Published in final edited form as:

Contemp Clin Trials. 2012 November ; 33(6): 1180–1188. doi:10.1016/j.cct.2012.08.005.

Applying the Ecological Model of Behavior Change to a Physical Activity Trial in Retirement Communities: Description of the study protocol

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Abstract

OBJECTIVES—To describe the intervention protocol for the first multilevel ecological intervention for physical activity in retirement communities that addresses individual, interpersonal and community influences on behavior change.

DESIGN—A cluster randomized controlled trial design was employed with two study arms: a physical activity intervention and an attention control successful aging condition.

SETTING—Sixteen continuing care retirement communities in San Diego County.

PARTICIPANTS—Three hundred twenty older adults, aged 65 years and older, are being recruited to participate in the trial. In addition, peer leaders are being recruited to lead some study activities, especially to sustain the intervention after study activities ceased.

INTERVENTION—Participants in the physical activity trial receive individual, interpersonal and community intervention components. The individual level components include pedometers, goal setting and individual phone counseling. The interpersonal level components include group education sessions and peer-led activities. The community level components include resource audits and enumeration, tailored walking maps, and community improvement projects. The successful aging group receives individual and group attention about successful aging topics.

MEASUREMENTS—The main outcome is light to moderate physical activity, measured objectively by accelerometry. Other objective outcomes included physical functioning, blood pressure, physical fitness, and cognitive functioning. Self report measures include depressive symptoms and health related quality of life.

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RESULTS—The intervention is being delivered successfully in the communities and compliance rates are high.

CONCLUSION—Ecological Models call for interventions that address multiple levels of the model. Previous studies have not included components at each level and retirement communities provide a model environment to demonstrate how to implement such an intervention.

Keywords

built environment; physical activity; older adults; walking; trial; successful aging; protocol

INTRODUCTION

The importance of environmental factors in older adults' health and functioning is emphasized in environmental gerontology theories (e.g., Lawton's person environment fit model; [1]) and in the international classification of functioning, disability and health [2]. More specifically, numerous cross-sectional studies have demonstrated the influence of built environmental attributes on physical activity (PA) in older adults [3, 4]. Various reports from authoritative groups including the World Health Organization [5], the Environment Protection Agency's Aging Initiative [6], and the American Association of Retired Persons [7] have highlighted the particular need for community design changes to support seniors' walking.

Although expensive, built environmental changes can benefit large population groups over longer timeframes [8]. Yet, environmental facilitators alone will not increase healthy behaviors across the population. As suggested by the Ecological Model of behavior change, attention must be given to the multiple levels of individual, interpersonal, community, and policy factors, and their interactions, in order to influence change [9]. In other words, the old adage "if you build it they will come" seldom holds true for health behaviors without awareness, personal motivation, and appropriate behavior change skills implemented alongside environmental change. An Ecological approach addresses both individual and interpersonal skills and motivations, and further ensures a supportive social and community environment. Indeed, this combination of psychosocial and built environmental factors is significantly related to seniors' PA [10].

Older adults are the least physically active segment of society, with recent objective monitoring indicating only 2.5% of adults over age 60 meet PA recommendations with levels decreasing with each decade after the age of 60 [11]. Moreover, seniors spend the most amount of time sitting: over eight hours daily [12]. This is of concern given the substantive evidence showing that PA is related to reduced morbidity and mortality [13, 14], and is essential in the prevention and treatment of obesity, type 2 diabetes, cardiovascular disease, and osteoporosis, as well as for improving postural stability and reducing falls risk [15–17]. Additionally, evidence has emerged that prolonged sitting has an impact on gene expression and molecular and metabolic processes involved in the etiology of obesity, type 2 diabetes, and coronary artery disease that is independent of moderate-to-vigorous intensity PA [18, 19]. Overall, this highlights the urgent need for interventions to increase the amount of physical movement by seniors.

Due to their complexity, multilevel Ecological interventions are scarce. However, for encouraging older adults to be physically active and less sedentary, retirement communities provide an ideal, small-scale, self-contained environment in which interventions based on the Ecological Model of behavior change can be tested. The nature of the setting allows for multiple levels to be influenced. Thus, designing and testing an ecological intervention within retirement communities can inform the development of larger, neighborhood-wide

ecological interventions. This paper describes intervention protocol for the Multilevel Intervention for Physical Activity in Retirement Communities (MIPARC) – the first study to simultaneously address all levels of the Ecological Model of behavior change to improve PA in older adults. The purpose of the paper is to describe MIPARC's ecological intervention and evaluation, and to demonstrate a real world application of the Ecological Model that other researchers can replicate and adapt to neighborhood settings, environments, and other age groups.

METHODS

Overview and study design

MIPARC is a group randomized controlled trial assessing the effectiveness of a 12 month multilevel intervention for improving PA in Continuing Care Retirement Community (CCRC) residents. The Ecological Model provided the framework for the multilevel intervention design. Moreover, social cognitive theory guided the intervention's use of specific behavior change strategies, while principals of organizational change theory and community mobilization informed the policy components [19, 20–22]. In summary, the intervention includes individual components (pedometer-based self-monitoring, educational materials, and tailored bi-weekly counseling calls); interpersonal components (bi-weekly group sessions and peer mentoring); environmental components (walking signage prompts, tailored community walking maps, posted step counts of different corridors and classes); and policy components (improvement of onsite activity opportunities and walking environments through peer led advocacy). Up to sixteen retirement community sites in San Diego County are being randomized to the intervention or control condition using an Efron-type procedure [23]. Ethical approval for the study was obtained from the University of California, San Diego (#091028).

Recruitment and eligibility criteria

Sites—Contact information and mailing addresses for CCRC facilities in San Diego County were identified from county Elder Care resources. Sites with over 100 residents, independent living accommodations, and a park or shops within walking distance (1 mile) were eligible to participate. Twenty sites met these criteria, all were contacted but two sites refused to participate, one discontinued contact due to staffing pressures, and two sites were not able to recruit more than 10 participants. A total of 7 sites have been recruited to date (May 2012). Site managers and activity directors were given information about the study and a memorandum of understanding was signed before randomization. New sites are brought on every 6 months with at least 2 sites running in any one sixth month period.

Peer Leaders—In each site, 2–5 peer leaders aged 65 or above are selected to help deliver the program. Potential peers are identified from staff and resident recommendations, flyers and personalized letters. We ask staff to identify residents who are leaders in their community, engaged in the programs offered at the site, and, in at the PA sites only, a good role model for physical activity. Applicants are interviewed and screened for their availability and commitment to the program. The interview includes several questions including: any past leadership experience, ideas to engage residents in programming, their comfort level in contacting other residents during the study, and (in PA sites) the physical activities they enjoy. Peers are given a \$600 personal honorarium for the 12 month study period in the intervention sites, \$300 in the control sites. Payments are made in installments upon completion of the peer training, 6 month measures, and 12 month measures.

Peers complete 4–8 hours of facilitated discussion/training prior to participant recruitment. The discussion time includes learning about the study and their role, identifying recruitment

strategies, planning group-led activities and preparing for the first education sessions. They also experience a measurement visit which allows them to see what measures participants were expected to complete and helps them understand the purpose of the study. Their first task is to identify recruitment strategies and encourage enrollment among residents. Each peer leader is asked to identify and talk with 10 other residents who might be interested in participation. All recruitment and training activities occur at the CCRCs.

Resident participants—Study participants are CCRC residents aged 65 years and above. Eligibility criteria include: ability to speak and read English; ability to complete written assessments; ability to hold conversation over telephone; ability to attend weekly meetings; permission from their physician to participate in the study (PA sites only); ability to provide informed consent; no history of falls within the past 12 months that resulted in hospitalization; ability to walk 20 meters without human assistance, completion of the Timed Up & Go Test in less than 30 seconds; able to read survey questions; and completion of a post-consent comprehension test. Active recruitment methods are applied [24]. Recruitment strategies are site-specific and based upon suggestions from the peer leaders. However, methods include recruitment through flyers, presentations, participant testimonials from previous sites, and encouragement from site staff and peers. All recruitment and activities take place at the CCRCs. Participants receive \$10 for the baseline, 3 month and 9 month measurements, and \$15 and \$20 at the 6 and 9 month measures, respectively.

MIPARC intervention

The primary intervention goal is to increase the number of minutes per day that older adults spend in light-to-moderate intensity PA (LMPA). This is accomplished with three specific behavior change targets: 1) increase walking by 3,000 steps/day over baseline through the gradual increase of daily, pedometer-measured step counts; 2) increase attendance at available on-site and local physical activity classes; and 3) reduce sedentary behavior by taking a break from sitting every 30 minutes. Behavior change is encouraged through multiple components that reflect each level of the Ecological Model.

Individual support—There are three main components of support at the individual level: printed materials, self monitoring, and tailored phone calls from a trained counselor.

Printed materials: Printed materials are compiled in a study binder which includes information about the study (schedule of events), safe walking tips, barriers and benefits to PA, goal setting, social support, relapse prevention, PA recommendations for exercise, disease specific recommendations for PA, website resources, and local walking resources (e.g. walking groups, walk for a cause dates) [See figure 1 for example materials]. Participants also receive the National Institutes Aging “Exercise & Physical Activity: Your Everyday Guide from The National Institute on Aging” book [http://www.nia.nih.gov/sites/default/files/exercise_guide.pdf]. At each health educator led session, participants receive materials that summarize the skill development strategies that were introduced.

Self monitoring: Participants monitor their steps with a pedometer (Omron HJ100), daily step logs, and bi-monthly progress charts graphed by study staff from participants’ weekly step count averages. Participants record their daily step counts on a NCR copy step log which allows the research team to collect the duplicate log information. Participants are provided with a year’s worth of step logs. All participants initially aim for the same step count goal of 3000 extra steps per day above their own baseline over the course of 3 months, equivalent to 1.5 miles or 30–40 additional minutes of walking [25]. In the first education session, all participants receive a standardized approach to gradually increase their steps in small increments, which is graphed on their progress chart starting from their own baseline

value. This provides both a long-term step goal and weekly goals that are clearly specified in advance. Having a common goal of 3000 extra steps per day for all participants, regardless of individual baseline step counts, was designed to increase social cohesion among site participants. Despite differences in individual walking abilities, all participants are working toward the same increase, which creates a “team” mentality. The aim is to reach the 3000 step increase within 3 months to encourage early behavior change success that can translate to meaningful health benefits, and to allow time to practice maintaining a goal while still under the guidance of study staff (for the following 3 months). The phone counselors guide participants toward the 3000 step goal while recognizing differing needs, motivations and obstacles. Participants are given a certificate of recognition when they reach their 3000 steps above baseline goal. Once achieved, they then plan a long term maintenance goal and identify strategies to maintain their new daily walking level. Some participants maintain their 3000 increase, others continue to work towards reaching or exceeding the 3000 steps, and some reduce their steps slightly to allow for a more realistic long term goal (but not less than 2000 above their baseline).

Phone calls: Individual phone counseling is provided every other week during the first 8 weeks of the study to support early attempts at behavior change, to help participants overcome barriers, to increase their confidence in their ability to walk more, to plan PA into their day, and prepare for maintenance of their increased walking. Counselors receive 8 hours of training and practice in motivational interviewing and the behavioral strategies that are incorporated into the study (e.g. self-monitoring, goal-setting, and relapse prevention). The main themes of the step counseling calls are to encourage participants to walk every day, plan short bouts of PA into their day, and settle into a consistent daily routine (e.g. avoid high and low step counts across days). Additionally, participants’ step count increases are framed in the context of the environment; they are provided step count estimates for common routes around their site, which helps them add steps each day. If a participant meets his/her step goal on at least 4 days of the week, they are encouraged to increase their counts the following week. Increases are gradual, starting at 100 extra steps per day and building up to 400 extra steps per day over their previous level. If a participant becomes ill—a common occurrence in this age group—he/she is advised to take the time needed to recover without increasing their step counts. Once healthy, they are encouraged to return to their walking at a comfortable level, even if it is lower than their initial study baseline. From that new (possibly lower) baseline, they increase their steps very gradually starting with an additional 100 steps per day.

Interpersonal support—Social support is provided through group-based educational sessions and use of peer leaders.

Group based educational sessions: During the first 6 months of the intervention, participants attend a total of 9 group education sessions delivered every other week for four months, and then once a month in the last two months. The group education sessions aim to provide information and skill development to support behavior change related to the 3 intervention goals, and also to provide a forum for group discussion and shared experiences. The sessions are facilitated by an experienced health educator, providing an interactive learning environment. Participants find solutions through group brainstorming, bi-weekly sharing of barriers & benefits, and activities such as celebration circles, drawing a “roots of change” tree, games, and active learning exercises. The sessions cover relevant constructs from Social Cognitive Theory and behavioral modification, including: self-monitoring, barriers and benefits, social support, environmental barriers, celebrating success, positive thinking, and relapse prevention. The objective of the first 6 group sessions is to increase walking. Walking is the target activity as it is an easy activity that can be done at any time,

alone or with friends, without dedicated equipment or space, is self paced and can build confidence and strength for other activities. It is a preferred activity for older adults. The second goal, introduced in the second 3 month period, is to add other PA types into their daily routine through classes or home based exercises for strength, balance and flexibility as recommended [26]. Finally, the third behavior change goal, which is introduced by week 16, is a reduction in periods of prolonged sitting. Standing breaks are promoted via reminder cards and a laminated, reusable log which serve as a reminder for participants to stand up during extended periods of sitting, for example when watching TV. Others set timers to remind themselves to stand up. Participants are advised to stand for at least 2 minutes when finding themselves in a seated position for at least 30 minutes, and to log the number of breaks at the end of the day. Participants start with a goal of 10 standing breaks per day and worked towards increasing this to 30 breaks, equivalent to a break almost every half hour.

Peer led groups: In the first 8 weeks of the study the Peer Leaders help guide the educational sessions, contributing ideas for icebreaker and engaging activities. This “on the job” structured learning opportunity allows them to further understand the study and their role, and to develop skills and confidence to take on responsibility for leading group events later in the study. In the second 4 months of the study, peers lead activity sessions every other week that include games, treasure hunts, and group walks. Prizes are awarded to participants with significant step increases or who overcome barriers to walking. Additionally, a study “celebration board” is updated bi-weekly and displayed in a prominent location at each site to provide recognition for participants. The celebration board includes a walking goal for the group, (e.g., adding up all participants’ steps and plotting “trips” across the US/world) pictures of prize winners, pictures of events and community projects, review of the educational sessions, and newspaper clippings. In the last 6 months of the study, when study staff is no longer present on site, peers continue to organize monthly group events, if not more frequently.

Community and policy support—Support at the community and policy level is accomplished by the provision of community resources for walking and community projects that are led by the Peer Leaders.

Community resources: To support walking in and around the community, participants help identify step counts of various corridors and paths around the campus (indoor and outdoor) and in the local neighborhood. This information is then mapped and provided to participants in a user-friendly format. Participants can then use the routes to work out how to meet their increasing step goals. In the first 6 weeks of the study, participants are encouraged to walk on campus to increase their confidence and strength. They then are encouraged to try safe neighborhood routes which are also mapped. A peer led group walk is conducted to provide participants with a comfortable introduction to neighborhood walking. Information about additional resources such as PA classes on site and in the local community is provided. PA class instructors are invited to demonstrate typical class activities in the peer led sessions. Participants use their pedometers to collect step counts for each class that is then shared with all participants. Additional signage to promote walking paths is placed around the campus.

Community projects: The Peer Leaders are expected to work on community improvement projects to enhance the walkability of the environment, either on site or in the surrounding neighborhood. The framework for the community projects is outlined in Table 1. The table indicates the different locations that could be considered (indoor, outdoor, on campus, off campus etc.) and the different assessments and activities that could take place at each location (e.g. availability, variety, quality, promotions). For example, an on campus path could be assessed for its access, interesting features, resting places, hazards, and use.

Improvements could be made in directional signage to improve access, benches could be added for appeal, maintenance of paths attended to for safety, and a treasure hunt organized along the path to promote use.

The peer leaders receive additional training from a pedestrian advocacy organization – Walk San Diego. They learn what features make environments walkable, how to prioritize projects, and how to reach key decision makers in city government to action changes. Peers and staff audit walking paths (e.g., sidewalks, street crossings) on campus and within the local community to identify potential safety concerns or opportunities for improvement. They are provided with a \$500 budget to purchase equipment or organize events and promotions. The on-site community improvement projects start as demonstration events to garner support of the management to adopt policies or make investments that support continued provision of instruction and equipment, or maintain improvements in the environment. Example on site programs include: providing outdoor games equipment such as bocce ball and horse shoes, providing additional exercise classes and improving opportunities for step-based exercise in class (not just chair exercises), instructional materials and staff in fitness rooms, organizing Wii and other games leagues, and walking programs to local stores. When neighborhood environments are the focus of such improvement projects, Walk San Diego provides technical assistance to identify city personnel and mechanisms for community improvement projects. Example neighborhood projects include: improving crossing safety through design and signal timing, cleaning up facilities such as bridges and parks, filling potholes and repairing cracked sidewalks. The Peer Leaders collaborate with staff, local businesses, schools, community council members, and other stakeholders in the community to reach their goals. Policy level changes might include investments in qualified instructors, provision of daily physical activity opportunities, provision of transportation services for off site excursions, and institutionalizing standing breaks in committee meetings.

Attention-matched control condition

An attention-matched control condition is necessary in older adults, many of whom are isolated and do not spend much time interacting with young people. Changes in emotional functioning could be in part due to engagement in the study, not just an increase in PA, so this is controlled for in the design. Future studies could compare a multi level to individual intervention (e.g. pedometer only), but first we must establish that the multilevel intervention is effective compared to a control condition that is matched on attention. An individual level intervention would inherently provide less attention which may confound results, especially in older adults.

The Successful Aging control condition is based on the control condition from the Stanford LIFE P study [27]. The sessions are 90 minutes long including 30 minutes of participant sharing around the session topic, 30 minutes of an educational presentation, and 30 minutes of discussion. Participants are asked to bring an item or story that reflects the week's topic and are challenged with take home activities. For example, an Aging with Humor topic involves participants bringing a joke to share, an educational session on the health benefits of laughter, and a discussion about how to keep humor a part of daily life (for example reading the humorous cards in a store). Participants are then encouraged to try to make someone else laugh that day. The groups are interactive and support social cohesion. Example topics include: Over 90s and Loving it (factors that are related to successful aging), The Blue Zones (longevity themes from 100 year olds around the world), San Diego Then & Now (how historical events and changes in daily habits affect our lives); Writing your own story; Genealogy; Effective communication with your doctor; Brain fitness; Healthy Sleep Habits; and New Technologies. The topics fit into an "Adapting to Change" framework that addresses emotional health, social engagement and continued learning. Participants also

receive the individual telephone counseling calls to ask about their enjoyment of the session, their take home activity, and inquire about their health status. Peers are recruited in the Successful Aging sites to help tailor the program and to complete participant reminders. Control sites are given a budget of \$250, to buy prizes or resources, for example.

Measurement

Table 2 presents the measures used to evaluate the MIPARC intervention, organized by the level of influence specified in the Ecological framework. The individual measures are based on constructs specified in the theoretical models presented earlier, notably Social Cognitive Theory, Organizational Change Theory and Community Mobilization models.

Both primary and secondary outcome measures (minutes per day of LMPA, physical functioning, blood pressure) are assessed using objective methods. LMPA is assessed using accelerometry, the field based gold standard of free living PA. Time spent in activities at counts over 1952 per minute and at counts over 1040 counts per minute will be investigated [28]. Physical functioning is assessed using the Short Physical Performance Battery and the timed 400m walk (during which participants also wear their accelerometer); systolic and diastolic blood pressure are measured at the brachial artery pressure using sphygmomanometry. Measurements are taken at baseline, 3 months, 6 months, 9 months, and 12 months post baseline [See Table 2]. The frequency of measurement is dictated by the expected temporal sensitivity to change, as well as practical and logistical constraints. For example, changes in cognitive function were hypothesized to occur relatively slowly (measured at baseline, 6 mo, and 12 mo), whereas changes in self efficacy, social connectedness, and optimism may occur more rapidly (measured at baseline, 3, 6, 9, and 12 mo). Factors that were deemed unmodifiable (or resistant to change), such as many demographic indicators, are measured only once.

In addition to outcome measures, a series of process measures are used to assess the mechanisms through which intervention-related change occurs, as well as factors associated with intervention implementation (fidelity). As previously stated, the mechanisms of change are measured using validated scales of the theoretical construct (e.g., self efficacy, depression, fear of falling), as well as scales adapted specifically for our target population (e.g., barriers to walking in retirement communities). In contrast, fidelity assessments examine the extent to which the intervention was “faithful” to the pre-stated intervention model [29]. We used the model proposed by Dane and Schneider[30] to guide our fidelity assessment plan. Table 3 presents the intervention fidelity assessment plan, with example indicators. Of note is that some indicators provide information about multiple factors of fidelity. For example, participant attendance at group sessions provides information about both the delivered and received dose of the intervention. An additional novel method of assessing how participants change their behavior is a GPS device. Participants wear these in conjunction with the accelerometer and this allows us to assess where activities are taking place, for example are participants walking more often in their local neighborhood, do they walk further, and do they walk the walking routes mapped during the study?

Sample size estimation

We selected a sample size that provided us with a minimum of 80% power for detecting a medium effect (Cohen’s $d = 0.5$) in LMPA at 6 months (about a 30 minute increase in light to moderate activity), assuming approximately 16% of the variance in LMPA could be attributed to site (based on our earlier studies). We assumed an autoregressive structure where subjects’ consecutive observations were correlated at 0.6; a 10% rate of participant ineligibility, and a 16% drop out rate at the 3 and 6 month time point. After accounting for

these factors, our target sample size is 320, or approximately 20 participants in each of the 16 sites.

RESULTS to date

The aim of this paper was to describe the study protocol. Recruitment is on going. We have recruited almost 200 participants (two thirds of our sample) and 20 Peer Leaders, and we have successfully delivered the intervention to 10 groups. Typically, 15–25% of CCRC residents attend an introductory presentation by our staff and of these, 55–80% are interested in completing eligibility screening. Of those interested, 85% are eligible and agree to participate.. Attendance at group sessions has been high, 82%, and evaluations extremely positive. Successful delivery of the phone counseling component is currently 87%. In the intervention arm, a total of 57% of participants have met their 3000 step increase goal, 83% a 2000 step increase, and 98% have had at least a 1000 step increase. Compliance rates with the measurement devices are 96% at baseline, 93% of participants have completed the 3 month measures, 91% 6 month measures and 75% 12 month measures.

DISCUSSION

To our knowledge, this study is the first to assess a long-term multi-level Ecological PA intervention for the older adult population. This study is important because multi-level interventions that combine environmental and individual approaches to promote PA in older adults show promising results [31,32]. Older adults are expected to greatly benefit from increasing their activity levels, and this study will inform intervention development for future studies, as well as the design and setting of care facilities for older adults, the provision of onsite PA resources, and opportunities and policies in retirement communities. Overall, this study's components will add to the research community's understanding of ways to help older adults become and stay active, remain independent, and reduce the impact of age-related disease and functional impairment.

This study is innovative in its development and evaluation of a comprehensive multilevel intervention, including the often under-evaluated (or rarely included) aspects of peer mentoring and advocacy. It is particularly significant to employ such an advanced model in sedentary older adults at high risk for chronic diseases. The use of GPS technology and accelerometry to measure key outcomes will also advance the field. The MIPARC intervention gradually reduces the level of support participants receive, with phone calls omitted after 2 months, and group sessions after 6 months. Signage, policy change, self monitoring tools, and peer mentoring do remain in place throughout the study's duration and beyond. This gradual reduction will allow participants and peer mentors to take ownership of the program and gradually become self-sufficient. The MIPARC intervention is therefore a program that is expected to be feasible for translation into community practice.

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Figure 1.
Example intervention materials

Figure 2.
Example walking route maps

Table 1

Framework to assess and improve community physical activity environment

Domain	Access, availability	Variety, appeal	Usability, safety, quality	Promotion, usage
Outdoor campus				
Walking paths	Number Easy to get to	Interesting things to see Paths vary in length & route Resting places Shade	Hazards on paths Hazards at crossings Lighting	# people use Organized events (walking club, activity along route) Prompting Signage
Exercise courts/equipment	Number Easy to get to, Equipment available for games	Variety of courts/ equipment In nice surroundings	Maintained	# people use Organized events Signage
Indoor facilities				
Exercise room/equipment	Opening hours Location	Choice of equipment Décor, layout	Maintained Supervised	# people use Organized events Signage
Classes/programs	Number Time of day Day of week	Variety of types of PA Instructor	Level of PA SOFIT-X	# people use Promotional materials
Corridors/stairwells	Number Easy to get to Wide	Interesting things to see	Maintained Railings Lighting	# people use Organized events Signage
Neighborhood				
Walking routes	Sidewalks available Crossing available, close by	Interesting things to see Resting places Shade	Sidewalk hazards Hazards at crossings (not marked, not see traffic) Traffic hazards (cars don't stop, travel too fast, too close) Senior safe (curb ramps, timed crossing) Signage for safety	Signage for safety Organized events (walking groups, traffic safety, crossing safety)
Exercise classes	Number Time of day Day of week	Variety of types of PA Instructor Senior focus	Safe for seniors Level of PA (steps, Heart Rate) Transportation	# people use Promotional materials
Excursions	Number Time of day Day of week		Level of PA (steps)	# people use Promotional materials

Table 2

Measurement battery for the MIPARC study

	BL	3mo	6mo	9mo	12mo
Individual Level					
Physical Activity/Sedentary Behavior:					
Accelerometer; GPS; self-report sedentary behavior measure	x	x	x	x	x
Physical Functioning:					
Short Physical Performance Battery; 400 Meter Walk Test; Blood Pressure; self-report functioning	x		x		x
Cognitive Functioning:					
Trails A and B; Symbol Search	x		x		x
Psychosocial self-report measures:					
Depressive symptoms; Self-efficacy*; Quality of Life; Sleep; Pain; Fear of Falling*; Optimism; Stress; Health status; Demographics	x	x*	x	x*	x
Interpersonal Level					
Social Measures					
Social Support (friends/family/staff); Social support (study related); Social Connectedness; Cohesion (Study group); Cohesion (retirement community); Social Engagement; Exercise preference	x	x	x	x	x
Environment Level					
Objective environment					
Audits Of Physical Activity Resources For Seniors (APARS); System for Observing Fitness Instruction Time – Group Exercise (SOFTT-X); Site Activity Calendar Review	x				x
Perceived environment					
Activity locations; Satisfaction; Barriers	x		x		x
Policy Level					
Site					
Physical activity policy changes					x

Table 3

MIPARC intervention fidelity assessment plan

Fidelity measure	Description	Example indicators from MIPARC
(i) adherence	Were the program components delivered as prescribed?	Percent of strategies recommended vs. actually delivered by intervention staff during phone calls or educational sessions.
(ii) exposure	How much of the program content was received by participants?	Participant attendance at group sessions; number of phone calls completed; change in # of activity focused events on site calendar; # environmental prompts to increase walking.
(iii) quality of the delivery	Was the theory-based ideal delivered in terms of processes and content?	Self ratings of role satisfaction among peer leaders; ratings of knowledge and skills of peer leaders; # of physical activity policy changes at site.
(iv) participant responsiveness	What was the level of engagement of the participants?	Participant self reports of group cohesion and session satisfaction; level of social support received from peer leaders.
(v) program differentiation	What unique features of the intervention are distinguishable from other programs?	Proportion of multilevel (ecological) model elements targeted and implemented during intervention compared to other interventions with older adults.