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Correlates of 1-year Incidence of Urinary Incontinence in Latino Seniors Enrolled in a Community-Based Physical Activity Trial

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Abstract

The prevalence of urinary incontinence (UI) among urban older Latinos is high. Insight into etiologies and contributing factors to the development of this condition is needed. This longitudinal cohort study identifies correlates of 1-year incidence of UI in community-dwelling Latino seniors participating in a senior-center-based physical activity trial in Los Angeles, California. Three hundred twenty-eight Latinos aged 60 to 93 years participating in *Caminemos*, a randomized trial to increase walking, were studied. Participants completed an in-person survey and physical performance measures at baseline and 1-year. UI was measured using the International Consultation on Incontinence item: “How often do you leak urine?” Potential correlates of 1-year incidence of UI included sociodemographic, behavioral, medical, physical, and psychosocial characteristics. The overall incidence of UI at 1-year was 17.4%. Incident UI was associated with older age, low levels of baseline activity of daily living impairment, health-related quality of life (HRQoL), and mean steps per day. Incident UI was also associated with

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increased depressive symptoms. Multivariate logistic regression models revealed improvement in physical performance score (odds ratio (OR) = 0.69, 95% confidence interval (CI) = 0.50–0.95) and highbaseline HRQoL (OR = 0.60, 95% CI = 0.40–0.89, and OR = 0.62, 95% CI = 0.43–0.91) were independently associated with lower rates of 1-year incident UI. An increase in depressive symptoms at 1-year (OR = 4.48, 95% CI = 1.02–19.68) was independently associated with a higher rate of incident UI. 1-year UI incidence in this population of urban older Latinos participating in a walking trial was high, but was lower among those who improved their physical performance. Interventions aimed at improving physical performance may help prevent UI among older Latinos.

Keywords

urinary incontinence; incidence; Latino; aging

INTRODUCTION

UI affects over 15 million people in the US and about 30–40% of the population aged 75 years and older. It can have adverse psychological, physical, and social effects including skin breakdown, recurrent urinary tract infections, impaired sleep, falls and fractures, social withdrawal, anxiety, depression, and institutionalization.¹ The cost of UI is expected to increase dramatically as the overall US population continues to age.

Annual incident UI in community-dwelling adults aged 60 years or older ranges from 8% to 18%.^{2,3} Incidence of UI in older women has been associated with poor general health, lower income, higher BMI, limited mobility, and depression.^{4,5} Although recent studies suggest that the risk factors for incident UI may vary according to racial or ethnic group, few studies report on the incidence in different ethnic groups.^{6–8}

Latinos currently represent 15% of the U.S. population and are the fastest growing group of Americans aged 60 years and older.⁷ Studies of UI in middle-aged and older Latinos indicate a similar or slightly higher prevalence of UI compared to non-Latino white women.^{8,9} Though Latinos are a heterogeneous group, it might be expected that Latinos would have higher rates of UI: Latinos are more likely to state that age-related changes (such as urinary incontinence) are an expected part of normal aging than non-Latinos¹⁰ and also experience lower rates of high quality care.¹¹ It is important to identify correlates of UI among older Latinos to design and implement appropriate interventions to prevent UI and its sequelae in this rapidly growing population.

The purpose of this study was to improve our understanding of UI and its predisposing characteristics among older Latinos. The prevalence of UI and its cross-sectional correlates among urban Latinos seniors enrolled in a randomized trial of a physical activity intervention, “*Caminemos*” was described previously.² This study took advantage of the longitudinal data from the *Caminemos* trial to accomplish the following specific aims: 1) measure 1-year incidence of UI; and 2) identify longitudinal correlates of 1-year UI incidence among urban Latino seniors.

METHODS

Sample

Baseline and one-year data from a trial of a behavioral intervention to increase walking among sedentary older Latinos in the greater Los Angeles area (*Caminemos*, [Clinicaltrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT00183014) Identifier: NCT00183014) were used for this study. Participants were recruited from 27 community-based senior centers between August 2005 and 2007. To be eligible, potential participants had to be 60 years and older, self-identify as Latino, be able to communicate verbally in English or Spanish, pass a six-item cognitive screening test,¹² and report exercising less than 20 minutes three times weekly. Of 1,217 potential participants screened, 572 (47%) met eligibility criteria, completed informed consent, and enrolled in the *Caminemos* trial. Detailed study design and the demographic data for the 572 participants are presented elsewhere.² For the current analysis focused on UI incidence, subjects were excluded if they had UI at baseline (n=154) or if they did not complete the 1-year survey (n=90). Therefore, 328 participants were included in the analytic sample, 57% of the original sample in the randomized trial.

Data Collection

After completion of informed consent and prior to randomization, each enrolled participant completed a 1:1 in-person baseline interview survey conducted by a trained bilingual research associate, as well as a brief physical examination and a series of standardized physical performance measures (see below). Data collection was repeated after 1 year. All staff conducting data collection was blinded to which study arm the participant was in. The University of California at Los Angeles Office for the Protection of Research Subjects (IRB Board) approved the study.

Measures

Primary Construct Of Interest: Incontinence—UI was measured using an item from the International Consultation on Incontinence Questionnaire: “How often do you leak urine?”¹³ There were six possible responses: never, less than one time per week, two to three times per week, once per day, several times per day, or all the time. Participants who responded anything other than “never” were classified as having UI.

Sociodemographic Characteristics—Age, sex, marital status, level of education, and income were measured at baseline using standard previously tested measures. Acculturation was assessed using the Marin Short-Acculturation Scale, which attempts to capture the extent to which Latinos have adapted to the mainstream American (non-Latino) culture. Since Latinos are known to be more likely to attribute age-associated problems to normal aging, more acculturated Latinos might be more likely to state they have UI. Scores on this instrument range from 1 (no evidence of acculturation) to 5 (most acculturation).¹⁴ Because 46% of the sample scored the lowest possible score on this measure (1), acculturation was dichotomized into any (scores >1) versus none (score = 1).

Behavioral Characteristics

Body Mass Index (BMI): Because obesity is a construct that is amenable to behavioral change, BMI was categorized with other behavioral constructs. Height and weight were collected following a standardized protocol and were used to calculate BMI (kg/m²). BMI was divided into four categories (18.5 kg/m² (underweight), 18.6–24.9 kg/m² (normal weight), 25.0–29.9 kg/m² (overweight), and >30.0 kg/m² (obese)) according to the World Health Organization criteria.¹⁵ A BMI difference score was calculated by subtracting the baseline score from the 1-year score. Interrater reliability for baseline BMI on a random 10% of participants was 0.99 ($P<.001$) for height and weight.

Smoking History: Smoking history was assessed from the Behavioral Risk Factor Surveillance System Survey Questionnaire.¹⁶

Medical Characteristics—The modified Charlson Comorbidity Index¹⁷ quantified the number of comorbid conditions: hypertension; myocardial infarction; congestive heart failure; stroke or transient ischemic attack; diabetes mellitus; arthritis; hip fracture; wrist, arm, or spine fracture; asthma, emphysema, chronic obstructive pulmonary disease, or chronic bronchitis; cirrhosis or liver disease; cancer (other than skin); Parkinson's disease; lower extremity bypass; Alzheimer's disease or dementia; depression; and anxiety.

Physical Performance, Function And Activity Characteristics

Physical Performance: Physical performance was assessed using Guralnik's Short Physical Performance Battery¹⁸ following a standardized protocol measuring balance, gait, strength, and endurance. A summary score was calculated by summing categorical rankings of performance on each test. A random 10% of participants had baseline tests measured twice; interrater reliability was 0.99 ($P<.001$). A physical performance difference score was calculated by subtracting the baseline score from the 1-year score.

Activities Of Daily Living: The activity of daily living (ADL) summary scale was used to assess difficulty performing sixteen basic tasks.¹⁹ Results were dichotomized into the absence or presence of ADL impairment at baseline and 1-year. Changes in ADL impairment from baseline to 1-year were determined.

Steps Per Day: Physical activity is a marker of better health and mobility that we would expect to be associated with lower rates of UI. Each participant was given a Digiwalker™ pedometer and instructed to wear it on their waist at all times other than bathing or sleeping for an entire week prior to the scheduled data collection. The display on the pedometer was covered by a fabric case to minimize the effect of the pedometer as a motivational tool rather than simply a measure of walking level. At the time of data collection trained research staff downloaded the pedometer data to a computer using Digiwalker™ software that counted the steps recorded each day. Mean steps per day over the previous week were calculated at baseline and 1-year. A pedometer difference score was calculated by subtracting the baseline from 1-year score.

Psychosocial Characteristics

Health-Related Quality Of Life: Responses from the Medical Outcomes Study 12-item Short Form Survey (SF-12)²⁰ were used to compute a Physical Component Summary (PCS-12) and a Mental Component Summary (MCS-12) using standardized weights with a mean of 50 and a standard deviation of 10. The PCS-12 and MCS-12 difference score was calculated by subtracting baseline from 1-year scores.

Depressive Symptoms: The five-item Geriatric Depression Scale (5-item GDS) was dichotomized at less than 2 versus 2 or higher; this cut point has a sensitivity of 97% and a specificity of 85% for clinical depression.²¹ Increases in depressive symptom score from less than 2 to 2 or higher from baseline to 1-year were recorded.

Analysis

The rate of incident UI was calculated using simple descriptive statistics. Bivariate associations between 1-year incident UI and potential correlates were tested using the Pearson chi-square test for categorical variables and the Student *t*-test for continuous variables. Significance was set at $P < .05$. Potential correlates included all baseline characteristics described above as well as change scores between baseline and 1-year values of the following characteristics: ADL, BMI, mental and physical HRQoL, physical performance, mean steps per day, and depressive symptoms.

Hierarchical multivariate logistic regression models were constructed to estimate odds ratios (ORs) and 95% confidence intervals (CIs) for incident UI using SPSS 18 (SPSS: An IBM company, Chicago, IL). With 15 variables in the final model and an adjusted R-squared of 0.1 to 0.3 we had 90–99% power to detect significant associations using an $\alpha = .05$. We constructed a series of hierarchical models, including different combinations of potential correlates of incident UI: 1). Baseline sociodemographic characteristics, 2). Baseline sociodemographic, behavioral and medical characteristics, 3). All the variables included in model 2 as well as baseline physical and psychosocial characteristics; 4) All the variables included in model 3 except that baseline characteristics were replaced with change scores (baseline score subtracted from follow-up score) for physical HRQoL, mental HRQoL, physical performance, BMI, pedometer reading, depression, and activity of daily living (ADL) impairment. We also adjusted all models for subject choice of survey language (English or Spanish) and clustering according to senior center site.

RESULTS

Mean age of the 328 participants at baseline was 72.5 years (range 60–93). Seventy-five percent of participants were female and 14.3% had been hospitalized in the previous 6 months (Table 1). The rate of incident UI at 1-year was 17.4%, with 18.5% of women and 13.8% of men reporting 1-year incident UI ($P = .33$ for difference between groups). Severity of incident UI was less than one time per week for 4.6% of entire sample, two to three times per week for 2.1%, daily for 3.4%, several times per day for 5.5% and all the time for 1.8% of the entire sample. Table 1 shows the characteristics of the study participants according to UI-incidence.

Baseline Correlates of Incident UI

Sociodemographic and baseline characteristics associated with incident UI at 1-year on unadjusted bivariate analysis ($P < .05$) included older age (years), lower number of mean steps per day, lower physical and mental HRQoL (scored on a continuous standardized scale), and ADL impairment (left-most column of Table 2). The results from hierarchical models are also shown in Table 2. The fully adjusted model using baseline but not change characteristics (model 3) revealed that higher physical and mental HRQoL were independently associated with a lower risk of incident UI (OR = 0.60, 95% CI = 0.40–0.89, and OR = 0.62, 95% CI = 0.43–0.91). Age, ADL impairment, and mean steps per day were correlated with UI on bivariate analysis but did not maintain statistical significance in the multivariate model. Medical comorbidity was not associated with 1-year incident UI. Of the 328 subjects, 17 (5%) reported cerebral vascular disease and 111 (34%) reported diabetes. For both cerebrovascular disease and diabetes, rates of UI were essentially the same between groups with and without these conditions (for CV Dz, 23% vs. 17%, chi-square p-value = 0.50; for diabetes, 17% vs. 17%, chi-square p-value = 0.93).

Change-Score Correlates

Change scores associated with incident UI on unadjusted bivariate analysis ($P < .05$) included an increase in depressive symptoms (5-item GDS) at 1-year from less than 2 to 2 or higher. The fully adjusted multivariate model including change scores (model 4) revealed that an increase in depressive symptoms was independently associated with a higher rate of incident UI (OR = 4.48, 95% CI = 1.02–19.68), and an increase in physical performance score at 1-year was associated with lower rates of incident UI (OR = 0.69, 95% CI = 0.50–0.95).

Weight gain of >5% at 1-year approached but did not reach statistical significance as an independent correlate of incident UI (OR = 2.55, 95% CI = 0.96–6.75). None of the other change-scores were found to have an association with 1-year incident UI.

DISCUSSION

In this sample of urban older Latinos participating in a senior-center based clinical trial of an exercise intervention in the greater Los Angeles region, overall 1-year incidence of UI was 17.4%, with 18.5% of women and 13.8% of men reporting new UI. This incidence rate is consistent with other studies that have shown annual incident UI rates of 8% to 18% among community-dwelling adults aged 60 years or older,² but higher than the rate of 11.5% found in Hispanic Established Populations for Epidemiologic Studies of the Elderly (EPESE) using a very different measure of UI.³ In the multivariate models adjusting for sociodemographic, behavioral, medical, physical, and psychosocial characteristics, we found that improvement in physical performance score at 1-year and higher baseline HRQoL were independently associated with lower rates of incident UI. In addition, an increase in depressive symptoms at 1-year was independently associated with a higher rate of incident UI.

Decreased general health, obesity, and poor baseline physical performance measures have been previously observed to be associated with incident UI.^{2,3,5} However, this is the first empiric study to show that an improvement in physical performance over time is associated

with lower incidence of UI. Physiologically this might occur by seniors being more easily able to get to the toilet in a timely manner or through a pathway in which overall physical fitness improves bladder stability as well. Though not conclusive, this new finding suggests that it might be possible to prevent or forestall UI among older Latinos by improving physical performance. Improvement in physical performance was experienced by 62% of the sample, with 26% of the sample increasing their scores on the summary scale by 2 points, a level likely to be associated with lower rates of disability.²² While one might argue that physical performance is a marker of overall health status rather than a modifiable “outcome,” an increasing body of data suggests that older adults can successfully improve their physical performance with focused interventions.^{23,24} In the landmark “PREHAB” intervention of 188 frail adults aged 75 and older, Gill et al.²³ found in their randomized controlled trial that balance and conditioning exercises performed over 6 months led to sustained increases in physical function and an improvement of 15.6% over the control group in the modified Physical Performance Test score at 12 months. Another randomized control trial evaluated the benefit of power and strength training in 39 community-dwelling adults aged 65–90 years over 4 months.²⁴ Physical Functional Performance Test total score was significantly greater for the power training group than in the strength training ($P=.03$) and control ($P=.02$) groups. The study concluded that power training was more effective than strength training for improving physical function in community-dwelling older adults. In light of our finding that increasing physical performance is associated with lower UI incidence, further investigations should examine whether interventions similar to the Gill and Misko interventions can also decrease UI incidence.

A robust association was found between an increase in depressive symptoms at 1-year and incident UI. Worsening of depressive symptoms was experienced by 94/328 (29%) of the sample. Among these, 29 (31%) scored >2 on the 5-item GDS, indicating high likelihood of clinical depression.²¹ However, baseline higher depression symptom score was not significantly associated with incident UI. Depression is a well-recognized risk factor for UI in nursing home residents, the elderly, and those admitted for hip fracture.²⁵ Depression has also previously been described in 60% of those with idiopathic urge incontinence,²⁶ however, the causal mechanism is not clear. To date there is contradicting literature on whether depressive symptoms occur as a cause of incontinence, or vice versa.²⁷ Although UI may lead to depression and social withdrawal, there is some evidence that bladder overactivity may be related to a decline in serotonin function,²⁶ (commonly seen in depression) or an alteration in dopamine neurotransmitter function.²⁸ It is possible that after the start of the *Caminemos* trial, some participants were subsequently diagnosed with depression and treated with antidepressants, altering the neurotransmitter levels in the bladder; unfortunately it is a limitation of this study that we do not have data on whether subjects were taking antidepressant medication. This could be why an increase in depression symptom score at 1-year was found to be a significant correlate of incident UI, but baseline depression symptom score was not. It is also possible that common medical conditions, such as stroke, could predispose older adults to both depression and UI, and that the depression and UI were part of a “symptom cluster.” There is already a known association between physical performance and depression in the elderly.²⁹ Exercise and strength training may

therefore have an enhanced potential to positively impact both depression and UI concomitantly.

The association between UI and HRQoL has been previously recognized.^{2,9,27} In this study, the fully adjusted model (model 3) showed a significant independent association between higher baseline physical and mental HRQoL and a lower incidence of UI at 1-year. Poor QoL is generally considered to represent multiple contributing physical and psychological factors. Even after controlling for medical comorbidity, ADL function and depressive symptoms, HRQoL scores at baseline remained significantly correlated with incident UI, suggesting that people with new UI have lower QoL for other reasons beyond UI's effect on function and mood.

Obesity is associated with multiple medical comorbidities and weight loss of 5–10% is known to improve physical health and hypertension, hyperglycemia and hyperlipidemia, reduce the risk of type 2 diabetes, and result in improve QoL.³⁰ Although it is well established that obesity can also cause UI or contribute to the condition's severity,^{4,5} our study did not show BMI or gain of >5% body weight to be a significant correlate of incident UI. However, the trend towards incident UI with >5% gain in body weight was strong and it is possible that had we had greater power with a larger sample we would have found an association. This trend should be further evaluated in future studies since obesity is so prevalent and weight reduction may be an effective treatment for overweight and obese women with UI.

Some important bivariate correlates did not maintain statistical significance in the multivariate models, including older age, baseline ADL impairment, and mean steps per day. Most likely other constructs, most notably the physical performance score, captured the impact of these factors. In contrast to cross-sectional associations with prevalence of UI reported earlier,² neither the Charlson Comorbidity Index, the presence of cerebrovascular disease, nor the presence of diabetes correlated with 1-year incident UI. The cross-sectional association may demonstrate the cumulative effect of years of chronic diseases, such as diabetes mellitus and vascular disease, and their effect on the innervation of the lower urinary tract leading to UI. It is possible that those who were susceptible to these effects had already reported UI at baseline and thus were not in our sample. Alternatively, because the Charlson Comorbidity Index was only assessed at baseline it is possible that many participants experiencing incident UI had new comorbidity such as stroke that we did not measure and this could account for the lack of an observed association. It is also interesting to note that unlike in other studies, neither cerebrovascular disease nor diabetes were associated with incident UI, possibly

Major limitations of this study include selection bias, attrition, and possible measurement error. Our sample was made up of ambulatory Latinos in a single geographic area recruited from community centers for a physical activity trial. Senior Latinos who were less likely to go to a senior center or in poorer health in nursing care or at home may have led to an underestimation of true UI incidence. Missing data (18% missing in Model 4) may have biased our findings either towards or away from the null hypotheses depending on whether the subjects missing data experienced the variables of interest in the direction we observed

to be associated with UI. Also, there was no physical exam conducted; these data are based on self-reported instruments and as such are subject to recall and social desirability bias. Another limitation of the study is the absence of questions to separate urge and stress UI, which may have different risk factors and etiologies. This study's use of a single-item measure of UI modified from the 4-item ICIQ with previously unmeasured validity may have resulted in a different outcome than those from another UI measure. It is also important to point out that this study identifies correlates of any UI, but there may be different correlates of having UI less than once per week versus all the time. Future studies should also examine whether a change in living situation, for example moving from independent living to relying on others for access to a toilet contributes to incident UI.

CONCLUSION

The 1-year incidence of UI among community-dwelling urban older Latinos was high with 18.5% of women and 13.8% of men reporting incident UI at 1-year follow-up. The robust associations between incident UI and HRQoL, worsened depressive symptoms, and improved physical performance highlights the potential impact of interventions to improve physical performance and decrease depressive symptoms upon rates of UI.

Future studies should examine whether focusing on improving physical performance measures in the elderly may be a powerful way to prevent and treat UI among sedentary urban older Latinos.

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Table 1

Baseline Characteristics of Participants (N=328)

Characteristic	ALL (N=328)	No Urinary Incontinence at 1 year (N=271, 82.6% of sample)	Urinary Incontinence at 1 year (N=57, 17.4% of sample)
	N(%)	N(%)	N(%)
Mean age	72.5	72.1	74.5
Gender			
Male	80 (24.4)	69 (25.5)	11 (19.3)
Female	248 (75.6)	202 (74.5)	46 (80.7)
Marital status			
Never married	42 (12.8)	35 (12.9)	7 (12.3)
Married	101 (30.8)	82 (30.1)	19 (33.3)
Divorced / separated	74 (22.6)	59 (21.8)	15 (26.3)
Widowed	111 (33.8)	95 (35.5)	16 (28.1)
Living situation			
Spouse or family	200 (61.3)	161 (60.0)	39 (68.4)
Alone	126 (38.7)	108 (40.0)	18 (31.6)
Income			
< 5,000	50 (16.7)	43 (17.0)	7 (15.2)
5,000–9,999	91 (30.4)	74 (29.2)	17 (37.0)
10,000–19,999	96 (32.1)	84 (33.2)	12 (26.1)
20,000–29,999	45 (15.1)	37 (14.6)	8 (17.4)
30,000	17 (5.7)	15 (5.9)	2 (4.3)
Education			
No schooling	41 (12.5)	31 (11.4)	10 (18.5)
8 th grade	196 (59.8)	165 (60.9)	31 (57.4)
High school	91 (27.7)	75 (31.1)	13 (24.1)
Acculturation, n			
=1	187 (57.0)	155 (57.2)	32 (56.1)
>1	141 (43.0)	116 (42.8)	25 (43.9)

Characteristic	ALL (N=328)	No Urinary Incontinence at 1 year (N=271, 82.6% of sample)	Urinary Incontinence at 1 year (N=57, 17.4% of sample)
Lifetime Smoking, cigarettes, n			
<100	207 (63.1)	176 (64.9)	31 (54.4)
>100	121 (36.9)	95 (35.1)	26 (45.6)
Hospitalization in past 6 months			
No	281 (85.7)	229 (84.5)	52 (91.2)
Yes	47 (14.3)	42 (17.4)	5 (8.8)
ADL impairment			
No	238 (72.8)	205 (75.6)	33 (58.9)
Yes	89 (27.2)	66 (24.4)	23 (41.1)
Number of comorbid conditions, n			
<3	180 (54.9)	152 (56.1)	28 (49.1)
3	148 (45.1)	119 (43.9)	29 (50.9)
Depressive symptoms, n			
<2	254 (77.7)	213 (78.9)	41 (71.9)
2	73 (22.3)	57 (21.1)	16 (28.1)
Body mass index, kg/m²			
18.5 (underweight)	1 (0.3)	1 (0.4)	0
18.6–24.9 (normal)	61 (18.6)	55 (20.4)	6 (10.5)
25–29.9 (overweight)	118 (36.0)	96 (35.6)	22 (38.6)
30 (obese)	147 (44.8)	118 (43.7)	29 (50.9)
Mean steps per day (±standard deviation)	3207 (2000)	3342 (2052)	2555 (2198)

Table 2

Incident UI at 1-year According to Bivariate and Multivariate Regression Analyses

Variable	Bivariate Model [†]	Odds Ratio (95% CI)			
		Model 1 (n = 328)	Model 2(n = 326) [‡]	Model 3(n = 315) [§]	Model 4(n = 269)
Age	1.05 (1.01–1.10)*	1.05 (1.01–1.10)*	1.06 (1.01–1.11)*	1.05 (1.00–1.10)	1.04 (0.99–1.09)
Female (reference male)	1.43 (0.70–2.91)	1.42 (0.69–2.91)	1.80 (0.82–3.95)	1.68 (0.70–4.00)	1.88 (0.79–4.45)
Education (reference no schooling)					
8th grade	0.58 (0.26–1.31)	0.62 (0.27–1.41)	0.67 (0.29–1.58)	0.69 (0.28–1.74)	0.76 (0.28–2.03)
Some high school or other	0.66 (0.27–1.62)	0.71 (0.27–1.90)	0.84 (0.31–2.32)	1.01 (0.34–2.96)	0.82 (0.26–2.62)
Acculturation	1.04 (0.59–1.86)	0.99 (0.52–1.90)	0.92 (0.48–1.78)	0.98 (0.49–1.99)	1.07 (0.51–2.24)
BMI (reference normal or underweight)					
Overweight	2.14 (0.82–5.59)		2.37 (0.88–6.35)	2.25 (0.80–6.30)	
Obese	2.29 (0.90–5.84)		2.51 (0.96–6.56)	1.87 (0.67–5.17)	
Medical comorbidity (reference <3)	1.32 (0.75–2.34)		1.20 (0.66–2.20)	0.73 (0.36–1.50)	1.42 (0.72–2.79)
Tobacco lifetime use (reference <100)	1.55 (0.87–2.77)		1.92 (1.02–3.63)*	1.90 (0.95–3.80)	1.72 (0.85–3.49)
BASELINE CHARACTERISTICS					
ADL Impairment (reference = none)	2.17 (1.19–3.95)*			1.14 (0.50–2.61)	
Mean steps per day [#]	0.62 (0.44–0.89)*			0.80 (0.54–1.19)	
Physical performance score [#]	0.77 (0.58–1.03)			1.22 (0.84–1.75)	
Physical HRQoL [#]	0.60 (0.45–0.80)*			0.60 (0.40–0.89)*	
Mental HRQoL [#]	0.69 (0.52–0.92)*			0.62 (0.43–0.91)*	
5-item Geriatric Depression Scale score 2 (reference <2)	1.46 (0.76–2.79)			0.72 (0.31–1.69)	
CHANGE-SCORE CHARACTERISTICS					
New ADL impairment developed at 1-year	1.85 (0.84–4.06)				1.13 (0.42–3.03)
Changes in body mass index	1.20 (0.99–1.45)				1.27 (0.96–1.68)
Changes in physical performance score [#]	0.76 (0.56–1.03)				0.69 (0.50–0.95)*
Changes in physical HRQoL [#]	0.81 (0.59–1.10)				0.80 (0.54–1.19)
Changes in mental HRQoL [#]	0.97 (0.74–1.31)				0.96 (0.67–1.36)

Variable	Odds Ratio (95% CI)				
	Bivariate Model [†]	Model 1 (n = 328)	Model 2(n = 326) [‡]	Model 3(n = 315) [§]	Model 4(n = 269) [¶]
Changes in 5-item Geriatric Depression Scale	5.12 (1.43–18.30)*				4.48 (1.02–19.68)*
Changes in mean steps per day [#]	1.02 (0.92–1.14)				1.03 (0.91–1.15)

* P<0.05.

[†] Bivariate model: logistic regression analyses included one variable at a time.

[‡] Model 1 plus body mass index (BMI), medical comorbidity, and tobacco use.

[§] Model 2 plus baseline scores for pedometer reading, physical health-related quality of life (HRQoL), mental HRQoL, physical performance, and depression.

[¶] Model 3 replacing baseline scores with change scores for physical HRQoL, mental HRQoL, physical performance, BMI, pedometer reading, depression, and activity of daily living (ADL) impairment.

[#] Point estimates based on continuous scores, standardized using weights with a mean of zero and a standard deviation of one.