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Adherence to a physical activity intervention among older adults in a post-transitional middle income country: a quantitative and qualitative analysis

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Abstract

Objectives—The effectiveness of community level interventions depends to a great extent on adherence. Currently, information on factors related to adherence in older adults from developing countries is scarce. Our aim was to identify factors associated to adherence to a physical activity intervention in older adults from a post-transitional middle income country.

Design, setting and participants—Using a combination of quantitative and qualitative methods we studied 996 older Chilean subjects (65-67.9 years at baseline) with low to medium socioeconomic status from 10 health centers randomized to receive a physical activity intervention as part of the CENEX cluster trial (ISRCTN48153354).

Measurements—Using a multilevel regression model, the relationship between adherence (defined *a priori* as attendance at a minimum of 24 physical activity classes spread over at least 12 months) and individual, intervention-related and contextual factors was evaluated. We also conducted 40 semi-structured interviews with older adults (n=36) and instructors (n=4). Transcripts of the interviews were analyzed using content analysis to identify barriers and facilitators to adherence.

Results—Adherence to physical activity intervention was 42.6% (CI 95% 39.5 to 45.6). Depression, diabetes mellitus, percentage of impoverished households and rate of arrests for violent crimes in the neighborhood predicted less adherence ($p < 0.05$) while being retired, participation in physical activity prior to the intervention, and green areas per habitant were positively associated with adherence ($p < 0.05$). The qualitative interviews identified three primary

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Competing Interests

All authors declare that they have no competing interests.

Author's Contributions

A.D. Dangour and R. Uauy conceived and designed the CENEX study. D. Dangour C. Albala and R. Uauy applied for the funding. C. Albala, R. Uauy and M.L. Garmendia conceived the present manuscript. M.L. Garmendia wrote the first draft paper. P. Eguiguren provided qualitative studies expertise. E. Allen collaborated in data analysis. All authors read and approved the final version of the manuscript.

barriers to adherence: current health problems, lack of time due to commitments for caring for family members, and being employed, and two primary facilitators to adherence: the health benefits attributed to the intervention and the opportunity the classes provided for social interaction with others.

Conclusion—In order to enhance effectiveness of community exercise interventions, strategies to improve participation should be targeted to older adults from deprived areas and those with psychological and medical conditions.

Keywords

Patient Compliance; Aging; Physical activity

Introduction

The benefits of physical activity (PA) for the health and well-being of older people are well established [1–4]. Regular participation in physical activity, including aerobic and resistance activities confers protection from chronic diseases such as coronary heart disease, hypertension, type 2 diabetes, osteoporosis, colon cancer, anxiety, and depression [1,2]. Resistance training is particularly important in older adults because its role in increasing muscle strength and improving functional limitations [1,5]. Thus, PA interventions should be included in the promotion of healthy aging and preventing disease and disability among older people [6,7]. However, the effectiveness of any community level PA intervention depends on adherence. PA programs are known to have poor adherence: more than half of subjects who start a PA intervention abandon it within six months [8,9]. Thus, during the planning phase of PA interventions strategies that enhance participation in the target population should be considered [10]. PA interventions in older adults have identified that participants with a better health status, history of previous PA, non-smokers and higher self-efficacy are more adherents [11–13]. Environmental correlates of physical activity include transportation and recreational facilities, and aesthetics [14]. Most of existing studies have focused on developed countries, so they have limited ability to generalize to developing countries. To identify factors related to adherence is particularly relevant to the design of community-based interventions.

Chile, a post-transitional middle income Latin-American country, has experienced a rapid epidemiological and nutritional transition [15]. Between 2005 and 2007, we conducted a cluster randomized controlled trial of the effect of nutrition and physical activity interventions on measures of physical and functional health in older people (CENEX study) [trial registration: ISRCTN48153354] [16,17]. Using a combination of quantitative and qualitative methods to allow for a deeper and more rigorous analysis [18], the objective of this study was to identify factors associated with adherence at PA classes among older subjects from low and medium socioeconomic status participating in the CENEX study.

Materials and Methods

Quantitative methods

Design—This study was part of the CENEX study [16,17]. Briefly, CENEX was a cluster RCT in which primary care health centers (PCHC) were randomized to a nutritional supplementation program, a PA intervention, both interventions, and neither. PCHC were eligible if they were from a low-socioeconomic county in Santiago (main city of Chile) and had more than 400 persons aged 65.0-67.9 years. From a total of 36 PCHC, 20 were randomly assigned, using stratified random sampling, to one of the four treatment arms (n=5 per arm). Later, in order to increase power for the nutrition intervention outcome, eight PCHC were randomly assigned to the nutrition supplementation and the control arms; PA intervention remained as originally planned (n=10 PCHC). Per each PCHC, ~100 participants who fulfilled inclusion criteria, aged 65-67.9 years and residents within the catchment area of the PCHC, were randomly selected from the PCHC registries. Participant were excluded because of inability to walk, unplanned weight loss in the previous three months, planning to move house, and poor cognitive health (mini-mental state examination (MMSE) short-version score <13 and an 11-item Pfeffer screen score six or greater [19]). Excluded people were sequentially replaced following the same procedure. For the present analyses we consider all participants (n=996) who were assigned to the 10 PCHC randomized to the PA intervention. Assuming a power of 80%, $\alpha=0.05$, and a conservative adherence proportion of 50% this sample size allows detecting differences in adherence of 18% between exposed and non-exposed.

Intervention—The PA intervention was a progressive resistance exercise protocol with one-hour classes twice a week (total classes offered = 228) over two years, supervised by a PA instructor. The original protocol consisted of a routine of three levels of chair stands, three levels of modified squats (with or without Thera-bands), three levels of step-ups on a stair, and six sets of arm pull-ups using rubber bands with variable resistance. About 6 months after the start of the study, the protocol was revised following participant requests to include some recreational activities such as dance.

Variables—Adherence was defined a priori as registered attendance at a minimum of 24 PA classes spread over at least 12 months [17].

We selected a wide range of potential factors associated of adherence based on scientific knowledge and on our own hypothesis but considering if they could identify risk groups in which targeted interventions could be implemented in clinical or public health settings. Data collected included the following variables: 1. Individual factors: sex, years of education (>8 years), work status (working or retired), average household income (<US\$600/ U\$600), participation in community organizations/social clubs, self-perception of social support (have someone to turn to for help), care of relatives (spend more than four hours per week caring for grandchildren or other relatives), household composition (live alone/live with family), depression (score of 5 or more on the Yesavage Geriatric Depression Scale, 15-question version (GDS-15) [20]), self-report of chronic illness (osteoarthritis, hypertension, heart disease, stroke, chronic obstructive pulmonary disease (COPD), diabetes mellitus),

obesity ($>30 \text{ kg/m}^2$ [21]), current smoker, participation in physical activity prior to the intervention; 2. Intervention-related factors: user satisfaction in relation to the intervention, with a 1-7 point scale (7 = highest score), and distance from home to the PA center (in meters); and, 3. Contextual factors: impoverished households by neighborhood (%), community organizations by neighborhood (rate per 1,000 inhabitants), well-kept community green areas by neighborhood ($\text{m}^2/\text{inhabitant}$), and arrests for violent crimes by neighborhood (rate per 100,000 inhabitants).

Individual information was extracted from the baseline measurements from the CENEX study. User satisfaction was recorded in 742 of the 996 participants (74%) at 12 months of the intervention. Participants with and without user satisfaction data showed that subjects with missing data were significantly less adherent than participants who rated their satisfaction ($p<0.05$). Linear distance from home to the PA center was calculated by address using the geographical information system ArcView 3.3. Areas of influence were created for each PCHC with rings 10 meters apart up to a distance of four kilometers. We were able to achieve a match rate of just above 80% in the georeferencing process (i.e. to define a spatial position of a participant on the map); 195 (19.6%) participants were not analyzed further due to spelling inconsistencies in addresses and small streets with similar names. When we compared differences between geocoded and non-geocoded participants, we observed a significant lower adherence in participants without distance data ($p<0.05$).

Contextual information was obtained from the Urban Observatory of the Government of Chile for 2005 for the nine neighborhoods where PCHC are located [22].

Analysis—To assess the relationship between predictor variables and adherence, a multilevel logistic regression model was used to allow for clustering by PCHC. This model had two levels: an “individual” level, which included fixed-effect variables (individual, intervention, and context variables) and a “health center” level, which included a random intercept. In order to assess the correlation among participants within a PCHC (i.e. intra-class correlation coefficient, ICC) we ran a two-level null model without covariates. Variables were included in the final model if they correlated with the dependent variable in the univariate models at a $p\text{-value}<0.20$. The model that was significant with the fewest variables was selected, using the likelihood ratio test. All statistical analyses were carried out using Stata 10.0 (Statacorp. 2003).

Qualitative methods

Design—A convenience sample was selected from CENEX participants based on adherence (yes/no) and sex, resulting in four participant profiles: adherent men, adherent women, non-adherent men, and non-adherent women. The sampling was cumulative and sequential until sufficient data were collected to fulfill the study objective (data saturation). All five PA instructors who participated in the study were included as they were relevant actors with experience in intervention.

Areas of interest—Semi-structured interviews were used to collect data. A list of themes guided the interview. These included: exercise history, perception of self-care activities, motivation to participate, opinion about the PA intervention, self-evaluation of participation,

abilities, and achievements, perceptions about personal, familiar, or contextual factors influencing their adherence, and changes to the intervention the participant felt might have improved adherence.

Procedures—Potential participants were invited to participate by telephone. Data were collected in the homes of the older adults and instructors' workplaces after the PA intervention was finished. Thirty-six interviews with older adults were performed, at least six per profile. Four of the five PA instructors were interviewed.

Analysis—Interviews were taped and transcribed. The transcripts were analyzed using content analysis. The texts were organized to identify categories of facilitators and barriers of adherence, based on both explicitly stated and underlying significance. To ensure exhaustiveness, these categories included ideas defined based on the conceptual framework and new ideas that surfaced during the analysis. Using the constant comparison method, we sought to identify common points and differences among studied profiles, observing how given categories and factors were related to them. The sampling process was guided by this analytical work, initiated with the first interview, and stopped when the saturation point was reached.

Ethics and trial registration

The protocol for the CENEX study was approved by the Institutional Review Board at INTA, University of Chile, and by the LSHTM Ethics Committee. The protocol for the adherence study was approved by the Institutional Review Board at INTA, University of Chile.

Results

Quantitative results

Retired women made up the largest section of the total sample (Table 1) who in general reported low rates of participation in community organizations and who lived with relatives and spent several hours per week caring for family members. The sample had a high rate of chronic illness, especially hypertension. Most had not previously participated in exercise groups and more than 80% were overweight or obese (Table 1).

The distance from home to the PA center was variable, ranging from 30 meters to 3,480 meters. The average intervention rating was very satisfactory, and the percentage of participants with a satisfaction score of 7 was 87%. The low standard deviation found in contextual variables indicates low dispersion among neighborhoods (Table 2-3).

Adherence to PA intervention in the total sample was 42.6% (95% confidence interval: 39.5, 45.6). In the univariate models, 18 factors (12 of the individual, and all of the intervention and contextual variables) were associated with adherence at a p -value <0.20 (Tables 1-3) and these variables were included in multivariate analysis (distance to PA center and user satisfaction were not included in the final model because of missing data). In the multilevel regression model, the null model showed a very proportion of variance in adherence attributed to "health center" level (ICC= 0.014; data not shown).

Table 4 presents the results of the multilevel regression model of factors associated with adherence in the 914 participants with complete data. Of the individual variables, depression and self-report of diabetes mellitus were negatively associated with adherence while being retired and participation in physical activity previous to the intervention were associated with increased adherence. Among contextual variables, adherence was negatively associated with percentage of impoverished households and higher rate of arrests for violent crimes in the neighborhood and positively associated with the size of well-kept community green areas by inhabitant.

Qualitative results

The qualitative study revealed three main barriers to participation in PA among older adults: health problems, caring for family members, and working (Box 1). Chronic illnesses, mental health problems, osteoarthritis, and pain were major barriers to participation. Depression was also a barrier to PA mainly among the women. Those with osteoarthritis reported that poorly paved streets on route to the PA center created a fall risk, and that distance to the center was also a relevant factor. Many of the non-adherent women said that caring for family members was a barrier to class attendance. The instructors also perceived these domestic commitments as barriers to adherence. Men reported that the most common barrier to adherence was employment.

The analysis revealed two main facilitating factors for adherence to PA: the health benefits attributed to the intervention and the social interaction the participants enjoyed with the instructor and other class members. All older adults who adhered to the intervention highlighted these aspects. In terms of physical health, participants perceived improved mobility, agility, autonomy, and independence. The benefits of socializing were expressed repeatedly. The classes offered participants the opportunity to meet and interact with others and to feel part of a peer group. The sense of feeling productive and entertained by this activity was the main motivation for many older adults to attend. They had warm feelings towards their instructors and reported that the interaction and exchanges with the other participants were fundamental to the intervention's success. The barriers and facilitators perceived by the older adults were also identified by their instructors providing some external validity to these qualitative findings.

Discussion

In a large sample of low to medium socioeconomic status older people in Latin America we found that adherence to a physical activity community intervention was low (below 50%) and mainly defined by prior participation to PA and mental and physical health (i.e. depression, diabetes mellitus, etc.) of older people; characteristics of the neighborhood (i.e. poverty, violence, and green areas) were also important to ensure participation.

As in other studies [23,24], we found that in this population previous participation in PA classes was the most significant factor for ensuring adherence to the intervention-. This result is relevant because it suggests that the intervention failed in recruiting non-previously motivated older people. People with previous exercise history feel with higher self-efficacy for exercise what positively influence their future PA participation [25]. The challenge for

community exercise intervention trials is to reach non-motivated people and attract them to engage on regular PA; addressing the challenges associated with achieving this goal is of paramount importance to ensure effectiveness. Other studies have also found these results.

Being depressed or having diabetes mellitus were associated with 1.5 and 1.9-fold reductions in adherence, respectively. These findings are consistent with previous reports showing that current health status is one of the most important factors in initiating or maintaining PA in older adults [26,27,13]. Further, in the qualitative interviews, osteoarthritis and depression also surfaced as barriers to PA, the latter mainly among women. In contrast, improving physical and mental health was mentioned as an important facilitator for adherence to classes; those who could not overcome the initial barriers to class attendance were unaware of the potential benefits. Individuals with these conditions may have benefited most of the physical and mental benefits from the intervention. These findings have implications for healthcare providers. Interventions must be flexible, safe, and adapted to the illnesses and disabilities older adults face. Elderly attend frequently the PCHC for their health control, therefore it is important that healthcare professionals give exercise advice to the patients during their visits, particularly to those with chronic diseases and functional limitations [13,28].

Several contextual variables were also directly associated with adherence, and it is clear that safe neighborhoods, proximity to parks and social institutions and lower levels of deprivation seem to be particularly important in older adults [29–32]. However, enabling changes to environmental factors will pose great challenges that require the commitment of political and social actors.

Additionally, the qualitative study showed that the opportunity the intervention provided to meet and interact with others and to feel part of a peer group emerged as an important facilitator of adherence. The evidence also shows that positive reinforcement, social interaction, and leadership characteristics are positively correlated with adherence [33–35]. These results suggest the importance of adapting PA interventions to include enjoyable activities and promote social interaction to enhance participation.

Taken together, our results show that there are different levels of factors that influence adherence to physical activity. A comprehensive approach is therefore required in addressing, not only individual but also environmental, economic, and social factors to improve adherence. Interventions aimed at enhancing neighborhood inequalities (decreasing crime, more green areas), gender differences and social support might improve PA adherence in older adults particularly in developing countries.

This is the first time that factors associated with adherence to PA classes has been studied in such a large sample of older people in Latin America and this study provides high quality evidence on which to base the design of PA classes in these and other similar population groups. A major strength of this study was the use of a combination of quantitative and qualitative methods, and thus overcome some of the limitations of each approach when used separately. For example, gender differences emerged as an important issue in interviews; however, the variable sex was not significant at the statistical level in the quantitative study.

The large sample of subjects with an objective measurement of adherence is a further strength.

It is important to remark that given the homogeneity of our sample we were unable to assess some potential determinants of adherence such as income, education, and age. In terms of the intervention itself, we were not able to assess the relevance of different protocols (i.e. we had a single protocol) nor the satisfaction with the protocol proposed. Satisfaction with the protocol could only be measured in participants who attended PA sessions (~75% of total sample); therefore, this variable could not be included in the final model. Some of the individual predictors of adherence were self-reported nonetheless they were all measured previous to the intervention and therefore, response bias is unlikely. Finally, adherence to an intervention during two years may encompass two different groups of people: those who do not engage at all in the intervention and those who start but then do not continue. However, our overall attendance rate (24%) was similar throughout the study (i.e. first 6 months (28%), 6-12 months (32%), 12-18 months (27%), etc.) indicating that low adherence is not due to the length of the intervention but rather to the intervention itself.

In summary, our research provides high-quality evidence-based information on the barriers and facilitators that older people from a post-transitional country face in adhering to interventions promoting physical activity. In order to enhance effectiveness of community exercise interventions, evidence-based strategies to improve participation should be targeted to older adults from deprived areas and those with psychological and medical conditions. Ultimately, our results indicate that actions aimed to achieve active lives at young ages will be the more effective way of ensuring adequate PA throughout life.

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List of Abbreviations Used

PA	physical activity
RCT	Randomized Controlled Trial
PCHC	Primary Care Health Center
GDS-15	Yesavage Geriatric Depression Scale, 15-question version
COPD	chronic obstructive pulmonary disease
LSHTM	London School of Hygiene & Tropical Medicine
SD	standard deviation
OR	odds ratio

CI	confidence interval
OA	older adults
P	physical education instructors

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Box 1**Barriers and facilitators to adherence with physical activity among older adults in Santiago, Chile.****Barriers to adherence with physical activity**

Mental health problems and osteoarthritis

“I think that it was mainly depression, maybe on important dates like the anniversary of a spouse’s death, and some of them stopped coming” (P)

“In some cases the people had a lot of physical disability, for example people with hip replacements who were starting to have knee problems too, advanced arthritis, didn’t come” (P).

Caring for family members, especially among women.

“The thing is that we are grandmothers, and if your daughter has to do something, there goes grandma to take care of the children, or if she is sick or has to cook, and so you place a higher priority on being a grandmother, that’s what I think” (OA).

Working, especially among men.

“Because I’m also working, but I’m not always working, I only work when the catering company calls me, ... you know, to supplement my pension” (OA).

Facilitators to adherence with physical activity

The perceived benefits that the intervention provided,

“What did it do for me? It gave me energy and health, that’s how I would sum it up” (OA) “It impacted my physical condition, it made me work body parts that hadn’t moved in a while, so I felt better physically in general. The mental part was also important, meeting others from my neighborhood that I hadn’t had the chance to meet before” (OA).

The opportunity to meet and interact with other people *“This group allowed me to get together with people of my own age” (OA)*

“Being with other people, talking” (OA).

Between January and June 2008, semistructured interviews were carried out with 36 older adults (OA) and 4 physical education instructors (P) who participated in the CENEX controlled trial.

Table 1
Individual-level factors associated with physical activity adherence in older adults.

VARIABLES	N (%)	% Adherence (95% IC)	OR (95% CI)
Sex			
Male	304 (30.5)	43.4 (39.7, 47.1)	1.00
Female	692 (69.5)	40.8 (35.2, 46.3)	0.90 (0.68, 1.18)
Years of education			
8 years	398 (41.8)	42.8 (38.6, 46.9)	1.00
>8 years	554 (58.2)	43.0 (38.1, 47.8)	0.99 (0.77, 1.29)
Retired			
No	349 (35.0)	35.0 (29.9, 40.0)	1.00
Yes	647 (65.0)	46.7 (42.8, 50.5)	0.61 **** (0.47, 0.80)
Average household income			
>US\$ 600	234 (25.2)	44.4 (38.0, 50.9)	1.00
US\$ 600	694 (74.8)	42.1 (38.4, 45.8)	1.10 (0.82; 1.48)
Participation in community organizations			
Yes	374 (37.6)	46.0 (40.9, 51.1)	1.00
No	622 (62.5)	40.5(40.9, 51.1)	1.25 ** (0.97, 1.62)
Have someone to turn for help			
Yes	843 (84.6)	44.0 (40.7, 43.4)	1.00
No	153 (15.4)	34.6 (27.0, 42.3)	1.48 *** (1.03, 2.13)
Household composition			
Live with family	923 (92.7)	42.1 (39.0, 45.3)	1.00
Live alone	73 (7.3)	47.9 (36.2, 59.7)	0.79 (0.49, 1.27)
Spend more than four hours per week caring for grandchildren			
No	493 (49.8)	45.0 (36.0, 44.7)	1.00
Yes	498 (50.3)	40.4 (36.0, 44.7)	1.21 * (0.94,1.56)
Spend more than four hours per week caring for parents or in-laws			
No	879 (96.2)	41.5 (38.3, 44.8)	1.00
Yes	35(3.8)	51.4 (34.0, 68.8)	0.67 (0.34, 1.32)
Depression			
No	687 (69.2)	47.6 (43.9, 51.3)	1.00
Yes	306 (30.8)	31.4 (26.1, 36.6)	1.99 **** (1.50, 2.64)
Self-report of osteoarthritis			
No	604 (62.6)	41.4 (37.5, 45.3)	1.00
Yes	361 (37.4)	43.8 (38.6, 48.9)	0.91 (0.70, 1.18)
Self-report of hypertension			
No	364 (37.1)	44.5 (39.4, 49.6)	1.00
Yes	618 (62.9)	41.3 (37.4, 45.2)	1.14 (0.88, 1.48)
Self-report of heart disease			
No	836 (84.4)	43.9 (40.5, 47.3)	1.00

VARIABLES	N (%)	% Adherence (95% IC)	OR (95% CI)
Yes	155 (15.6)	36.1 (28.5, 43.8)	1.38 ** (0.97, 1.97)
Self-report of stroke			
No	954 (96.0)	42.5 (39.3, 45.6)	1.00
Yes	40 (4.0)	45.0 (28.9, 61.1)	0.90 (0.48, 1.70)
Self-report of chronic obstructive pulmonary disease			
No	834 (84.2)	43.0 (39.7, 46.4)	1.00
Yes	157 (15.8)	40.8 (33.0, 48.5)	1.10 (0.78, 1.55)
Self-report of diabetes mellitus			
No	780 (79.3)	45.0 (41.5, 48.5)	1.00
Yes	204 (20.7)	34.3 (27.7, 40.9)	1.57 *** (1.14, 2.16)
Participation in physical activity prior to the intervention			
No	907 (91.2)	39.4 (36.0, 42.7)	1.00
Yes	89 (8.9)	56.4 (49.2, 63.5)	0.50 **** (0.36, 0.69)
Obesity (>30/Kg/m ²)			
No	600 (64.0)	47.0 (43.0, 51.0)	1.00
Yes	338 (36.0)	41.4 (36.1, 46.7)	1.25 ** (0.96, 1.64)
Current smoker			
No	844 (84.8)	43.8 (40.5, 47.2)	1.00
Yes	151 (15.2)	35.1 (27.4, 42.8)	1.44 **** (1.01, 2.07)

*p < 0.2, **p < 0.1, ***p < 0.05, ****p < 0.01

Table 2
Intervention-related factors associated with physical activity adherence in older adults.

Variable	N (%)	Mean (SD)	OR (95% CI)
Distance from home to the physical activity center (meters)	801 (80.4)	910.0 (537.9)	1.00 (0.99, 1.00)
Satisfaction with the intervention	742 (74.5)	6.8 (0.7)	1.52 ^{***} (1.16, 1.99)

* p < 0.2, ** p < 0.1, *** p < 0.05, ****p < 0.01

Table 3
Contextual factors associated with physical activity adherence in older adults (n centers=9)

Variable	Mean (SD)	OR (95% CI)
Impoverished households by neighborhood (%)	5.6 (1.7)	1.08* (0.97,1.21)
Community organizations by neighborhood (rate per 1000 inhabitants)	5.8 (1.8)	0.87*** (0.78, 0.97)
Well kept community green areas by neighborhood (m ² /inhabitant)	2.3 (1.3)	1.14**** (1.14, 1.26)
Arrests for violent crimes by neighborhood (rate per 100,000 inhabitants)	2.9 (1.1)	1.08* (0.97, 1.21)

SD: standard deviation

*p < 0.2, **p < 0.1, ***p < 0.05, ****p < 0.01

Table 4
Multivariate regression model of factors associated with physical activity adherence in older adults

	OR	95% C.I.
<i>Individual level</i>		
Depression	0.53 ^{****}	0.40, 0.71
Self-report of diabetes mellitus	0.66 ^{***}	0.47, 0.92
Retired	1.55 ^{***}	1.17, 2.04
Participation in physical activity prior to the intervention	1.95 ^{****}	1.40, 2.71
<i>Contextual level</i>		
Impoverished households by neighborhood (%)	0.93 ^{****}	0.89, 0.98
Well kept greens areas by neighborhood (m ² /inhabitant)	1.25 ^{****}	1.07, 1.46
Arrests for violent crimes by neighborhood (rate per 100,000 inhabitants)	0.82 ^{***}	0.70, 0.96

* p < 0.2, ** p < 0.1, *** p < 0.05, ****p < 0.01