweight or obese, and 8.7% had diabetes.[80] Thus, implementation of effective strategies to promote PA should be a priority for public health in Atlanta.[4] Approaches that impact various ecological levels of influence including individual, environmental and social, have been documented to be more effective in increasing PA levels.[4,81]

Ciclovias (called Open Streets in the U.S.) are multisectoral community-based programs that promote the use of public space by closing streets to motorized vehicles temporarily and to open them to people, allowing free, unrestricted access to various forms of PA, recreation and socialization.[82,83]The Ciclovias movement has grown exponentially[82] into what has been called a healthy epidemic,[84] with over 350 Ciclovias documented during 2012 within the Americas.[84]

Similarly, Open Streets has gained popularity within the U.S., where more than 100 events have been hosted over the past five years.[85] A recent report from the Robert Wood Johnson Foundation (RWJF), identified Ciclovias /Open Streets as promising examples for moving toward a Culture of Health ("in which all members of our diverse society are able to lead healthier lives now and for generations to come").[86] The report highlights the potential of these programs to inspire communities to be active in public spaces, to empower people, and to set the foundation for thinking about PA as a social norm by increasing visibility and access to PA programs.[86]

Inspired by the Bogota Ciclovia and the Sunday Streets program in San Francisco, U.S.,[87] the City of Atlanta, hosted its first Open Streets event *Atlanta Streets Alive* (ASA), in May 2010. For this initial event, the City closed 1.5 miles of downtown streets to vehicular traffic for the purpose of inviting people to engage in PA. Since the launch of ASA, ten additional events have been held through 2014.[88] ASA's growth is reflected in its increasing number of events and miles per year. ASA has also rapidly increased attendance from approximately 5,000 participants in 2010 to more than 80,000 participants per event in 2014.[88] The routes have expanded to include other main streets, resulting in an increase in the number of miles of street closings, ranging from 3 to 5 in 2013 and 2014.[88] Such growth suggests that ASA has been a well-received program and that it is beginning to achieve sustainability as evidenced by in-kind support, increased partnerships, and sponsorships.[87,88]

ASA aims to become an environmental and policy intervention as it further establishes itself as a standing City program.[89] Regular Ciclovia programs in Latin America have been classified as a type of environmental and policy intervention in which community-wide planning efforts and policies (use of streets and public spaces) are implemented to increase PA levels.[89] ASA's

mission and goals incorporate key components of a Ciclovia conceptual model proposed by Sarmiento, et al., (2009).[82] The model illustrates the connections between the multiple sectors and policies that determine the implementation of a Ciclovia program and its potential public health outcomes. These outcomes include PA behavior change, promotion of recreation, promotion of businesses along the route, and improvement of health-related quality of life (QOL), air quality, social and physical environments.[82] Preliminary evidence has shown a positive association between Ciclovias and public health outcomes including increased PA,[82,90,91]improved social environments and air quality,[82,90] enhanced safety perception, and increased equity in access to recreational activities to low-income populations.[90] Ciclovias have also been shown to be cost-beneficial (having greater savings in direct medical costs than dollars invested in the program).[92] Most of this evidence hails from Latin America where programs are well established and conducted weekly. Scholars in the U.S. have evaluated U.S. "Open Streets" initiatives in an effort to strengthen the evidence of public health impact in North America.[93,94] Early findings from these initiatives demonstrate their potential to increase PA,[95,96] to promote social cohesion, stimulate neighborhood economies, and focus attention on inadequate infrastructure for active transportation.[95]

An evaluation committee comprised of Georgia State University (GSU) School of Public Health members designed and implemented evaluation of the first five ASA events (from May 2010 to May 2012). The purpose was to learn more about the characteristics of ASA participants, the influence of the event on PA levels, as well as perceptions of safety and neighborhood social capital during the event. This paper describes the findings of the ASA evaluation and contributes to the growing knowledge base on Open Streets initiatives in the U.S.[95]

Methods

The team collected data to be used for the ASA evaluation at five different events (as shown in Table 1). The evaluation protocol was approved by GSU's Institutional Review Board (IRB H10465). ASA's evaluation consisted of participant counts and a participant survey. Participant counts were conducted during all five events. Participant surveys were conducted during three events (Table 1). The protocol and instruments utilized were adapted from existing tools.[90,93,97]

Participant counts

Two count locations were defined for each event based on the length of the route (Table 1) and original protocol.[97] Four trained observers were positioned at each count location in the middle of the street. Tally counters and observation was used to record number of participants and participation characteristics including type of activity performed, the apparent gender, and approximate age category.[97] Counts were conducted during the first 15 minutes of every hour of the event,[97] for a total of four count periods.

Participant survey

Intercept surveys were conducted as a convenience sample at natural points of the route where participants were expected to slow down or stop, thus allowing survey team members to approach as many participants as possible. The survey included 22 questions that assessed five components: (1) PA, (2) transportation mode to the event and location of residence, (3) social capital and safety perceptions, (4) characteristics of participation and perceptions about the event, and (5) demographics (sex, age, race, education, and income) (see supplementary information for the complete survey).

Data Analysis

Analysis was performed using IBM SPSS statistics software version 20. First, the count and observation data were analyzed by estimating total participation in the event using a previously defined formula[97] and describing observed demographics (sex and age group –adult or youth). Second, descriptive and frequency statistics were computed for survey data to better understand the participation and PA characteristics of the ASA participants. Third, demographic characteristics of participation were compared among the three different events in which surveys were conducted using the Pearson χ^2 test and F-test as appropriate. Two additional PA variables were calculated. First, we classified individuals as meeting recommended PA at ASA (150 minutes or more of any type of PA reported during the ASA event), or not meeting the recommended PA (less than 150 minutes of any type of PA reported during the ASA event). This classification was based on the 2008 "Physical Activity Guidelines for Americans," which recommends at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic PA each week.[28] Second, we classified participants based on total minutes spent performing all types of PA at the ASA event.

Results

Participant count and observation

A summary of results of participant counts for the five events is shown in Figure 1. The estimated overall participation for all five ASA events was 28,143 participants, ranging from 1,550 on June 11 2011 (ASA 3) to 12,520 on May 20 2012 (ASA 5). The distribution of observed males and females was consistent in all the events; however there was a slightly higher proportion of males (56 and 59%) estimated in ASA 1 and 2 respectively compared to the proportion of females (44 and 46%). The majority of participants were estimated to be adults in

all the events. Youth accounted for a range of 9 to 15% (as shown in Figure 1). The activity most commonly observed was walking at all five events, followed by cycling.

Survey data

A total of 627 participants responded to the survey (150 at ASA 1, 238 at ASA 2, and 239 at ASA 5, the events in which we conducted the survey portion of the evaluation protocol). After excluding 38 surveys that had incomplete data, from May 2010 to May 2012, 589 surveys were included in the analysis. The sample nearly represented males/females equally. As shown in Table 2, the mean age was 34 years. The majority reported to be White (60.4%), followed by Black (20.5%), and Latino (5.4%). Seventy five percent of respondents reported having a bachelor's degree or above and 63% having an annual income of ≥$45,000 per year. Most people (64.9%) reported walking or cycling and using Metropolitan Atlanta Rapid Transit Authority (MARTA) to get to the event. Use of MARTA was significantly higher on ASA 1 and 2 (almost 19% on each event) compared to ASA 5 (1.3%). Most participants (82%) reported spending money at the ASA events. Among participants of ASA 2 and 5, the majority were attending the event for the first time (67.2% at ASA 2 and 81% at ASA 5). Participants of ASA 5 were more likely to have higher educational attainment (81.4% bachelor's degree or above) and income (64.4% reported having an annual income of ≥$45,000 per year) compared to participants of ASA 1 and 2. In addition, a higher proportion of participants of ASA 5 were White (75.1%), reported traveling to the event walking or cycling (66.8%), and reported spending ≥$10.00 USD at the event (46.5%) compared to ASA 1 and 2. After grouping ASA 1 and 2 (both held at the same route-Downtown Atlanta) and comparing them with ASA 5 (Virginia Highlands) the differences in the demographic characteristics remained statistically significant: participants of ASA 5 had higher educational attainment (χ^2=43.2, P<.001) and income (χ^2=11.4, P=.003),were

more likely to be white (χ^2=20.4, P<.001), reported lower use of public transportation and higher walking/cycling to the event (χ^2=48.5, P<.001), and were more likely to report spending ≥$10.00 USD ($\chi^2$=23.9, P<.001), compared to participants of ASA 1 and 2 as a group.

Reported Physical Activity (PA) at ASA

Most survey respondents reported engaging in more than one activity during the events; therefore reported activities were not mutually exclusive. As shown in Table 3, walking and cycling were the most frequently-reported primary activities (73.7% and 37.7% respectively). Respondents indicated walking for an average of 57 minutes (SD 57), cycling for 32 minutes (SD 54), and staying at the event for an average of 142 minutes. The average estimated total minutes of PA engaged in for three events was 99 minutes (median minutes = 90). No significant differences were found in the average minutes of walking or cycling among the three events surveyed. Overall, 19.4% of participants of the three events met the recommendation of 150 minutes of PA weekly during one ASA event. A slightly higher proportion of participants met the PA recommendation at ASA 1 (23.3%), compared to ASA 2 and 5 (20% and 16.4% respectively); however, the difference was not statistically significant. Significant differences were found in the average minutes of PA accumulated at the ASA events (151 at ASA 1, 148 at ASA 2, and 130 at ASA 5, $F_{2,578}$=6.33 P=.002), as well as in in the main activity participants reported they would be doing if they were not at the event. Thirty four percent of respondents in ASA 1, 49.6% in ASA 2, and 54.4% in ASA 5 indicated they would be engaged in a sedentary state at home-- indoors, watching TV, or on the computer-- if they were not participating at the ASA event (χ^2=19.84, P=.001).

Social capital and perceptions of the event

When asked about their perceptions of the event, nearly all participants felt safe (97.8%). Most agreed that ASA was an event that welcomed everyone (99.7%), and that people at ASA generally get along with each other (93.9%). Eighty percent also agreed that they would "hang out" with people they normally would not at the events. Eighty percent of the respondents indicated that ASA changed their feelings about the city of Atlanta in a positive way, and 85.7% found the city more vibrant during an ASA event. In contrast, 58.1% of participants rated the city of Atlanta as poor or average in providing friendly environments to walk, bike, or to participate in outdoor recreational activities.

Discussion

The preliminary findings of this study support previous research that have identified regularly implemented Ciclovia and Open Streets programs as promising interventions to increase PA while providing opportunities for recreation and for promoting better social environments.[82,90,95]

ASA participation characteristics

The demographic characteristics of the ASA participants were similar to the demographic profile of the City of Atlanta. Women accounted for 50% of the ASA participants, which is also characteristic of Atlanta where 50% of the population are females.[98] The ASA participants were diverse which is an important aspect in a racially diverse city like Atlanta, where 38% of the residents are White and 54% African-American.[98] Thirty-five percent (35%) of the ASA participants reported to be non-White. Although ASA 5 was less racially diverse compared to ASA 1 and 2, 24% of the survey respondents reported to be non-White. The lower proportion of ethnic minorities in ASA 5 may be explained by the fact that it was located in a predominantly white neighborhood (where nearly 85% of the residents are White)[99]. Thus, the short length of the route may have promoted a greater participation from residents of the surrounding areas. In

San Francisco, the Sunday Streets program was also found to represent ethnic minorities in similar proportions to the overall city population.[93] Therefore, the results suggest that a regular implementation of Open Streets like ASA may improve access to safe public spaces for physical activity and recreation among minorities and low income populations living along the Open Streets routes.[90,95] However, a greater inclusion of ethnically and socioeconomically diverse groups may be accomplished by connecting with additional, diverse neighborhoods along ASA routes and by enhancing City-wide promotional campaigns that appeal to distinct populations. ASA organizers aim to target more diverse neighborhoods in future events. For instance, one of the routes in 2015 is located in a predominantly African American neighborhood (West End),[100] where 98.3% of the residents are African American and 26.5% of the residents live below the poverty level.[101] By connecting the West End route with the Highlands (ASA5) route (predominantly White, highly educated and higher income population area), the social outcomes and inclusion of more vulnerable populations, including lower educated, lower income and ethnic minorities could be accomplished. Interestingly, it is important to note that ASA's evolving and expanding routes have been attributed to both community residents and local leaders who have expressed interest in future events after observing initial events and the PA traffic they generated. ASA's potential to be inclusive of ethnically diverse populations is significant, given the racial and socioeconomic disparities in the distribution and access to recreational facilities and resources in the United States, and the importance of overcoming PA barriers that frequently contribute to disparities among vulnerable populations.[102]

ASA and active transportation

ASA also provided an opportunity for residents along the route to experience active transportation by enjoying the city by foot, bicycle, or using public transportation. More than

half of the survey respondents reported they had walked or biked to get to the ASA event, and 12% said they had used the Metro Atlanta Rapid Transit Authority system (MARTA). The significantly higher use of MARTA at ASA 1 and 2 compared to ASA 5 highlights the importance of having routes that are readily accessible by public transportation. ASA 1 and 2 had easy access to at least three MARTA stations (within ½ mile of the route), whereas ASA 5 was located in a more residential neighborhood where participants could walk or bike to the event, but did not have MARTA station within 1 mile. Increasing active transportation in conjunction with public transit should become a priority for Atlanta, given that only 1.5% of the residents walk or bike to work and only 3.4% use public transportation.[79] Active transportation has been associated with increased PA, better health outcomes including protection against obesity and other chronic diseases,[103,104] and better air quality.[105] Open Streets initiatives like ASA allow active transportation to be showcased as safe and beneficial to local residents.[95] Some of the ASA routes have showcased key places for recreational PA and active transportation in the city such as the route that incorporated a section of the Atlanta Beltline.[88] While ASA may have not directly generated built environment changes, the initiative highlighted the potential for change and unmet demand for a wider range of transportation options in Atlanta. Today the section of Edgewood and Auburn Avenues (within the first four ASA routes) has been modified with infrastructure that includes a new streetcar line and bike lanes. Highland Avenue and Peachtree Street (included in former routes) have also been considered for bike lanes. A regular implementation of ASA can contribute to the shift that the City of Atlanta is experiencing from urban sprawl to walkable urbanism by increasing the visibility and promoting the use of public urban infrastructure.[86,106] By opening streets to pedestrians and closing them to cars, ASA can

influence cultural norms towards more active living in a city that has been historically vehicle-oriented and in which new generations are demanding more productive walkable districts.

ASA, neighborhoods and business along the routes

ASA provided access to opportunities for free PA in public spaces, which attracted a significant and increasing number of participants to the events. Having a range of 1550 to 12520 participants per event in 1.5 to 2 miles of street closing suggests that ASA has the potential to involve an important proportion of the population living in surrounding areas of the selected route. ASA can also attract people from other neighborhoods as reflected in the number of participants that attended ASA's first route (stretch of Edgewood and Auburn Avenues) was relatively deserted outside of downtown Atlanta business hours. In addition, attendants to the ASA events hosted in this route (ASA 1 and 2) reported coming from 83 different zip codes, 14 of which were inside the Atlanta perimeter (an Interstate Highway loop encircling Atlanta for 63.98 miles). Participation greatly increased when ASA (#5) was implemented in a mixed-use neighborhood with a high proportion of residential area combined with activity friendly infrastructure, restaurants and shops. Participants of this event reported coming from 52 different zip codes from which 24 were inside the Atlanta perimeter. These participation differences suggest that route selection is crucial for exposing a greater amount of people to ASA, in addition to including easy access to them through public transportation and active travel infrastructure. It is more than likely that connecting less-appealing routes such as the one in ASA 1-4 with a more appealing route such as ASA 5, could connect diverse neighborhoods, enhance social environments in the more deserted areas and generate greater participation and impact. Our finding indicated that nearly 82% of the ASA participants anticipated spending $10.00 USD or more at the event, which suggests such events bear positive economic

implications for local businesses. Nonetheless the street closures may also disrupt traffic to local businesses, which should be considered in future studies. The St. Louis Open Street event found similar results with more than 80% of the respondents reporting having spent money at the event and 56% reporting increased awareness of new businesses along the route.[94] Similarly, businesses along the Sunday Streets route in San Francisco reported a 44% increase in revenue during the event compared to Sundays without.[95]

ASA and promotion of PA

ASA is a promising intervention to promote PA among its participants if it becomes a regular program. On average, participants in our study reported spending 142 minutes at the event and engaging in 99 minutes of PA. Thus, ASA provided an opportunity for participants to accumulate a substantial amount of PA to meet the 150 minutes a week recommended by the Centers for Disease Control and Prevention (CDC) to obtain health benefits.[28] In fact, 19% of the ASA survey respondents met the PA recommendation during the event they attended. Participants of Sunday Streets in San Francisco and St. Louis Open Streets also reported obtaining an important amount of the PA in one event.[93,94] These benefits could be sustained in time if a more frequent program was implemented and people had the same opportunity to be active at ASA on a regular basis, for instance, weekly, as with the Ciclovia programs in Latin America. Studies have demonstrated that moderate health gains may be accrued with as little as 60 minutes of moderate-intensity aerobic PA within a week.[28]

Our findings also indicate that 38% of respondents would have likely not have been moderately physically active while they were home indoors, watching TV, or using the computer if not at ASA. This result is consistent with data from the St. Louis Open Streets, in which 43% of the respondents said they would not be active elsewhere if they were not at the event, suggesting

they were physically active the day of the event because of Open Streets participation.[94] Our results suggest that just by providing free access to activities like ASA, participants of events like ASA may avoid sedentary time and may be persuaded to engage in active recreation with others in a public setting during the day of the event. However long-term effects may not be realistic unless the same population is exposed to the event on a regular basis. Lasting effects on PA levels among inactive people may also require additional behavioral interventions during the events.

While our preliminary results are promising, more research is needed to better understand whether or not these events are reaching physically inactive people. Also, the impact of ASA on PA behavior change should be assessed once a regular program is established.

In terms of type of activities, walking was observed to be the most frequent activity among ASA participants, which is consistent with other events in the U.S. such as Sunday Streets in San Francisco.[93] Increasing opportunities for walking is likely to have a large public health impact since it is the most popular form of PA in the US,[107] it is accessible, and provides important health benefits.[108] Complementary activities such as PA stations in which kids and adults can engage in active recreation (dancing, aerobics, wall climbing) have also been offered at all ASA events; however the impact of these activities on the PA outcomes at each event have not been measured. Future evaluations should assess PA outcomes in participants of the activity stations.

Both increasing PA and decreasing sedentary time are crucial for Atlanta's population health given the strong evidence that shows that physical inactivity increases the risk of adverse health conditions including non-communicable diseases and reduced life expectancy.[77,109] Data from 2012 indicates that 53.8% of the adult population in metropolitan Atlanta were not moderately

physically active,[79] 19% reported no PA in the last 30 days,[80] 60.9% were overweight or obese,[80] and 8.7% had diabetes.[79]

Participants' perceptions of the ASA events

ASA offers public spaces for activity and recreation in which participants feel safe. The perception of the social and physical environment during the event was also very positive. The majority of participants perceived ASA as inclusive and as promoting socially cohesive environments where people "get along with each other" and as allowing social contact with people they normally would not. ASA was also perceived as an event that created more vibrant environments and enhanced a positive perception of the event area. The enhanced perception of safety and social capital associated with Ciclovia events could encourage more residents along the routes to be physically active.[90]

Limitations

This study provides important preliminary information to understand the potential impact of ASA on the local areas. It is important to underscore that the health impacts of ASA discussed as a result of this evaluation have been treated as "potential" given the limited scheduling and short routes. Thus, long-term health and social benefits cannot be expected or measured until ASA becomes a sustained program instead of periodic, special event as it is currently. Nonetheless, the results of this evaluation are promising for two reasons (1) Regular open streets with longer routes and regular scheduling, such as the Bogota Ciclovia with 121 km of streets closings every week have been found to be associated with important health and social outcomes;[82,90,92] (2) The City of Atlanta is one of four cities that has committed to become an early adopter of open streets as "healthiest practices" in which the goal is to establish a program with expanded routes and

regular scheduling. Other methodological limitations should be acknowledged. First, the counts and surveys were conducted by volunteers, some of whom had only limited training and practice. Second, the counting method has not been validated for shorter routes with a greater density of participants which increases the likelihood of double-counting or overestimation of participation. In addition, gender, age and activity characteristics were difficult to observe and accurately record during the event with the highest attendance (ASA 5) because of the large numbers of participants. Enhanced and validated methodologies (including automating counts) should be considered for future events. Third, the surveys were conducted as intercept surveys to a convenience sample, limiting the generalizability of the findings. Additionally, the surveys relied on self-reported estimates (including minutes of PA) this may result in inaccurate estimation. Lastly, the descriptive nature of this study only permits documenting participation characteristics in ASA but not assessing associations among them. Future studies should address these limitations and move beyond cross-sectional evaluation to pre and post assessments in communities where ASA will be implemented for the first time. It is imperative to continue the development of an effective yet manageable evaluation methodology that adapts to the demands of the new routes and the available resources. With the growth of ASA, there is an increasing potential to explore other areas for research including: more extensive investigation of PA, social capital, and economic factors; injury, crime, and air quality along routes.

Implications for future events

A total of 11 ASA events have been held through 2014. Each one has seen an attempt to increase mileage in particular to appeal to bicycle riders. While higher mileage has contributed to the increased attendance, it has also resulted in increased cost and time spent fund-raising.

The next step is to continue to expand ASA's growth, and translate the demand into safer, more complete streets every day. Organizers hope to increase to a quarterly event by partnering more closely with the City of Atlanta in the near future. Organizers are also establishing planning committees recruiting member representatives from communities and businesses along the routes to promote ASA's acceptance, community engagement and buy-in which will foster the long-term goal of sustaining ASA in the future. Organizers are also exploring ways to expand and diversify routes so that new communities and previously disengaged population segments can be connected to ASA on a routine, frequent basis. Execution of these plans will be critical for sustaining ASA and its commitment to nurturing a culture of urban health.

Conclusion

Results from the evaluation of ASA show true promise to help Atlantans get active and enjoy a more vibrant city. Growing attendance, increasing distance and diversity of routes, participants and sponsorships highlight the potential for health impact. Population-based health interventions take time to build a presence. For ASA's continued growth and expansion, it must become a standing event on the City calendar to increase the potential population impact. While only a fraction of the population has participated in ASA events, adding neighborhoods to this positive movement will support the building of a culture of health in the City of Atlanta.

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Table 1. Details of the Atlanta Streets Alive (ASA) events evaluated

Event	Date	Location	Length of the route	Scheduled time	Evaluation Method
ASA 1	May 23, 2010	Edgewood Avenue	1.5 miles	1:00- 6:00 pm	Counts and survey
ASA 2	Oct 17, 2010	Edgewood Avenue	1.5 miles	1:00- 6:00 pm	Counts and survey
ASA 3	June 11, 2011	Edgewood Ave, Auburn Ave	2 miles	10:00 am-2:00 pm	Counts only
ASA 4	June 25, 2011	Edgewood Ave, Auburn Av	2 miles	4:00 pm -8:00 pm	Counts only
ASA 5	May 20, 2012	Highland Avenue	2 miles	2:00 – 6:00 pm	Counts and Survey

Table 2. Demographic characteristics of the Atlanta Streets Alive participants assessed by survey (2010, 2012)

	ASA 1 N(%)[a]	ASA 2 N(%) [a]	ASA5 N(%) [a]	Total N(%) [a]	X^2(P)
Sex					
Female	63(52.6)	107(46.5)	119(52.7)	296(50.3)	25.6(<.001)
Male	70(47.4)	122(53)	92(40.7)	277(47)	
Education attainment					
High school	6(4.5)	16(7)	4(1.8)	26(4.4)	45.6(<.001)
Some college	30(22.6)	46(20)	17(7.5)	93(15.8)	
Bachelor/above	97 (72.9)	163(70.9)	184(81.4)	444(75.4)	
Race					
Black	33(25.6)	59(25.7)	29(14.1)	121(20.5)	22.9(.001)
White	73(56.6)	129(56.1)	154(75.1)	356(60.4)	
Latino	11(8.5)	12(5.2)	9(4.4)	32(5.4)	
Other	12(9.3)	30(13)	13(6.3)	55(9.3)	
Mean Age	33.3(9.1)[b]	34.9(11.1) [b]	32.5(14.9) [b]	33.6(12.4) [b]	$F_{2,579}$=2.1(.123)[c]
Transportation Mode					
Car	50(37.6)	75(32.6)	72(31.9)	197(33.4)	49.9(<.001)
MARTA	24(18)	44(19.1)	3(1.3)	71(12.1)	
Bicycle/Walk	53(39.8)	107(46.5)	151(66.8)	311(52.8)	
Estimated spending					
Nothing	24(18)	39(17)	27(11.9)	90(15.3)	25.1(<.001)
< $10	60(45.1)	100(43.5)	80(35.4)	243(41.3)	
≥ $10	47(35.3)	91(39.6)	105(46.5)	240(40.7)	

a Some percentages do not add up due to missing data. *Mean(SD) c F-test One Way ANOVA

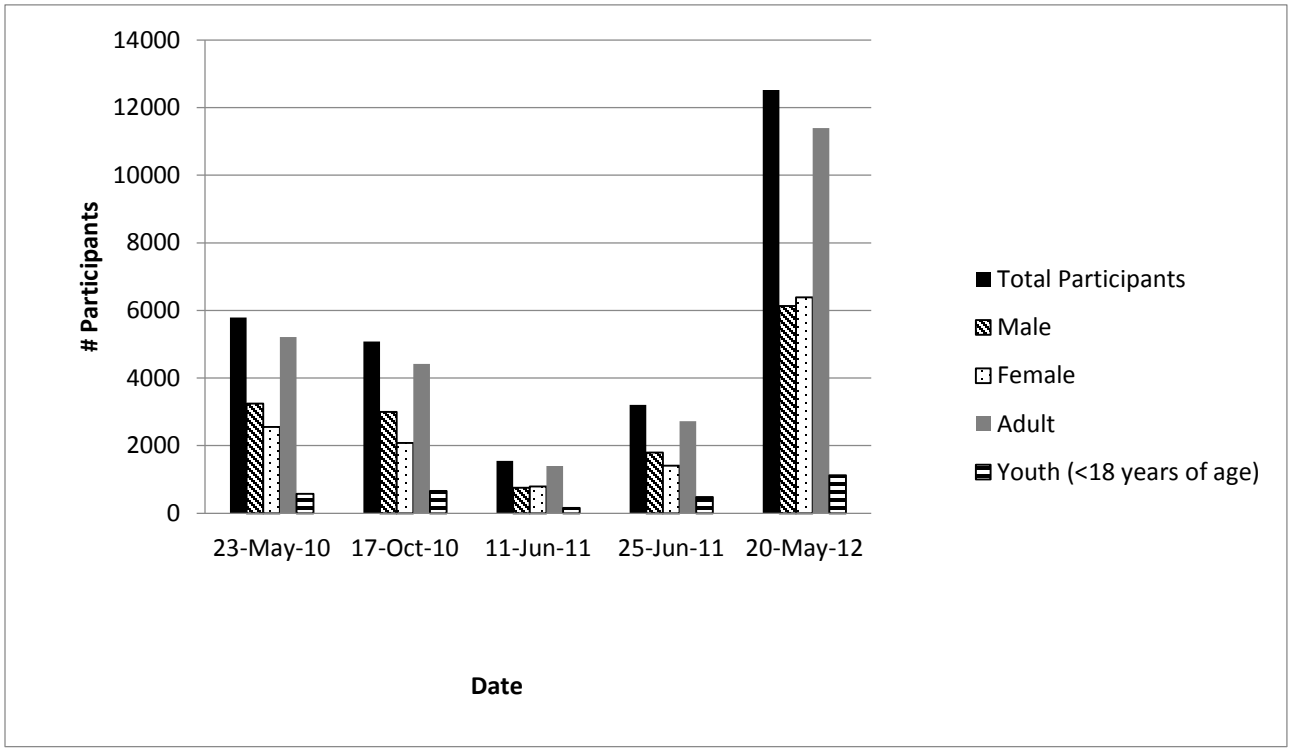
Table 3. Physical Activity (PA) characteristics at the Atlanta Streets Alive events assessed by survey (2010, 2012).

[a] Number and percentage of people engaging on the activity asked or meeting the defined criteria.

	ASA 1		ASA 2		ASA 5		TOTAL N= 589		
	N(%)[a];	Mean Minutes (SD)	N(%)[a];	Mean Minutes (SD)	N(%)[a];	Mean Minutes (SD)	N(%)[a];	Mean Minutes (SD)	X^2(P)/F(P)
Type of PA[b]									
Walking	92(69.2);	58(64)	162(70.4);	53(58)	180(79.6);	59(51)	434(73.7);	57 (57)	$F_{2,586}$=.63(.529)
Cycling	58(43.6);	39(53)	89(38.7);	30(56)	75(33.2);	29(51)	222(37.7);	32.3(53)	$F_{2,586}$=.159(.203)
Stations[c]	27(20.3);	4(15)	67(29.1);	13 (35)	27(11.9);	3(13)	121(20.5) ;	7.5(25)	$F_{2,586}$=9.04(<.001)
Meeting PA recommendation[d]	31(23.3)	------	46(20.0)	------	37(16.4)	------	114(19.4)	------	2.71(.258)[h]
Alternative activity[e]									
Indoors/TV/computer	46(34.6)[g]		114(49.6) [g]		123(54.4) [g]		224(38) [g]		19.84(.001) [h]
Other recreational activity/outdoors	69(51.9)		91(39.6)		64(28.3)		283(48)		
Other	17(12.8)		24(10.4)		26(11.5)		67(11.4)		
Average minutes at the event		151(70)		148(72)		130(50)		142(65)	$F_{2,578}$=6.33(.002)
Total minutes of PA[f]		109(55)		97(66)		95(55)		99 (60)	$F_{2,584=}$1.87(.154)

[b] The type of activity are not mutually exclusive.
[c] Activity Stations set up throughout the route for participants to get active with recreational type of activities for instance dancing classes, climbing wall, Yoga, soccer in the streets.
[d] Doing 150 minutes or more of moderate to vigorous physical activity during the Atlanta Streets Alive event.
[e] Survey question "What is the main thing you would be doing if you were not here?"
[f] Total minutes of PA preformed at Atlanta Streets Alive including all type of activities. [g] Percentages do not add up due to missing data. [h] X^2(P)

Figure 1. Estimated participation per Atlanta Streets Alive event assessed by observation



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Chapter 3

Assessing the effect of physical activity classes in public spaces on leisure-time physical activity: "Al Ritmo de las Comunidades" A natural experiment in Bogota, Colombia

The pandemic of physical inactivity is a major driver of non-communicable disease morbidity and mortality.[5,4] Researchers and practitioners are implementing and assessing new community-based interventions to promote physical activity (PA) around the world.[47,110] Community-based interventions for PA are feasible, cost-effective and more efficient than individually-focused behavioral approaches for producing changes in health-related behaviors, especially among socioeconomically disadvantage populations.[111,112,113] Brazil and Colombia are noted for implementing and evaluating innovative community-based interventions to promote PA.[47,114] One of these innovative interventions is the provision of physical activity classes in community settings (PA classes).[47,40] PA classes are free exercise classes conducted by trained instructors and offered in existing public spaces.[115]

The PA classes have been identified as a promising and innovative approach for promoting PA at the community-level.[47,40] Promising, given their rapid expansion in the Americas,[48] their sustainability in practice, and their ability to reach inactive populations including women, vulnerable socioeconomic groups, and those with limited access to recreational facilities.[48,116] Innovative due to their unique utilization of social support strategies and public infrastructure.[48] The infusion of PA programing in parks, including PA classes, has been identified as a scalable intervention with significant potential to promote leisure time PA in adults.[117]

One of the best known PA classes programs is the Recreovia in Bogota, Colombia. The Recreovia was initiated in 1995 by the Federal District of Bogotá Institute for Sports and

Recreation (IDRD). It provides free PA classes in public spaces (parks, plazas, streets, malls, and community centers).[118] The classes feature music, are conducted by trained instructors, and are offered every day of the week and on holidays. [118] The Recreovia is currently offered at 41 hubs in 95% of the city's districts (75% in low-middle income neighborhoods).[118] In 2015, the estimated participation in the program was 641,956.[118] Cross-sectional studies suggest that women who participate in the PA classes report more vigorous PA than non-participants.[119]

PA classes hold promise for improving social equity as well as increasing PA.[120, 121,48] However, published evaluation of PA classes are limited to cross-sectional studies from Brazil.[116, 120-122] While PA classes are promising, further studies are required to provide evidence on their effectiveness for increasing PA and improving equity.[40,48] The purpose of this study is to assess the effectiveness of the Recreovia program in increasing PA among users of nine parks in Bogota, Colombia. This study is a natural experiment in which individuals in the "intervention" group are community residents and park users exposed to newly implemented Recreovia programs in parks near their homes.

Methods

Data were collected in Bogota, Colombia between July 2013 and September 2015. Bogota has a population of 7,940,120 [123] and has very high levels of socioeconomic inequality.[124] Women and lower income residents in Bogota have disproportionally high prevalence of overweight[125] and physical inactivity in leisure-time.[125, 126]

Park Selection

The study was a natural experiment conducted in 9 public parks. Parks were classified into three groups: Group 1 were parks implementing new Recreovias in 2013 (n=3). Group 2

were control parks (n=3) without Recreovias. Control parks were selected randomly from a list of parks previously matched by SES, size, type of park, and potential PA target areas. Group 3 consisted of parks with existing Recreovías of at least 12 years duration (n=3) in order to provide perspective on the longer term effects on health and behavioral factors.

Study participants

Eligible participants were adults aged 18 and above, residents of the city of Bogotá, who reported no cognitive impairment, agreed to participate in the study, and reported not having participated in a Recreovia in the past 6-months (for the new Recreovia and control groups). In the new Recreovia and control groups, subjects were selected systematically from three settings: parks (60%), households within a radius of 500 meters around the park (22%), and community groups (18%). Parks were divided into a number of target segments and every fourth adult passerby was invited to participate. For the households every fourth household within a radius of 500 meters around the park was selected, moving in a clockwise direction. Every fourth subject in each of the selected households was recruited for the study if the inclusion criteria was met. For the community groups, individuals were recruited during their weekly meetings by inviting every fourth attendee, moving in a clockwise direction. Participants from the existing Recreovías were approached during the Sunday classes, and every fourth person was selected.

Exposure to the Recreovia (natural intervention)

Individuals from the parks with new Recreovias were newly exposed to the PA classes. The exposure consisted of free PA classes offered at a nearby park, led by trained PA instructors. The instructors offered 45-minute PA classes, every Sunday from 8:00 am to 12:00 pm. Individuals from parks with new Recreovias were only informed and invited to participate in the

classes, either by phone or email, and personally during data collection. However, participation in the Recreovia was voluntary, and not required to participate in the study. This design was selected to increase external validity by maintaining the normal conditions for participation in the Recreovia.

Measurement

At baseline, all participants (N=1533) completed a questionnaire and body mass index (BMI) was computed from direct weight and height measurements. Follow up occurred 6-8 months after implementation of the three new Recreovías. and only in the new Recreovias and control groups (N=1032). A random subsample of 396 subjects was selected to wear an accelerometer as follows: 66 individuals at each of the three parks with new Recreovias (total=198), 33 participants from each of the control parks (total=99), and 33 from each of the parks existing Recreovia (total=99).

The 65 item questionnaire was administered by trained interviewers. Questions included: (1) characteristics of participation in the Recreovia program (type of classes attended, frequency of attendance (at least 1 day /year to once/more days per week), time attending the Recreovia (ranging from less than 3 months to more than 2 years), transportation used to the Recreovia (walking, cycling/skating, public transportation, or motorized vehicle), and travel time to Recreovia (minutes); (2) self-reported PA; and (3) sociodemographic information.

Primary outcome measures. ***Self-reported leisure time PA (LTPA).*** Only the LTPA section only of the International Physical Activity Questionnaire (IPAQ) was used in this analysis since the focus was on LTPA in the Recreovia.[127] We used a continuous score of total weekly minutes of leisure-time-moderate-to-vigorous PA (MVPA) including walking (by adding

total minutes of moderate-PA + vigorous-PA + walking), and total minutes of MVPA per week excluding walking (total minutes of moderate + vigorous PA). We also classified individuals as meeting the PA recommendation in leisure time (those who accumulated 150 minutes or more of moderate-intensity PA , or 75-minutes for vigorous-intensity-PA per week excluding walking in bouts of at least 10 minutes each time) and not meeting the PA recommendation (those who did not accumulated 150 minutes of moderate or 75 minutes of vigorous PA per week excluding walking for leisure), based on the PA guidelines for Americans.[128]

Accelerometer-based PA. PA was measured objectively using Actigraph GT3X accelerometers. Participants were instructed to wear the monitors for seven days at all times, during waking hours, on the right hip. Accelerometers were programed to record 60-second epochs (i.e., counts per minute). Participants were trained at home on the use of the accelerometer and received two phone calls during the week to ensure protocol compliance. After 8 days, research assistants visited each participant to validate wear time. When valid time was not completed, participants were asked to wear the accelerometer for 7 additional days. Valid wear time was defined as four or more days with at least 10 hours per day, and had to include one valid Sunday. Data were scored using Freedson's counts thresholds for adults.[129] Data was processed with R software 3.2.3 using a previously described methodology.[130]

Minutes of MVPA were calculated for the entire week and for the weekend only. MVPA within bouts of at least 10 minutes was calculated for Sunday (the day in which the Recreovia program is implemented). Bouts were defined as continuous MVPA, having a minimum duration of 10 minutes, with a maximum break-time below the MVPA threshold of 20% of the total bout length (maximum of 2-minutes per individual break).[130]

Fixed effects. The fixed effects in the models included: (1) Sociodemographic characteristics: gender, age group (18-24 years, 25-60 years, or ≥ 60 years), occupation (not remunerated, remunerated), education (less than middle school, high school, bachelor's and above), marital status (single, widowed, or divorced; married or living with a partner) car/motorcycle in the household (yes, no), and socioeconomic status (SES). SES was assessed with a standardized scale used in Bogotá to classify neighborhoods on the basis of income, location, surrounding areas, and urban characteristics. The scale ranges from 1 to 6 and is classified as follows: low SES (categories 1 and 2), low-to-middle (3), middle-to high (4), and high SES (5-6). [131] (2) Objectively measured distance from household to Recreovia (Geocoded distance using ArcGIS 9.3 (ESRI Inc); and (3) intervention group status (parks where the program was implemented and control parks).

Random effects. A variable to identify each of the 9 parks (park ID) was included as a random effect to account for within-subject correlation among participants in each park given the multilevel structure of the data.

Data Analysis. First, descriptive analyses were conducted on the socioeconomic characteristics and the baseline physical activity outcomes of participants stratified by the three groups of parks. The new Recreovias and control groups were sub-stratified into those who continued in the study on T2 and those who only participated at baseline. The group of new Recreovia was also separately sub-stratified into those who reported starting participating in Recreovia and those who did not 6 months after the intervention started. Second, the median differences (pre-post) and interquartile range (IQR) of the self-reported and objectively measured PA outcomes, were calculated and compared using the Wilcoxon Signed Rank Test. This nonparametric statistical test was used due to the skew of the distribution of the differences.

Frequency statistics on the characteristics of participation among Recreovia users were also computed and compared between new and existing Recreovia users using the Pearson χ^2 test. Third, two general linear mixed models[132,133] were developed to assess the effects of the Recreovia program on self-reported PA, using the difference on MVPA in leisure time excluding walking for leisure as the dependent variable. The first was a bivariate and the second a multivariable model, respectively. Both models included park ID as a random effect. The level of significance was set a priori at α=.05. The intraclass correlation coefficient was calculated at level 2. Analysis were conducted using SAS version 9.2 software (SAS Institute Inc, Cary, NC).

Results

Participation

A total of 1533 participants were enrolled in the study: 501 for the cross-sectional evaluation of the existing Recreovias and 1032 participants for the pre-post study (509 at the new Recreovias and 523 at the control parks). Of those enrolled for the pre-post study, 74% continued in the study from the new Recreovias and 72% from the control parks. Of the accelerometer subsample, 37% from the new Recreovias and 36% from the control parks continued in the study through T2. Of the 509 participants enrolled in the parks with new Recreovias, 23% participated in the program, and of those new participants, 22 (18%) wore accelerometers and provided valid data.

Sociodemographic characteristics and Body Mass Index

As shown in table 1, participants from the new Recreovias and control parks were similar in their sociodemographic characteristics: Over 60% were age 25-to-60 and female,

approximately 60% lived in a low SES community (SES categories 1-2) and had lower educational attainment (high school or less), and 97% reported not having a car /motorcycle at home. Participants from the existing Recreovias were more likely to live in low-middle SES (47%) and middle-to-high SES (9%), to report a higher educational attainment (54% bachelor's/above), and to report having a car/motorcycle at home (37%). Participants who did not continue on the study were more likely to live further away from the park (2.5 km mean distance), compared to those who continued on the study (1.5 mean distance). The majority of participants (65% in the new Recreovias and 59% in the control parks) were overweight or obese; including those from the new Recreovias who started participating in the program (65% were overweight/obese). In contrast, participants from the group of existing Recreovias were less likely to be overweight (near 50% had normal weight).

Baseline Physical Activity

Participants who continued in the study through T2 had higher PA levels at baseline, compared to those who did not continue. Users from existing Recreovias had significantly higher vigorous activity measured objectively (16 minutes a week +/- 40) compared to new users (5 minutes +/- 16), P=0.003. Existing Recreovia users were also more active on the weekend (79 minutes of MVPA +/- 49) and on Sunday (20 minutes of MVPA in bouts), compared to new users at baseline (45 minutes of MVPA +/-33, and 6 minutes of MVPA in bouts), p=0.005 and p=0.007, respectively. Users from existing Recreovias also had higher self-reported and accelerometer-measured activity compared to participants from control parks, however this difference was not significant. (Table1). The users from existing Recreovias were significantly more active in all the accelerometer measures including vigorous activity, when compared to the parks with no Recreovia at baseline (new Recreovias and control groups grouped together) (Data not shown).

Differences in Physical Activity Outcomes

Overall, there was no differences relative to baseline for self-reported PA for participants in the new Recreovias (median difference 0, IQR-140, 140), nor for those in the control parks (median difference 0, IQR-140, 100), 6 months after implementation of the new classes (Table 2). By contrast, individuals from the parks with new Recreovias who started participating in the program had a median increase in total minutes of self-reported MVPA excluding walking of 15 minutes (IQR -180, 120) and a median increase including walking of 30 minutes (IQR -180, 180), compared to non-participants whom had a median difference of 0, IQR -120, 63 (excluding walking), and a median decrease of 90 minutes (IQR -120, 210) including walking for leisure. Yet, the differences between groups were not significant.

We found no statistically significant differences on accelerometer measures (Table 2).

Multilevel Associations with MVPA for new Recreovias and control parks

Results of bivariate and multivariable general linear mixed models are shown on Table 3. We failed to find statistically significant fixed effects, except for marital status. Being single, widowed, or divorced was significantly associated with a greater increase in minutes of self-reported MVPA (median difference -71, CI -138.69, -3.11), compared to being married/living with partner. This association was no longer significant in the adjusted model. However, having a non-remunerated occupation became significantly associated with lower self-reported MVPA on the adjusted model (median difference 103.9, CI 30.96, 176.85). No park-level effect was found when considering the random effect for parks. For that reason, we did not develop additional models with park-level variables.

Characteristics of participation: New vs. existing Recreovia users

Significant differences were found in the characteristics of participation between new and existing Recreovia users (Appendix 1). Most users (80%) of new Recreovias reported participating in the program for more than 3-months and engaged in cardiovascular classes (aerobics/dance), and almost all (97%) reported walking to the Recreovia. Additionally, 29% reported attending the Recreovia weekly and 43% attending the Ciclovia monthly. The majority of users of existing Recreovias (64%) reported having participated in the classes for over 6 months and of those, 40% had participated for more than 2 years. Most of them reported weekly attendance (71%), engaging in cardiovascular classes (84%), and walking (73%) or cycling/public transport (18%) to the classes. One out of four users from existing and new Recreovias indicated they would have been at home indoors, watching TV, or using the computer if the program was not offered on Sundays.

Discussion

Our study is the first in the 20 years of the Bogota program to assess whether LTPA is increased by the Recreovia. We found a pattern of increased self-reported PA after 6-months of program implementation for new Recreovia users compared to non-users in the intervention group, however this pattern was not significant. We found no changes on PA comparing the overall intervention and control groups.

In the cross-sectional analysis we found that users of existing Recreovias were significantly more active, measured objectively, specifically during the weekend and on Sunday (day in which most people attend the Recreovias) and were significantly less likely to be overweight/obese compared to new Recreovia users. Moreover, a high proportion of users from the existing Recreovias had participated regularly in the program for more than 2 years, indicating high levels of adherence

to the program. Long-term adherence to PA programs has been associated with greater health benefits including fitness, quality of life and disease prevention.[134] The existing Recreovias are well institutionalized,[135] and their inclusion in the study was crucial for reflecting the history and sustainability of the program. [136, 137]

These findings suggest that despite the lack of significant effects after 6 months of implementation, the Recreovia might play an important role in increasing MVPA. Our results indicated that 65% of the new Recreovia users were overweight/obese, suggesting this program can reach a population that has traditionally shown low participation and adherence to PA programs.[138, 139, 140] Such impact may be more likely to occur after the program becomes fully implemented as an "accepted practice" in the community in 2 to 4 years.[141] A 6-month study period may be insufficient for assessing changes in PA, BMI or other health outcomes.[142,143]

We hypothesize that significant improvements in MVPA and BMI might be observed among users in the parks with new Recreovias once the program is well accepted for two reasons: (1) Our results showed a high level of community penetration of the program with 23% of individuals from the parks with new Recreovias choosing to participate. Program reach or penetration is one of the most challenging issues for community-based physical activity interventions; [120, 144, 145 122] From a public health perspective having such strong reach for a community-based intervention without implementing any additional outreach activity is remarkable. (2) The higher levels of accelerometer-measured MPVA among users from existing Recreovias. Research has associated higher MVPA with important health benefits including healthier weight.[1, 146,147] Furthermore, it is possible that the weekly participation observed among most users of existing Recreovias and 29% of new users, in mostly cardiovascular exercise, represents an important contribution towards the accumulation of MVPA per week to

meet the PA guidelines to obtain health benefits.[128] Previous studies found that PA classes were associated with increased LTPA at the communities where it was implemented.[120, 121, 148] Recreovia could also contribute to decreasing sedentary time when the classes are offered, since 1 out of 4 participants indicated they would not be active elsewhere if they did not attend the program.

The Recreovia may have additional public health and social repercussions beyond PA, that are relevant for cities such as Bogota with marked inequity. Recreovia directly impacts LTPA, which has been associated with improved mental health, quality of life, and social capital in communities.[149, 150, 151] Previous studies show low levels of LTPA in Bogota, especially among vulnerable populations including the poor, women, and people with less education.[125, 149] Our findings indicate that most of the Recreovia users were lower SES and less educated women, from households without a motorized vehicle. Previous studies also found that PA-classes programs provide opportunities for PA in disadvantaged populations in Latin America.[115,116] Thus, the Recreovia program may be well suited for cities like Bogota, characterized by high levels of insecurity and socioeconomic inequalities.[152, 153, 154] In fact, the new Recreovias were implemented in communities with high poverty, violence, and insecurity,[152] providing access and opportunities for these vulnerable communities to engage in LTPA. These findings suggest that Recreovia can buffer social inequalities as has been found in other community-based programs in public spaces such as the Ciclovia.[155] The substantial participation of women suggests that this program can also contribute to decreasing gender disparities in the participation in LTPA.[155, 156] Finally, our results show that Recreovia can reach young and older adults with the same programming and infrastructure, providing the benefits of LTPA to a wide range of age groups in the city.

Limitations

Several limitations are present in this study. These limitations include: (1) a small sample size for the accelerometer subsample, leaving the study possibly under-powered to detect changes in PA. The lack of adequate objective PA data led to a reliance on self-reported data which is subject to misclassification bias. Previous studies show that IPAQ may not be sufficiently sensitive for detecting changes in PA, is subject to recall bias, and over-reporting.[157, 158] Nonetheless, IPAQ has been extensively used for population-based studies worldwide and in Latin America with acceptable validity and reliability, compared to other valid self-report measures.[159,160,120] (2) Our sample may have been subject to selection bias, limiting the generalizability of our findings for the following reasons (a) the higher level of baseline PA observed among participants who continued in the study to T2 compared to those who did not continue in the study, (b) most (78%) of our sample was recruited at parks or community groups, which make them more likely to be active before the study, and (c) significant loss to follow-up (27%). (3) the short follow-up period of 6 months may be insufficient for a community-based program to become established and lead to changes in PA.[142, 141, 143]

The limitations noted should be considered in the context of natural experiments, which must contend with inherently messy, complex, real-world conditions, that provide challenges for evaluation.[142] These "trade-offs" between maximizing internal validity while also trying to have substantive relevance have been documented before. [136,142]

Strengths of this study include that it is the first to assess the effectiveness of PA classes in public spaces for PA in Latin America with a strong study design that included pre and post data with multiple comparison groups. [70] The study also had a multilevel design that accounted for

park-level clustering effects. Objective measures of weight, height and physical activity were used in addition to self-report. Our study has a high level of external validity since we assessed a real-world intervention conducted in actual community settings, and preserved the real conditions in which the program was implemented. No incentives were provided to participants, and there were no additional strategies to increase participation and adherence to the Recreovia. The high external validity contributes to bridging the gap between research and practice, [70] making these results relevant for practitioners and development of future policies. Nonetheless it also generates significant internal validity issues that could be addressed in the design of future studies of community PA classes.

Recommendations for future studies on PA classes in public spaces

Future studies should increase the follow-up period to a minimum of one year and strengthen efforts to increase participation from inactive individuals. This will require a collaborative approach with the program administrators (IDRD) who could expand recruitment efforts to reach a broader community audience.[143] Additional strategies such as the provision of incentives, or behavioral approaches such as creation of "buddy systems" for social support, individual goal setting, or behavioral reinforcement through text messaging or newsletters could be implemented.[110] These strategies could also be useful to decrease the loss-to-follow up, nonetheless. Other studies on PA classes in Latin America have shown that more diverse participation may be accomplished by implementing broader strategies that are complementary to the PA classes such as educational strategies and policy and environmental changes.[120] Future studies should also attempt to increase the sample size for the objective measurement of PA and implement strategies to increase protocol compliance, for instance by using new devices that can be used 24/7 without having to be removed. Finally, future studies should explore other forms of

PA promoted by the PA classes including transportation-PA considering that most Recreovia participants reported walking to the classes.

Conclusions

The Recreovia is a promising program for increasing LTPA, especially among women, low-income, less educated populations, and the overweight and obese. Given the high penetration of this program and its focus on leisure and recreation in public spaces, Recreovia may also contribute to equity in Bogotá by providing better public services to disadvantaged communities.

Figure 1. Study flow chart

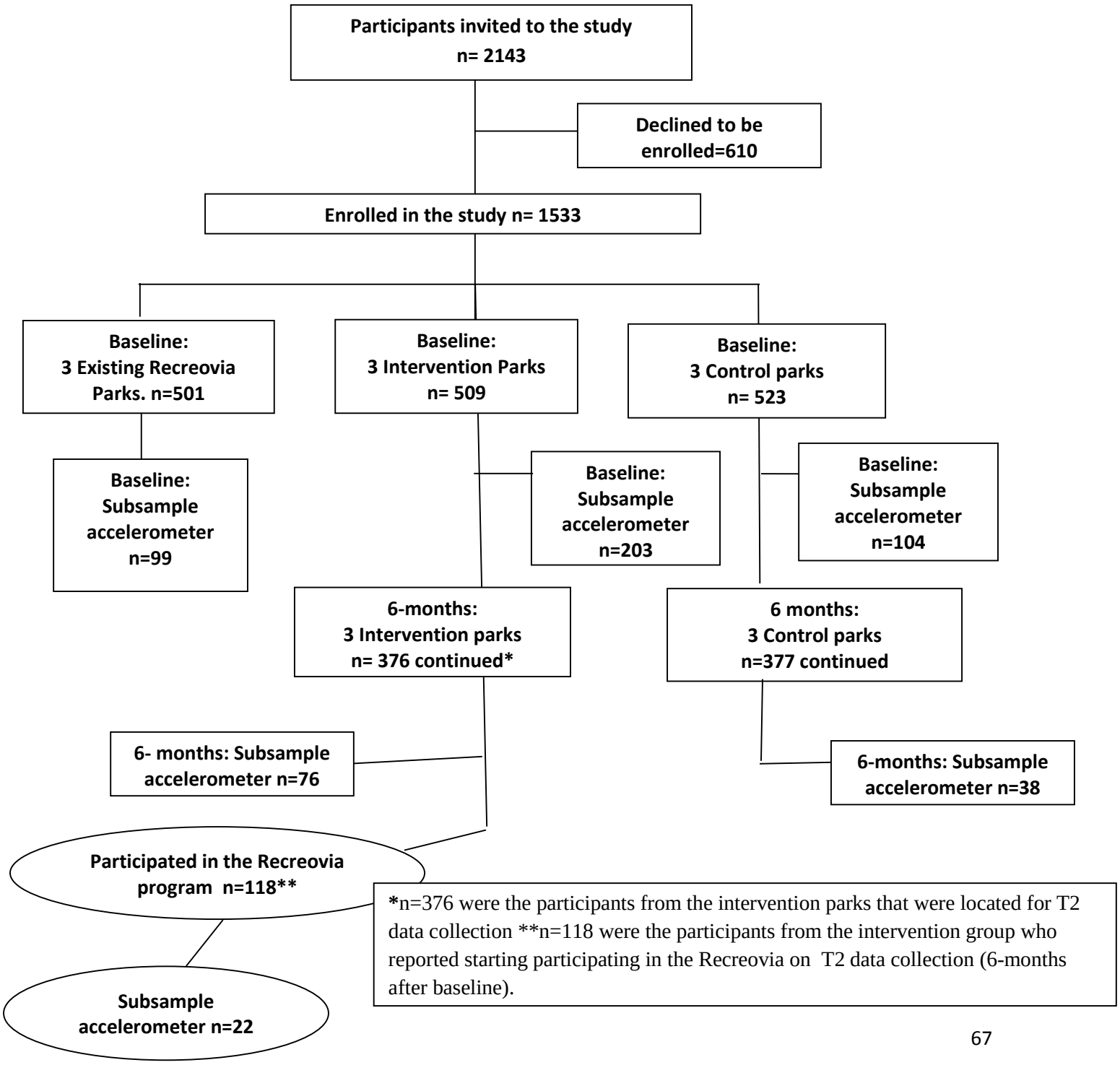

Table 1. Sociodemographic and baseline physical activity characteristics of study participants from communities with new Recreovia parks, control parks, and parks with existing Recreovias (with 10 to 20 years of implementation).

Variable		New Recreovias				Control		Existing Recreovias
		Continued in the Study to T2[c]	T1[c] only	New-Recreovia users	Non-users	Continued in the Study to T2[c]	T1[c] only	Recreovia users
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Age group	**18-24**	23 (6)	35 (27)	3 (3)	14 (8)	59 (15)	35 (24)	93 (19)
	25-60	267 (71)	85 (64)	92 (78)	105 (61)	225 (60)	100 (68)	381 (76)
	>=61	87 (23)	12 (9)	23 (19)	53 (31)	93 (25)	11 (8)	27 (5)
Sex	**male**	79 (21)	43 (33)	23 (19)	41 (24)	131 (35)	61 (42)	137(27)
	female	298 (79)	89 (67)	95 (81)	131 (76)	246 (65)	85 (58)	364(73)
SES[a]	**1 & 2**	249 (66)	80 (60)	91 (77)	72 (42)	223(59)	67 (46)	222 (44)
	3	126 (33)	51 (39)	27 (23)	98 (57)	154 (41)	78 (53)	235 (47)
	4&5	2 (1)	1 (2)	0	2 (1)	0	1 (1)	44 (9)

Education	**less than middle school**	87 (23)	21 (16)	21 (18)	37 (21)	114 (30)	22 (15)	43(9)
	High-school	149 (40)	63 (48)	46 (39)	67 (39)	147 (39)	63 (43)	187(37)
	bachelor's- above	141 (37)	48 (36)	51 (43)	68 (40)	116 (31)	61 (42)	271(54)
Marital Status	**single widow divorced separate**	148 (39)	59 (45)	42 (36)	66 (38)	162 (43)	70 (48)	273 (55)
	married living with partner	229 (61)	73 (55)	76 (64)	106 (62)	215 (57)	76 (52)	228 (45)
Occupation[b]	**Not remunerated**	183 (49)	51 (39)	51 (44)	88 (51)	166 (44)	52 (36)	130 (26)
	Remunerated	194 (51)	79 (61)	67 (57)	84 (49)	211 (56)	94 (64)	371 (54)
Car/motorcycle in the household	**Yes**	9 (1)	6 (5)	2 (2)	5 (3)	13 (3)	5 (3)	185 (37)
	No	368 (99)	126 (95)	116 (98)	167 (97)	364 (97)	141 (97)	316 (63)
Distance home-park	**Mean Distance in Km**	1.5 (2.4)[†]	2.5 (4.8)[†]	1.6 (2.3)[†]	1.4 (2.1)[†]	1 (1.6)[†]	1.7 (3.7)[†]	3.1 (1.9)[†]
BMI **Kg/m²**	**Underweight-normal**	126 (33)	53 (40)	41 (35)[**]	84 (33)	142 (38)	70 (48)	247 (49)[**]
	Overweight	153 (41)	56 (43)	46 (39)[**]	106 (41)	168 (45)	49 (34)	180 (36)[**]
	Obese	98 (26)	23 (17)	31 (26)[**]	67 (26)	67 (18)	26 (18)	74 (15)[**]
		Baseline Physical Activity						
Accelerometer	**MVPA/week**	276 (194)[†]	216 (167)[†]	271 (164)[†]	235 (206)[†]	246 (163)[†]	225 (188)[†]	305 (189)[†]

	VPA/week	8 (22) †	5 (18) †	5 (16) † **	8 (28) †	6 (17) †	8 (35) †	16 (40) † **
	MVPA/weekend	56 (54) †	46 (42) †	45 (33) † **	52 (57) †	55 (58) †	48 (47) †	79 (67) † **
	Bouted MVPA Sunday	11 (20) †	8 (19) †	6 (13) † **	9 (18) †	9 (21) †	8 (15) †	20 (37) † **
Self-report	**Total minutes of LTPA excluding walking**	278 (247) †	264 (319) †	245 (212) †	268 (269) †	228 (240) †	189 (171) †	274 (360) †
	Meeting PA Guidelines in LT Excluding Walking for leisure	147 (65)	78 (35)	43 (61)	85 (70)	145 (57)	50 (70)	203 (59)

† mean (SD), otherwise N (%).

** p< 0.05 comparing new vs. existing Recreovia participants (median differences (pre-post) and interquartile range (IQR) were calculated and then compared using the Wilcoxon Signed Rank Test.

[a]SES categories: 1&2 (low), 3 (low-middle), 4-5 (middle-to-high)

[b]Occupation: Not remunerated (unemployed, student, or unpaid family worker), remunerated (employee, employer, own-account worker)

[c] T1 refers to all measures taken at baseline and T2 to all measures taken 6-months after the beginning of the program at the communities with new Recreovias.

Table 2. Differences (Pre- Post) on Physical Activity Outcomes among all participants and among the accelerometer subsample

Data given as Median Difference and IQR 25th-75th

Self-reported physical activity on leisure time						
Variable	**New Recreovias**	**Control**	**p**	**users of new Recreovias**	**Non-users of new Recreovias**	**p**
Total Minutes MVPA Excluding walking	0 (-140, 140)	0 (-140,100)	0.653	-15 (-180, 120)	0 (-120, 180)	0.426
Total Minutes MVPA including walking	0 (-150, 180)	0 (-180, 120)	0.04	-30 (-180, 180)	90 (-120, 210)	0.068
Participants from the accelerometer subsample only						
	New Recreovias (n=75)	**Control (n=36)**	**p**	**Recreovia users (n=22)**	**Non-users of Recreovia (n=35)**	**p**
Total Minutes MVPA	-16 (-142, 63))	-44 (-116-35)	0.87	11 (-119, 98)	-11 (-102, 63)	0.58
MVPA/weekend	-8 (-43, 21)	-20 (-37, 17)	0.54	-3 (-24, 10))	5 (-43, 38)	0.48
Bouted MVPA Sunday	0 (-13, 8)	0 (-17, 0)	0.27	0 (-10, 0)	0 (-17, 9)	0.76

Table 3. General Linear Mixed Model of the Difference on Self-Reported Total Minutes Per Week of Moderate-to-Vigorous Physical Activity (Excluding walking) with Sociodemographic Variables among study participants from communities in the parks with new Recreovias and Control Parks. †

Independent variable		Bivariate			Multivariable		
		Estimate	**95% CI**	**p value**	**Estimate**	**95% CI**	**p value**
Intervention group	Control vs. parks with new Recreovias	14.78	(-52.56, 82.13)	0.666	12.18	(-57.11, 81.48)	0.72
Age	18-24	36.24	(-86.22, 158.55)	0.19			
	25-60	-51.13	(-125, 22)				
	>=61						
Sex	Male	35.04	(-35, 105)	0.32	-5.45	(-81.37, 70.46)	0.88
	Female						
Education	none-primary	8.73	(-78, 95.54)	0.31			
	High-school	-49.15	(-128.5, 30,2)				
	bachelor's-postgraduate degree						
Occupation	unemployed or unpaid family worker, student	-51.2	(-108.2, 5.8)	0.07	103.91	(30.96, 176.85)	0.005
	Employee, employer, own-account worker						

SES**	1 & 2	-0.49	(-67.28, 66.71)	0.98	26.75	(-42.05, 95.57)	0.44
	3, 4 & 5						
Marital Status	Single widow divorced separated	-70.9	(-138.69, -3.11)	0.04	-58.67	(-126.53, 9.18)	0.08
	Married/living with partner						
Distance home-park	Measured in Km.	-14.01	(-33.51, 5.48)	0.13	-13.59	(-33.52, 6.34)	0.18

**SES categories were combined for modeling purposes; however, they are described in three categories on table 1 for conceptual purposes.
† Models include park as random effect.

Appendix 1. Characteristics of participation in the PA-classes among study participants from communities with the new and existing Recreovias.

Variables	New Users, No. (%) n=118	Existing Users, No. (%) n=501	P*
Time participating at the Recreovia			
less than 3 months	24(20)	47(9)	<0.0001
3-6 months	36(31)	133(26)	
6 months - 2 years	58(49)	119(24)	
more than 2 years	0	201(40)	
Frequency of attendance			
At least 1 day /year	11(9)	11 (2.41)	<0.0001
1-2 days per month	73(62)	120 (26.26)	
1 or more days per week	34 (29)	324 (70,90)	
Type of class attended			
Psychophysics/maintenance Gymnastics	14 (12)	29(6)	0.8820
Joint movement	2(2)	28 (6)	
Force stimulation	2(2)	25 (5)	
Folk Dance	8(7)	120 (24)	
Aerobics	85(73)	269(54)	
Rythmic activities for kids	6(5)	30(6)	
Time traveled to the Recreovia (minutes)			
0-10	75 (64,10)	195 (39)	<0.0001
11-15	12 (10,26)	85 (17)	
16-30	28 (23,93)	143 (29)	

31-120	2 (1,71)	74 (15)	
Transport used to the Recreovia			
Walking	111 (97,37)	368 (73)	<0.0001
Bicycling/skating	0	52 (10)	
Public transportation	0	42 (8)	
Motorized vehicle	2(2)	21 (4)	
Other	1 (0.88)	18 (4)	
Participates in the Ciclovia			
No	45(38.14)	166 (33.13)	0.2435
At last once a year	22(18.64)	90 (17.96)	
> 1 time per month	51 (43.22)	245 (48.90)	
Alternative activity [a]			
Indoors/TV/computer	28 (25)	121 (25)	
Other physical activity	90 (75)	377 (75)	

[a]Survey question "What would you do if the Recreovia classes did not exist"
*Chi-square test was conducted.

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Chapter 4

Academia Fit: An examination of the translation and transferability of a PA-classes program to increase physical activity among Latinos in San Diego, California.

Introduction

Leisure-time physical activity (LTPA) improves health outcomes including all-cause mortality and coronary heart disease[34,33,161] LTPA has also been associated with additional health and psychosocial benefits including improved mental health[35] and quality of life,[35] and increased social interactions, support, and cohesion.[36,37]Unfortunately, ethnic minorities in the US including Hispanics, do not accumulate enough physical activity (PA), particularly LTPA to obtain health benefits.[15] Hispanics and women in particular, have the highest level of self-reported inactivity during leisure time (39%) among all ethnic groups.[15,20] Although recent studies have found Hispanics to be the most active ethnic group when PA is assessed with accelerometers, [21,22,23] most of this high activity has been attributed to light-intensity occupational PA and not to LTPA.[23] Light intensity occupational PA may be associated with less sedentary time and could therefore provide some health benefits, but it might not represent sufficient intensity to increase cardiorespiratory fitness (CRF).[23]

The expanding evidence on the importance of PA for public health has been accompanied by public health efforts to increase PA in whole populations through the dissemination and implementation of community-based interventions.[38,162,40] As a result, more research has focused on assessing the efficacy of these interventions in increasing PA. However, the same emphasis has not been placed in documenting elements of external validity including adoption, implementation, maintenance, and translation of community interventions.[163,71] Lack of research

on external validity elements affects the generalizability of these interventions and their relevance for real practice and policy.[19] Scholars have emphasized the need to document dissemination outcomes, especially implementation and translation efforts, to inform the applicability of interventions in new contexts (e.g., countries, and regions).[71] Implementation outcomes, for instance reach, adoption, and feasibility, contextualize traditional individual-level effectiveness outcomes and improve the translation from research to practice.[71]

Recommendations from the Guide to Community Preventive Services (Community Guide), include (a) the implementation of strategies that provide social support in community settings and (b) creation of or enhanced access to places for PA as effective interventions to increase PA in populations.[39] Physical activity classes in community settings (PA classes) have been identified as a promising intervention in Latin America and may have potential to increase PA in Latino communities in the US.[47] PA classes incorporate social support through group-based classes and enhanced access to LTPA through the addition of classes programing in public spaces.[48]

PA classes are free classes conducted by trained instructors offered in existing public spaces such as parks, community centers, and shopping centers.[48] One of the most widely recognized PA-classes programs is the Academia da Cidade program (ACP), implemented in the city of Recife, in Brazil.[53] ACP is a government-funded program offering free PA classes, nutrition education, and health monitoring (i.e., blood pressure measurements, anthropometric and nutrition assessments) in 21 public spaces (parks, beaches, and recreation centers) in the city.[53] Classes are conducted by physical education teachers every day of the week in one-hour sessions.[53] The ACP has expanded across Brazil, and has also served as a model for a national program.[164]

Recent studies have found PA classes programs in Latin America such as the Recreovia from Bogota, Colombia and the ACP in Brazil to be associated with increased LTPA among vulnerable populations (e.g., women and low-income individuals).[53,54,165] Consequently, PA classes have expanded rapidly in Latin America and have also reached the US, [65-57] suggesting they may provide a culturally adapted PA intervention for Latinos in the US. Thus, PA classes represent a unique opportunity to examine and document the translation, implementation, and transferability of community-based programs in public spaces from Latin America into Latino communities in the US. The need to adapt community-based interventions to increase LTPA while providing accessible facilities, multilingual staff, and culturally sensitive activities specifically targeting Hispanics living in the US has been recognized.[20,166]

To our knowledge, no studies have assessed the translation of population-based PA classes programs from Latin America to the US. For the purpose of this study, *translation* is defined as the adaptation and integration of an intervention to suit the needs of a new setting.[167] *Transferability* is defined as "the extent to which the measured effectiveness of an applicable intervention could be achieved in another setting."[66]

The purpose of the proposed study is to document the translation, implementation, and transferability of the Academia Fit program for Latino communities in San Diego, California, US, using the RE-AIM framework. The RE-AIM provides a conceptual model to guide intervention research through a balanced approach that incorporates internal and external validity aspects.[71,73] From the practice viewpoint the RE-AIM informs program adoption and implementation decisions.[168,169] The RE-AIM framework has been previously used in the evaluation of community-based PA interventions, [170,171] specifically on LTPA-enhancing interventions,[172] and on PA interventions for Latinas living in the US.[173] RE-AIM

conceptualizes the impact of an intervention as a function of five factors: *reach* (percentage and characteristics of persons receiving a program),[73] *effectiveness* (impact of an intervention on specific outcomes, including potential negative effects),[174] *adoption* (proportion of settings and intervention agents willing to initiate a program)[175], *implementation* (extent to which a program is delivered as intended),[73] and *maintenance* (extent to which a program is sustained over time at the individual and organizational levels).

Methods

A secondary analysis was conducted using data collected from the "Academia Fit (AF)" program by researchers in the School of Public Health at San Diego State University (SDSU). The AF was a three-year translation study (October 2009 – Sept 2012) funded by the Centers for Disease Control and Prevention (CDC). The primary purpose of the study was to adapt, implement, and integrate AF to the target communities using the ACP model from Brazil. The study also aimed to determine implementation factors that help or hinder the program's success in the new communities. The original program was modified to better meet the needs and resources of the target communities.

Setting

AF was implemented in four communities located along the US-Mexico border in Southern San Diego, CA including National City, Chula Vista, Imperial Beach, and San Ysidro. The estimated 2010 aggregate population of these four communities was 358,250 [176] residents, with Latinos encompassing 66% of the population.[176]

Intervention

The AF is a PA classes program adapted from the ACP. The classes consisted of free 60-minute group fitness classes, implemented from Monday to Friday at public venues identified across the 4 target communities, and taught by Spanish-speaking community members (*promotores*), who were trained and nationally certified as group-fitness instructors (GFIs). Classes included yoga, pilates, dance, fully body (a mix of aerobics and Latin music), Zumba, running, and boot camp. The GFIs signed a volunteer behavioral contract committing to implement the AF classes during a one- year time-frame. Nonetheless, the program was intended to be sustainable for a two- year period.

The goals of the translation of the AF included: (1) Identification and recruitment of public venues; (2) recruitment and training of *promotores* as nationally certified fitness instructors through an established partnership with the American Council on Exercise (ACE®); and (3) Implementation of the free PA classes at the respective venues. It is important to underscore that enrollment of public venues and certification of GFIs were continuous and ongoing over the first year of the AF translation.

Identification and recruitment of public venues. Environmental audits were conducted in 73 public parks and recreation centers using a 21-item checklist assessing sports amenities and other features of park facilities. The audits included a comprehensive description of the environmental characteristics of the venues and their availability for public use. Each public venue was scored on the following categories: features, condition, access, aesthetics, safety and class appropriateness.[177] Each category was scored on a scale of 1 to 3, where 1 indicated a low and 3 indicated a high level of each category (i.e., high access). The scores for each category were summed for a possible range of total scores from 3 (low) to 18 (high) potential for implementing AF.[177] Venues with scores on the top quartile were selected and invited to the AF

implementation. Those that accepted provided a letter of support authorizing the use of the facilities at no cost.

Recruitment and training of community *promotores* as GFIs. *Promotores* from the target communities were recruited from community organizations and through an existing network of *promotores* from the San Diego Prevention Resource Center (SDPRC). Eligible *promotores* were required to be at least 18 years of age, Spanish-language dominant, to have experience conducting or attending PA classes, to have volunteer experience in community-based programs, to have at least a high school level education, and to be interested in working with Latino adults. *Promotores* were trained for 14 weeks to become GFIs certified by the ACE. All study materials were translated to Spanish and culturally adapted. Certified GFIs signed a volunteer behavioral contract committing to recruiting community members to participate in the AF classes, and to teaching two free AF classes per week for one year or 40 weeks. GFIs were given a stipend for purchasing equipment required for class instruction.

Class attendees and effectiveness study participants. Class attendees were recruited by the GFIs at the corresponding venues and surrounding communities. Recruitment was continuous throughout the first year of the AF translation, thus class attendees enrolled at different points of the program's implementation. All the individuals interested in attending the classes were screened using the Physical Activity Readiness Questionnaire (PAR-Q). [178] Those not reporting health risks were allowed to enroll the classes. Of all class attendees, a subsample of *n*=240 individuals was invited to participate in the AF effectiveness study at the end of their first class. Attendees were eligible for the effectiveness study if they were Latinos 18 to 65 years of age, lived within one mile of the class venue, indicated they would remain in the study area for at least 12 months, and agreed to participate in up to four measurement protocols. All class

attendees meeting the inclusion criteria were invited to participate in the study until the desired sample size was achieved.

Measures

Consistent with the recommended use of the RE-AIM framework, measures for the five dimensions were assessed.[179] The effectiveness dimension only included data collected among the effectiveness study subsample, *n*=240, (according to the study's original design). Measures for the remaining 4 dimensions also included data from all the individuals that attended the AF classes, referred to as "class attendees" (from whom only attendance data was collected). The measures and data sources for each RE-AIM dimension are described in Table 1.

Reach was assessed in two ways: (1) reach of the AF classes in the target population and (2) representativeness. Demographic and PA data was only available for the effectiveness study subsample (*n*=240). Thus, such data was used to estimate representativeness of all AF class attendees. Representativeness was determined by comparing socio-demographic and PA characteristics of the subsample against those from the four target communities (Table 1).

Effectiveness. The primary outcome measures were the changes in PA outcomes from baseline (after each participant's first class) through six months after each participant's baseline measure (T2). PA was assessed by self-report and objectively. Self-reported PA was measured using only the LTPA domain of the Global Physical Activity Questionnaire (GPAQ),[180] as the focus of the AF program was on leisure time. Objective PA was measured using Actigraph GT3X accelerometers. Participants wore the monitors on their right hips during waking hours for seven days. Accelerometers were programed to count activity in 60-second epochs (i.e., counts per minute). Valid accelerometer wear time was defined as five or more days with more than 600

minutes per day, or less than five days with 3,000 total minutes or more of wear time. The PA variables assessed are described in Table 1. Data collected from the study subsample also included socio-demographic characteristics measured by questionnaire at baseline and after six months, previous participation in PA group classes, and BMI computed from direct weight and height measurements.

Adoption was assessed at two levels: (1) setting (public venues) and (2) staff (GFIs). (Table 1). The percentage of public venues and GFIs approached that were willing to participate in the AF program was calculated. Participating and nonparticipating venues were also compared regarding quality score.

Measures of *implementation* included, overall implementation indicators, dose of classes per participant, quality and suggestions for program improvement, and fidelity (consistency of implementation during a one-year period) at the setting (public venues) and staff levels (GFIs). The one-year period was individual for each GFI and venue as a result of the continuous enrollment. Implementation indicators are described in Table 1.

Maintenance was assessed by calculating the number of class participants and the proportion of sites and instructors that implemented the AF classes after two years. Overall satisfaction with the program, main barriers for implementation, and suggestions for program improvement were also assessed among GFIs who implemented the classes.

Data Analysis

Data for the representativeness assessment were compared using the Wilcoxon Signed Rank Test, one sample t-test, and $\chi 2$ for goodness of fit test as appropriate. To assess change in PA outcomes, descriptive analyses of the socioeconomic characteristics and the PA outcomes of

subsample participants at T1 and T2 were computed. The median differences (pre-post) and interquartile range (IQR) of the self-reported and objectively measured PA outcomes were also calculated and compared using the Wilcoxon Signed Rank Test. Analyses were conducted using IBM SPSS statistics software version 20.

Results

Reach

A total of 851 individuals enrolled and participated in at least one AF class between November 2010 and October 2013. Of the total classes' attendees, 240 (28%) participated in the effectiveness study subsample. Of those, 239 provided self-reported data and 122 (51%) provided accelerometer data at baseline, and 167 (69%) and 40 (16%) provided self-reported and accelerometer data, respectively, at six months (T2). At T3 (one-year follow-up), only 14 individuals (5%) from the subsample were located. All data from T3 was dropped from the study (Figure 1). The reach (proportion of eligible adults from the target communities that attended the AF classes) was 0.15% (Table 2). The AF subsample was not representative of the four study communities on any of the socio-demographic characteristics (Table 3). The subsample was older (median age of 40), had a significantly greater proportion of women (90%), had a higher education attainment (57% had beyond high school), had higher income (only 30% had household income below poverty level compared to 53% at the target communities), were more likely to be employed (66%), contained a higher proportion of foreign born individuals whom had lived in the US for less than 10 years (57%), were more overweight (35%) and obese (45%), and were significantly more active (61% met the PA guidelines in leisure time at baseline compared to 30% at the target communities).

Effectiveness

There was no improvement on any PA outcome except for a significant decrease in sedentary time (median decrease of 22 minutes/week, IQR -60, 120, from baseline to T2). In contrast, bouts of MVPA decreased significantly (median decrease of 56 minutes/week IQR (-3,128), six months after baseline (which was at different time-points for each participant due to the continuous enrollment). Decreases were also observed in total minutes of continuous MVPA and the proportion of participants meeting the PA guidelines during leisure time, but these changes were not significant (Table 2). When the subsample was stratified by those meeting and not meeting the PA guidelines at baseline, there was a median increase of 7.5 minutes/week, IQR (-86,11), but it was not significant (P=0.07) (Data not shown). The socio-demographic characteristics and BMI of the subsample at baseline and T2 are shown in Table 4.

Adoption

Setting. Of the total venues audited, 23 (31%) were eligible to implement the program based on quality score and site characteristics. Permission to implement the program was obtained from 12 venues out of the 23 selected. Two additional venues were not audited because they were not parks or recreation centers (church and apartment complex, respectively). These two venues were suggested by GFIs who had established relationships with the venues. As a result, there were a total of 14 adopter venues (were willing to initiate the AF classes). The mean quality scores were 13.6 for the non-participating venues (*n*=61) and 16.8 for the adopter venues scored (*n*=12).

Staff. All the trained and certified GFIs (100%) adopted the program.

Implementation

Figure 1. shows the number of active venues, classes implemented, and number of attendees per month throughout the AF implementation. A total of 406 classes (39% of the intended number) were delivered after one year of the program's implementation and 1248 classes (60% of the intended number) during the total implementation period (32 months). On average, 37 classes were delivered per month, (range of 1 to 79 classes delivered). The average number of participants in classes per month during year one was 364 (range of 9 to 234 participants). The average number of classes received by the classes' attendees was 9, and by the subsample participants was 22 over the course of the AF implementation.

Quality. Regarding overall satisfaction with the program, 78% of subsample participants reported being satisfied and 15% reported being dissatisfied with the instructor, while 84% were dissatisfied with the venue. The most frequent suggestions provided for program improvement were greater availability of class times, more convenient venues, and provision of child care.

Setting. One out of two adopter venues implemented the program during a one-year time-frame. Of the 14 adopter venues 10 were active for at least 6 months, and 5 on average delivered classes during a given month (range of 1 to 10). On average, 83 classes were delivered by each site (range of 9 to 234 classes), and only 6 venues implemented more than 83 classes over the 32 months of the AF implementation.

Staff. Eight out of twenty GFIs implemented the program during one year (after teaching their first class). Of the remaining 12, 10 were active between 1 and 6 months. The average number of classes taught per GFI was 125 (range of 1 to 359 classes). The dose intended per GFI was 80 classes in 12 months or 40 weeks (2 per week), for a total of 80 classes per GFI. Of the

adopter GFIs, 30% taught 80 or more classes during time frames ranging from 17 to 29 months. On average 3 GFIs delivered classes during a given month (range of 1 to 6).

Maintenance

Two out of the 14 adopter venues and 3 out of the 20 GFIs implemented the program for two or more years. On average, 367 classes were delivered per month during year two, (range of 77 to 571 monthly classes). Of the 20 adopter GFIs, 11 (55%) responded the satisfaction survey after one year of the program's implementation. Respondents were six females and five males with a mean age of 37.6 (+/- 11.36) years and living at an average distance from the AF venue of 6.23 miles (SD = 5.52) from the AF venue. On average, GFI respondents taught AF classes for 17 months, and the majority (63.6%) were no longer active instructors after the end of their behavioral contract. Most respondents (11 out of 12) were satisfied with the classes, and 7 out of 12 were very dissatisfied with the venues. The most frequently reported challenges of implementation were participant recruitment and inconsistent participation, in addition to limited advertisement of the program. The main reasons for no longer teaching the AF classes were lack of time and acquisition of a paid job.

Discussion

Our results indicate that the translation of a free PA classes program targeting Latino adults, was feasible in the 4 participating communities, located along the US-Mexico border in South San Diego. The 3 primary goals of the AF translation were accomplished: 14 public venues were recruited for the program's implementation, 20 Spanish-speaking *promotores* from the target communities were certified as GFIs by the ACE, and a total of 1248 free PA classes were delivered by the certified GFIs over 32 months, reaching 851 class attendees. However, our

results showed important implementation challenges including low fidelity (i.e., inconsistent class implementation among GFIs and venues) and a limited dose of PA classes received by participants. The intervention program had no observed effect on LTPA among the effectiveness study subsample. Still, the program may hold promise for increasing MVPA among less active, overweight and obese Latino women, who are more likely to be inactive.[20,181] This potential impact is supported by the significant decrease in sedentary time observed among the subsample participants and the observed pattern of increased MVPA among those who did not meet the PA guidelines at baseline (most of whom were overweight and obese women as were the majority of the AF subsample participants). Low dose of classes and recruitment of a highly active sample are two plausible explanations for the lack of effect observed among the subsample participants. However, the methodological limitations of the assessment of PA outcomes do not allow this study to draw conclusions on the effectiveness of AF in increasing PA.

An inconsistency of implementation was evident by wide ranges of classes delivered per public venue (9 to 234) and GFI (1 to 359), high variability in the number of active venues per month (1 to 10), and the low and inconsistent implementation rate by GFIs (with an average of 3 GFIs teaching classes per month). Possible reasons for the substantial drop out rate of instructors include lack of remuneration for teaching the classes, lack of motivation due to difficulties in recruiting and maintaining class attendees, and low satisfaction with the available venues. These issues were reported as the most significant implementation challenges by the GFIs who responded the satisfaction questionnaire. In addition, the distance between participating venues and GFI's homes ranged from 2 to 19.6 miles, which suggests that transportation and time constraints for GFIs could have served as a barrier to consistent implementation. The main reason GFIs reported for no longer teaching AF classes was the acquisition of a paid job.

Established and sustainable PA-classes programs in Latin America (Recreovia and ACP) differ from AF in that GFIs are hired and receive a salary for teaching the classes, which covers transportation expenses and minimizes competition with other tasks or jobs.[48] Our results suggest that inconvenient locations and class schedules may have contributed to the challenge reported by GFIs in recruiting and maintaining class participants. Most participants from the subsample reported a low satisfaction with the venue and suggested a greater availability of class times, more convenient venues, and provision of child childcare as strategies to improve the program. Despite these implementation challenges, an overall reach of 851 individuals is significant in a community-based intervention targeting Latinos in the US. Studies have consistently shown low participation and adherence to in-person PA interventions among Latinos in the US,[182,183] especially for women,[184] (who encompassed 90% of the AF participants). Furthermore, the overall amount of classes implemented (37 per month on average), which were sustained for 32 months in some venues is promising for a PA community-based intervention. Consistent with this study, previous PA interventions conducted among Latinos in US border communities had demonstrated the effectiveness of trained *promotores* as delivery agents for PA classes. [185,186,187,188] One of these interventions involved trained unpaid *promotores.*[48] In contrast to AF, these interventions accomplished changes in PA outcomes including increases in self-reported MVPA,[186,188] walking,[189] and aerobic fitness among adults.[187] None of these interventions reported detailed implementation indicators (e.g., using the RE-AIM dimensions), however, some implementation differences between them and AF can be observed. Most of these PA interventions had a shorter implementation (range of three to twelve months) and a lower dose of implementation, and overall reach.[184,185,187,190] All of these interventions used complementary strategies in addition to PA classes such as health education, provision of cues to action,

provision of pedometers and educational materials. Additionally, most of these interventions used different types of community-based venues (e.g., churches, schools, and Community Health Centers) for participant's recruitment and intervention delivery and not exclusively parks or recreation centers. Finally, these interventions used a broader recruitment strategy (i.e., using Hispanic media and attending events such as health fairs, and door-to-door recruitment) to support the promotor-based recruitment. [187,188,189]

Lessons learned

1. Establish feasibility prior to conducting a large trial examining effectiveness.

Implementing and evaluating community-based interventions is challenging in itself,[191] but assessing intervention effectiveness before prior to establishing community buy-in and feasibility is even more challenging. The implementation literature suggests that with community-based interventions, it takes time to build community buy-in.[143] Furthermore, it is estimated that community programs often require two to four years for reaching full implementation, [143] whereby an evaluation of effectiveness would be viable.[143] Future translation studies on PA classes should focus on strengthening program implementation and assessing process indicators to ensure a more consistent implementation and sufficient dose to generate impact.

2. Start small, and build the program over time[118]

The results of this feasibility study provide valuable information to improve the implementation of AF, perhaps at a smaller scale (i.e., reducing the number of target communities, focusing on the venues and GFIs that showed higher quality and fidelity of implementation). Lessons learned from Latin America indicate that PA-classes programs such as ACP take many years to establish a broad reach. Successful programs in this region of the world that were scaled up and sustained for over 10 years initially faced similar implementation challenges; but they persisted. Previously

utilized strategies to overcome challenges should be explored in the US context (e.g., low community reach and lack of resources and support), included allocation of public funds, progressive increases in local taxes, diversification of resources, coordinated advocacy by governmental and non-governmental organizations, multisector partnerships, and community empowerment.[118,115]Efforts to accomplish a sustainable implementation of PA classes programs in the US should continue with a flexible approach that allows for a progressive growth and integration of the program into the community.

3. The identification and recruitment of public venues is crucial for the successful implementation of AF.

Future implementation of PA classes for Latino communities in the US should incorporate input about the characteristics (i.e., type of facility, preferred class schedule) and location of convenient public venues to improve participation and adherence to the PA classes. Our findings showed that a church was the most successful venue in participation and implementation, followed by a park and a recreation center, demonstrating that for the context of Latino communities in the US, alternative venues where these communities gather may also be effective to deliver this type of programs.[192,193] Perhaps a combination of public venues that gather Latino communities such as churches with conveniently located city-run recreational venues (parks and recreation centers) can gradually encourage a greater adaptation to and utilization of parks and recreation centers by Latino communities for PA classes. Finally, our results showed only 10 of the 14 adopter venues in AF, implemented the classes for more than 10 months, and of those, only 6 implemented a substantial amount of classes. Concentrating efforts on recruiting and enhancing access to venues that provide convenience and effective support strategies may

increase the quality and consistency of implementation. Public venues should be identified with input from the community and GFIs.

Limitations

There were several limitations to this study. Data was not collected among all class attendees (i.e., only among the subsample) to assess the actual representativeness of the overall attendees. The effectiveness assessment had several limitations including: a self-selected sample (may have attracted more active and motivated individuals), no comparison group, small sample size, high attrition, and reliance on self-reported PA due to the low compliance of the accelerometer protocol. Future studies assessing the effectiveness should address these limitations. Some strategies to improve future effectiveness studies on PA classes include: increase the sample size of the study subsample, provide more frequent incentives for completion of measurements and protocol compliance, and use of reminder and follow-up mechanisms such as phone calls, mailed post-cards or text messages. Compliance to accelerometer protocols can be improved by exploring the use of alternative devices for this specific population group that promote higher protocol adherence, for instance 24-hour waist-worn accelerometer and by using daily activity log for accelerometer compliance. In addition, participant's self-selection should be avoided. To overcome this limitation, a systematic approach for the selection of the study subsample can be established.

The limitations mentioned above reduce the generalizability and validity of the findings. It is important to underscore that the primary purpose of AF was to translate a PA-classes program, and not to assess the effectiveness of an existing intervention. For this reason, emphasis was placed on accomplishing an adaptation and implementation of the program under real-world conditions maximizing its external validity, although that could minimize internal validity

aspects as well. As an example, AF class attendees were recruited primarily by *promotores*, with no intervention from the research team, and no incentives provided to encourage participation or adherence. Lastly, the consistently documented challenges of reaching and promoting adherence to PA interventions among Latino communities in the US border communities should be considered. Studies have reported low participation and retention rates among Latino communities. [44,185,187] Barriers for adherence to PA programs among this population have included: high proportion of illegal immigrants,[182,194] transportation barriers, and reported challenges to spend time away from family.[189]

Conclusion

The findings of this translation study demonstrated that the implementation of AF for Latino populations at the US-Mexico border in San Diego was feasible. Efforts should focus on improving implementation fidelity and quality and in implementing a smaller- scale program until it reaches full implementation and becomes integrated into the community. Once the program is fully implemented, its effectiveness in increasing PA and improving other health and social outcomes should be assessed.

Table 1. RE-AIM dimension's measures and data sources for assessing Academia Fit.

RE-AIM Dimension	Measure	Data source
Reach	-Reach of the AF classes in the target population: number of class attendees during the implementation of the intervention divided by the estimated Latino population 18 years and older in the four communities.	-Attendance records collected by GFIs in each class. -Population data for the four communities was based in census data 2010. [176]
	-Representativeness: determined by comparing characteristics of the effectiveness study participants (*n*=240), including age, educational attainment, country of origin, preferred home language, years living in the US, Body Mass Index (BMI), LTPA, against those from the general population of the four target communities.	-Data from the study subsample was collected through questionnaires conducted at baseline and 6-months after starting participating in the program. -Population-based data from the 4 target communities was obtained from the 2010 US Census,[176] the 2009-2011 California Health Interview Survey,[195] and the San Diego Prevention Research Center's (SDPRC) Community Survey 2009.[194]
Effectiveness	Self-reported PA: -Total minutes per week of moderate-to-vigorous intensity PA during leisure time (LTMVPA) -Total minutes per week of sedentary time during waking hours (e.g., sitting, driving, watching TV) -A binary variable was created from the LTMVPA to classify individuals as either meeting/not meeting the PA recommendation in leisure time (those who accumulated 150 minutes or more of moderate-intensity PA , or 75 minutes for vigorous-intensity-PA per week, excluding walking in bouts of at least 10 minutes each time).[28]	- LTPA domain of the Global Physical Activity Questionnaire (GPAQ) [180] included in the overall questionnaire conducted to the study subsample. - Effectiveness was only assessed among the participants of the effectiveness study subsample (*n*=240).
	Objective PA: - Total minutes of moderate-to-vigorous PA (MVPA) - MVPA within 10-minute bouts were calculated for the entire week. Bouts were defined as continuous activity, having a minimum duration of 10 minutes, with a maximum break duration of 20% of the bout length (i.e., 2 minutes per bout for a 10-minute bout).[130]	Actigraph GT3X accelerometers used among the effectiveness study subsample (*n*=240).

Adoption	GFIs adoption: -Percentage of trained GFIs that agreed to teach AF classes.	-Records of GFIs certification completion and signature of behavioral contract
	Public venues adoption: -Percentage of public venues selected and approached that agreed to participate in the AF program.	-Records of selected venues and of venues that provided authorization.
	Participating and nonparticipating venues were also compared regarding quality score	-Public venues environmental audits
Implementation 1-year period	Overall implementation: total number of classes delivered/total intended, number of classes completed in year 1/intended, number of classes per month, total time of classes' implementation, number of class participants per month over a 1-year period. The intended number of classes are the expected number of classes by each GFIs based on the behavioral contract.	-Records of class implementation, GFIs attendance, and class participation.
	Dose: -average number of classes per class attendee -average number of classes per sub-sample participant	-Records of class attendance collected among all class attendees including effectiveness study subsample.
	Quality of the program Suggestions for program improvement	Questions about overall satisfaction with the program from the subsample's questionnaire administered at T2.
	Fidelity at the setting (public venues): No. venues implementing the AF classes for one year/No. adopter venues; No. classes per site; No. venues implementing the classes/month.	-Records on classes' location (venue) and date
	Fidelity at the staff levels (GFIs): No. of GFI's implementing the AF classes for one year/No. GFI's; No. classes per GFI; No. of GFI's teaching the intended dose of classes/No. GFI's	-Records of GFIs class implementation (type of class taught, date)
Maintenance	Overall class participants per month year 2	-Records of class participation
	Setting (GFIs)-level No. venues implementing the AF classes for two or more years'/No. adopter venues	
	No. of GFI's implementing the AF classes for two years or more/No. GFI's	

Figure 1. Academia-Fit Flow chart: Overall class attendance and participation in the effectiveness study (sub-sample).

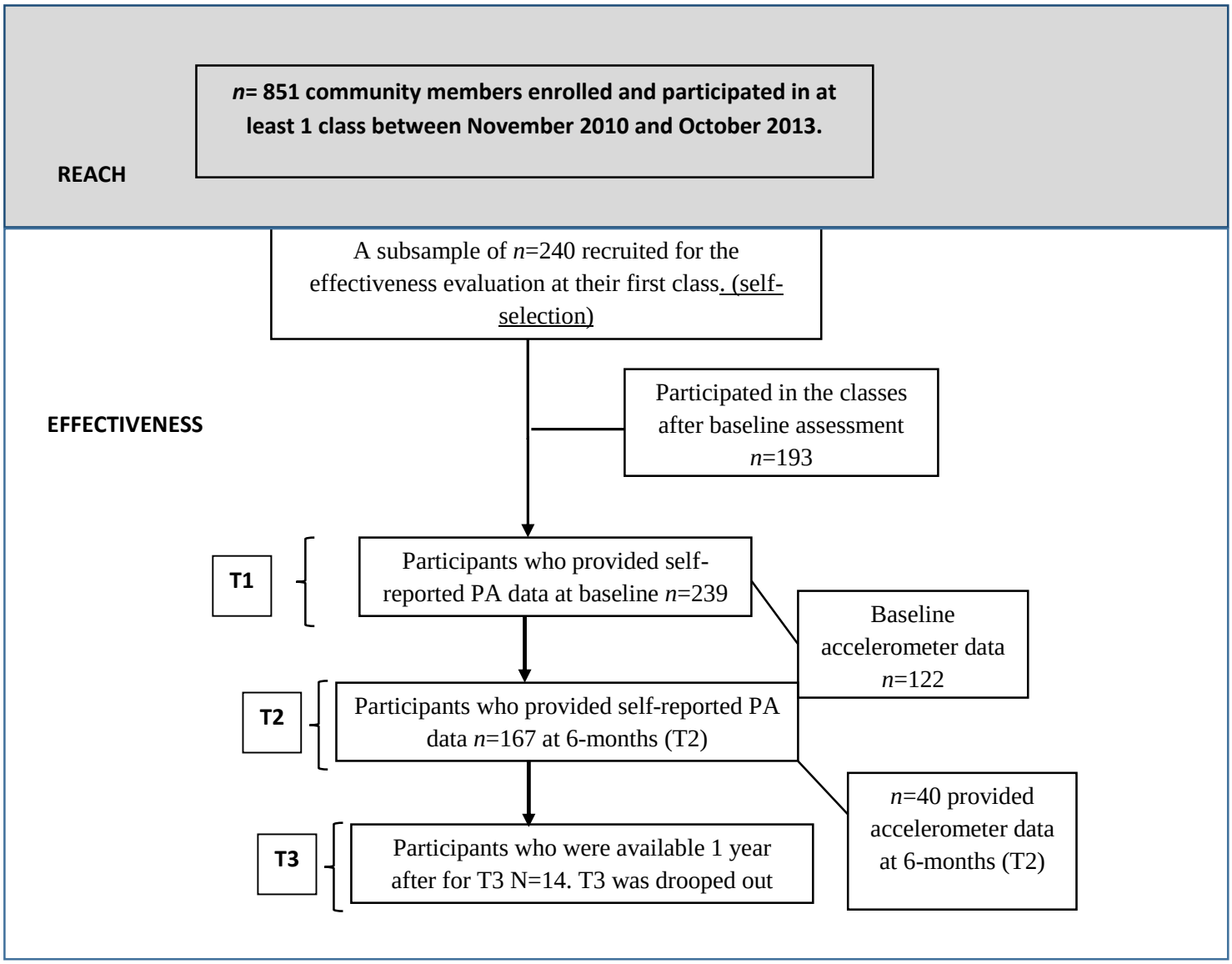


Table 2. Descriptive Statistics of the RE-AIM Indicators: Academia Fit program, 2010-2013

RE-AIM factor	N (%)	Mean (SD)	Median IQR[b]
Reach			
Total number of AF classes attendees	851		
Number of AF study participants (sub-sample)	240		
Reach of the AF classes at the target communities	851/164,601 (0.15%)		
Reach of the effectiveness study among classes' attendees	240/851 (28%)		
Effectiveness			
MVPA minutes (Self-reported)			30 (-48, 180)
Minutes of sedentary time (Self-reported)			22 (-60, 120)*
MVPA minutes(accelerometer)			56 (-3, 128)*
Bouted MVPA minutes(accelerometer)			0 (-24, 66)
Meeting LTPA Guidelines at baseline	111 (61%)		
Meeting LTPA Guidelines at T2	50 (43%)		
Adoption			
Setting-level			
No. venues selected/ all audited and scored	23/73 (31%)		
No. venues adopting the AF classes/selected venues	12/23 (52%)		
Total number of adopter venues (two additional non-audited venues offered their facilities)	14		
Staff-level			
No. GFI's adopting the AF classes/ No. trained GFI's	20/20 (100%)		
Implementation			
Overall			
Total No. classes delivered/total dose intended	1248/2064 (60%)		
No. classes completed in year 1/No. intended[c]	406/1032 (39%)		
No. classes per month	1-79 (range)	37 (22)	
Total time of classes' implementation	32 months		
No. of class participants per month year 1	15-749 (range)	364 (231)	
Dose: No. classes per class attendee [a]		9 (17)	
Dose: No. classes per sub-sample participant		22 (23)	
Setting-level			
No. venues implementing the AF classes for one year/No. adopter venues	7/14 (50%)		
No. classes per sites	9-234 (range)	83 (70)	
No. venues implementing the classes/month	1-10[†]	5 (3)	
Staff-level			
No. of GFI's implementing the AF classes for one year/No. GFI's	8/20 (40%)		
No. classes per GFI	1-359 (range)	125 (88)	
No. of GFI's teaching the intended[c] dose of classes/No. GFI's	6/20 (30%)		
Maintenance			
Overall			
No. of class participants per month year 2	77-571 (range)		367 (151)
Setting-level			
No. venues implementing the AF classes for two or more years/No. adopter venues	2/14 (14%)		

Staff-level	
No. of GFI's implementing the AF classes for two years/No. adopter GFI's	3/20 (15%)

* P<0.05 [a]Excluding sub-group participants [b]Median difference and IQR (25, 75) c The intended dose was calculated by adding the number of classes expected per GFI (2 per week over 40 weeks and multiplied by the number of GFIs (20)

Table 3. Comparison of Academia Fit effectiveness study participants with target communities.

Variables		Target communities	Academia Fit	p
median age		31	40	<0.001*
Sex	**Male**	45%	10%	<0.001
	Female	55%	90%	
Education	Less than high school graduate	24%	18%	<0.001
	High school graduate	27%	25%	
	Beyond high school	48%	57%	
Employed		46%	66%	<0.001
Household income below poverty		53.2%	30%	<0.001
Country of origin	Us born %	64%	42%	<0.001
	Foreign born %	36%	57%	
Preferred language	English only	33%	59%	<0.001
	Spanish	59%	40%	
Time in the US	<10 y	25%	57%	<0.001
	>10 y	75%	42%	
BMI 2009	normal weight	41%	18%	<0.001
	overweight	34%	35%	
	obese	25%	46%	
Total Leisure Time MET Minutes		615.5 (1234.2)	996 (1906)	<0.001**
Meets LTMVPA recommendations (yes)		30%	61%	<0.001
Does not meet LTMVPA		70%	39%	<0.001

*one-sample non-parametric test Wilcoxon Signed rank test

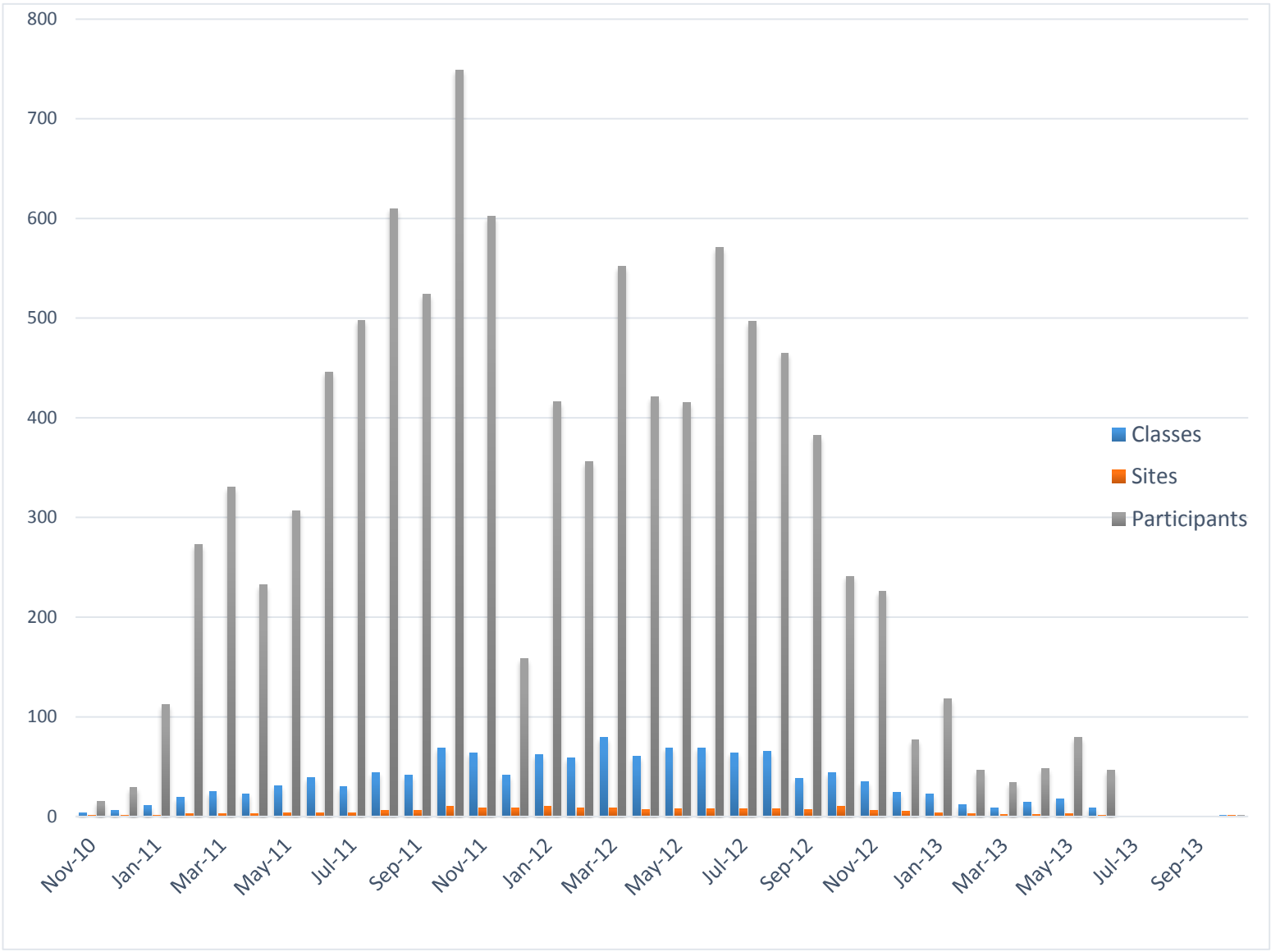
**one sample t-test

Else Chi square for goodness of fit test

Table 4. Socio-demographic characteristics Academia Fit program subsample for effectiveness evaluation.

Variable		T1 (n=238)	T2 (n=169)
		N (%)	N (%)
Mean age		39+/-10	
Sex	male	22 (9)	18 (11)
	female	217 (90)	151 (89)
Monthly Household income	6000-14,994	57 (24)	44(29)
	20,994-38,994	77 (32)	53(35)
	44,94-65,944	57 (24)	38 (25)
	72,000 or >	28 (12)	17(11)
Education	less than high school	41 (18)	28(16)
	high school/equivalent	57 (25)	45 (27)
	beyond high school	129 (57)	96 (57)
Marital Status	single widow divorced separated	90 (37)	60(35)
	married living with partner	148 (61)	109(65)
Occupation	Not currently working	82 (34)	63 (37)
	Working full-time	113 (47)	74 (44)
	Working part-time	46 (19)	32 (19)
Working motor vehicle at home	No	7 (3)	6 (4)
	1 or 2	166 (69)	119 (70)
	3 or more	66 (27)	44 (26)
Country of origin	United States	101 (42)	65 (38)
	Mexico	118 (49)	89 (53)
	Other	19 (8)	15 (9)
Years in the US	less than a year	102 (42)	66 (39)
	<10	35 (14)	28 (17)
	10 or more	102 (42)	73(43)
Language preference	English	142 (59)	92 (54)
	Spanish	97 (40)	78 (46)
BMI kg/m^2	normal weight	43 (18)	34 (20)
	overweight	84 (35)	67 (39)
	obese	93 (39)	61 (35)
	extreme obesity	15 (6)	11 (6)

Figure 2. Academia Fit Implementation: Number of active public venues, classes, and class attendees per month of program implementation.



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Chapter 5. Conclusions and Future Directions

The purpose of this dissertation was to assess the impact of two types of community-based programs implemented in public spaces, Ciclovias (Open Streets) and PA-classes, on population-level LTPA. This dissertation also sought to assess and document the applicability, translation and effectiveness of these interventions from two Latin American countries (Brazil and Colombia) into the US context (Atlanta, GA and San Diego, CA). The main findings of each program were addressed within their respective chapters (Chapter 2: Atlanta Streets Alive: A Movement Building a Culture of Health in an Urban Environment, Chapter 3: Assessing the effect of physical activity classes in public spaces on leisure-time physical activity: "Al Ritmo de las Comunidades" A natural experiment in Bogota, Colombia, and Chapter 4: Academia Fit: An examination of the translation and transferability of a PA-classes program to increase physical activity among Latinos in San Diego, California). This section summarizes the overall findings of this dissertation and discusses recommendations and implications for research and practice.

The overall findings of the three studies among communities in three different geographic locations including Bogota, Colombia in Latin America, and San Diego, CA and Atlanta, GA, in the US, indicate that free community-based interventions implemented in public spaces such as Open Streets and PA-classes are promising for increasing moderate-to-vigorous PA (MVPA) on leisure-time within the communities where they are implemented. First, results from the natural experiment conducted on the Bogota Recreovia, indicated the program has a high community reach, especially among low income, overweight women. In addition, a pattern of increased self-reported LTPA was observed among new Recreovia users after 6 months of participation in the program. Furthermore, a significantly higher accelerometer-measured MVPA and lower prevalence of overweigh and obesity was observed among users of existing Recreovias (those

that have been implemented for more than 12 years). Second, despite the methodologic limitations for the assessment of effectiveness, findings from the translation study conducted on the Academia Fit program suggested that the program may hold promise for increasing LTPA among less active individuals. The results of the effectiveness assessment indicated that there was a significant decrease of sedentary time among the study participants and an observed pattern of increased MVPA among those who did not meet the PA guidelines at baseline. Moreover, the majority of the participants of the program were overweight and obese Latino women, whom are more likely to be inactive in leisure-time.[20]

The findings of this dissertation also support previous research that had found community-based interventions to be effective to reach vulnerable populations. Specifically, the three programs studied in this dissertation reached women, low income, overweight and obese individuals (Academia Fit and Recreovia), diverse ethnic groups including African-Americans (ASA), and Latinas living in the US (Academia Fit). Thus, regularly implemented Open Streets such as ASA, and PA-classes programs such as Recreovia and AF, may also contribute to equity by providing better public services to disadvantaged communities.

The results presented on this dissertation also showed that the implementation of an Open Streets initiative and a free PA-classes program was feasible (applicable) in Atlanta, GA, in the US and San Diego, CA, respectively. On both cases, results of their assessments suggest they were successfully translated (adopted and integrated) from Latin America to their respective contexts in the US. In the city of Atlanta, the Ciclovias model from Latin America was applied in a smaller scale by closing 2 miles of streets that are designed for motor vehicle transit to allow exclusive access to pedestrians, and people in non-motorized vehicles such as bicycles to engage in various forms of activity and recreation. The interest and commitment of the city to gradually

increase the number of ASA events per year (range of 2 in 2010 to 4 in 2015), the miles of streets closing (range of 1.5-2 in 2010 to 5 in 2015), and the substantial increase in attendance documented in the ASA evaluation, show the successful adaptation and integration of ASA to the context of the city of Atlanta. Similarly, the feasibility of the translation of the Brazilian PA-classes program, Academia de Cidade, into 4 communities in the US-Mexico border in South San Diego, program was demonstrated in the Academia Fit (AF) study. Results of this study showed that the three goals of the AF translation were accomplished as follows: 14 public venues (12 of them government-run) were recruited for the program's implementation, 20 Spanish-speaking *promotores* from the target communities were certified as professional group fitness instructors (GFIs) by the American Council of Exercise, and a total of 1248 free PA classes were delivered by the certified GFIs over 32 months, reaching 851 class attendees.

The methodologic limitations of the two US-based studies, ASA, and Academia Fit, which are discussed within their respective manuscripts, did not allow a rigorous assessment of the transferability (effectiveness to increase LTPA in the new setting) of any of the programs. Data for ASA was collected in cross-sectional evaluations during the 5 documented events which allowed the documentation of participation characteristics in ASA but not their association with PA outcomes. Furthermore, long-term health and social benefits were neither expected, nor measured in ASA due to its limited scheduling and short routes. Similarly, Academia Fit was intended to be a translation study, focused on adaptation and implementation. Although effectiveness was measured, several limitations, some related with the stage of the program which had not reached full implementation, and some with methodological weaknesses, did not allow a rigorous assessment of effectiveness. Nonetheless, both programs provided valuable data that allowed the formulation of hypotheses and thus will inform and guide future research.

The implications of contextual differences in research and practice

It is imperative to consider the context in which community-based interventions are implemented and evaluated. There are substantial differences in sociocultural, economic, geographic, and political characteristics between Latin America and the US that are major determinants of how health promotion, including PA interventions are approached.[38] For instance, a fundamental difference that may explain in part the high level of sustainability of community-based interventions in public spaces in Latin America is the more paternalistic government approach where governments often regulate, provide, and subsidize public programs.[38, 196] In fact, many countries in Latin America totally or partially subsidized PA promotion programs in public spaces such as PA classes or Ciclovias.[1 ,135] Consequently, the availability of public venues that are enhanced with equipment, such as stages and music, and the availability of high quality instructors for PA classes is regular and sustainable. In contrast, in the US the liberal model prevails in which the government provides a regulatory framework but is less of a "provider", and individual responsibility prevails along with private entities.[197] Another significant contextual difference is the collectivistic culture more prevalent in Latin America, which emphasizes shared responsibility, group activities, and cooperation.[198] In contrast, in the US culture individualism prevails, people expect to make their own way in life, personal goals and individual success go beyond collective well-being.[196] As a result, local governments are less likely to provide funding for community-based programs and tax payers may be less likely to be supportive of spending tax revenues on these type of programs. Nonetheless, the Open Streets initiatives in the US that have achieved a level of sustainability have obtained at least partial government support, reflecting an increasing interest from governments for active living programs and infrastructures.[199] Still, the high costs associated with the number of police officers

required, the complex infrastructure required to implement an Open Street event, and the challenges in recruiting reliable volunteers represent the major barriers for providing regular programs with longer routes in the US.[199] Ciclovia programs in Latin America differ in cost, staff, and infrastructure from the US Open Streets. For instance, in Bogota, costs are substantially reduced by minimizing the number of police officers with the inclusion of high school students doing their mandatory social service at the Ciclovia, serving in different tasks including traffic control supported by hired staff and police.

Future directions in research

The findings and evaluation challenges that have been discussed in this dissertation inform future research on community-based interventions such as Open Streets and PA classes. Research efforts should continue to be directed towards strengthening the evidence on the effectiveness of Ciclovias/Open Streets and PA classes in Latin America and in the US (transferability). In Latin America, where these programs are well established and in most cases baseline data is not available, study designs and methodologies should be adapted to gather the best evidence possible. PA classes programs should continue to use natural experiments which are ideal to evaluate existing interventions and allow the comparison of non-traditional subgroups (i.e., other than intervention and control) that occur naturally as the program is integrated into the community as demonstrated in the Recreovia study. Other study designs such as interrupted time-series should also be explored. Strong partnerships with practitioners implementing these programs are key to accomplish high quality research. It is important to underscore that these programs have been developed and implemented by practitioners and were not initiated by researchers as "interventions", but as part of recreational programs in cities in Latin America. Thus, partnerships with lead organizers of these programs are important to be

informed about program changes and innovations, such as the expansion of classes to new public venues. Such changes and program expansion represent unique opportunities for evaluation and allow the incorporation of pre and post designs and the identification of comparable controls which can also increase the internal validity of these studies.

Future studies should target recruitment efforts towards households and areas in the communities where people gather, other than parks and recreation centers, to allow for more diverse participants and to improve the generalizability of the findings. Random selection of neighborhoods, venues, households, and individuals within the sampling units should be considered when feasible to minimize selection bias. Efforts should also focus on increasing follow-up time-points to effectively assess changes in PA behavior and other health outcomes such as body composition. In addition to the adaptation of study designs, future research should examine the feasibility and effectiveness of measurement methodologies utilized to measure PA in large scale community-based interventions. For example, efforts to assess PA objectively should continue. The use of new accelerometer such as the 24-hour waist-worn device, smart phones, or regular cell phones that are widely available today should be explored. At the same time, barriers to the use of technology in real-world interventions and specific contexts (e.g. among Latino border communities in the US) should also be assessed. Strategies to overcome the loss to follow-up and low accelerometer protocol compliance observed in the Academia Fit and Recreovia studies should be implemented. Some possible strategies include: provision of more frequent incentives for completion of measurements and protocol compliance such as gift-cards, and small items such as t-shirts or caps, use of reminder and follow-up mechanisms such as phone calls, mailed post-cards or text messages, implementation of in-person recruitment and data collection by trained field workers or promotores (accelerometer training, delivery and

recovery, and face-to-face survey administration), use of daily activity log, and implementation of strategies to increase participant's trust such as distinctive shirt, badge, or uniform for field workers.[200] In addition to individual-level self-reported and objective PA data, observational tools to assess group-level PA should be considered, for instance the System for Observing Play and Recreation in Communities (SOPARC) which assesses park and recreation areas in relation to PA levels and types along with demographic characteristics.[201] Observational tools are especially useful for PA classes programs that are concentrated in one recreational area. Finally, the use of aggregated data collected through web-based or mobile device tools such as Google Earth, and Google Streetview can be used to assess the physical environments and PA behaviors. [201] Aggregate data can also be obtained through the analysis of social networks such as Twitter.[201] This emerging field of social networks tracking could also be explored given the increasing availability of smart phones at the population-level.

Future research with more rigorous designs should also assess other potential outcomes of both Open Streets and PA-classes programs including mental health outcomes, quality of life, social capital, and air quality.

More research should assess translation and implementation of these community-based interventions using valid frameworks such as RE-AIM to assess elements of internal validity but also to assess external validity issues that are extremely important in real-world interventions. More knowledge on adoption, implementation and sustainability will inform future programs and policies and may contribute to the establishment of regular programs. The identification of factors that contribute to the scalability and sustainability of free PA programs in public spaces in the US context are needed. For instance, while PA programs in public spaces in Latin America are government subsidized, they are not in the US. This fundamental funding difference may

have important implications for the sustainability of these programs in the US. In fact, as reported in the ASA study, while higher mileage of street closings has contributed to increased attendance, it has also resulted in increased cost and time spent fundraising, which may not be sustainable in the long term for a small non-profit as is the ASA's lead organization, the Atlanta, Bicycle Coalition. Similarly, as documented in the Academia Fit, the lack of remuneration to group fitness instructors may have contributed to the inconsistent implementation of the program.

Regularity of implementation should be a priority for these programs in the US. Regular implementation will ensure consistent exposure to these programs among residents of the communities where they are implemented. Continuous and consistent exposure will also increase the potential of these programs to impact PA behaviors and health outcomes and therefore the suitability of effectiveness evaluations. More research on translation, implementation, and transferability of these programs in specific population groups such as Latinos in the US can contribute to the knowledge base on effective strategies to recruit and engage participants and promote adherence to PA programs.

Implications for practice

Research findings that are relevant for policy and practice should contribute to enhancing these community-based interventions in public spaces. The main goal for practitioners who are implementing Open Streets and PA classes in US cities should be to achieve regular, ongoing implementation of these programs. To accomplish this goal, it is important to first establish smaller and more sustainable programs that can progressively be scaled up over time. It is also important for practitioners to conduct regular evaluation and to identify the stage of

implementation of the program before attempting to evaluate its impact. Formative and process evaluation provide valuable information that can be used to enhance the program and ensure its impact in the future.

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