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The Impact of Exercise on Depressive Symptoms in Older Hispanic/Latino Adults: Results from the "¡Caminemos!" Study

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Abstract

Objectives—Older Hispanic/Latino adults are more likely to be sedentary and display higher rates of depression compared to aged-matched peers of European descent. A critical factor may be that older Hispanic/Latino adults have lower expectations for aging, i.e., they are more likely to attribute age-associated problems such as disability and depression to aging. Thus, we examined the prospective effects of an evidence-based exercise intervention on depressive symptoms in older Hispanics/Latinos and the potential synergistic effects (if any) of an attribution-retraining component to counter negative ascriptions to the aging process.

Method—We analyzed baseline, 1-, 12-, 24-month data collected from Hispanics/Latinos 60 years participating in an exercise intervention (¡*Caminemos*!) across 27 senior centers (N=572). All participants were given 4 weekly 1-hour group-based exercise classes targeting strength training, endurance, balance and flexibility. In addition, they were randomly assigned to one of two conditions: a) treatment group—a 1-hour attribution retraining session in which participants were taught that aging does not mean one inevitably becomes sedentary, or b) control group—generic health education. The Geriatric Depression Scale was used to assess depressive symptoms. Covariates included age, sex, education, income, marital status, acculturation, and number of chronic conditions.

Results—In prospective analyses, participants in both trial arms displayed lower scores for depressive symptoms at the 12- (β_1 =-0.17, p=0.04) and 24-month (β_2 =-0.33, p<0.001) follow-up periods when compared to baseline values.

Conclusion—Given expected growth of the older Hispanic/Latino adult population, exercise programs are a promising potentially cost-saving strategy in maintaining and promoting favorable mental health.

Disclosure of Interest

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Keywords

older Hispanic/Latino adults; depressive symptoms; exercise intervention; randomized trial; age reattribution

INTRODUCTION

Depression is the leading cause of disability worldwide and is associated with a high burden of mortality (Ferrari et al., 2013; Walker, McGee, & Druss, 2015). Clinically diagnosed depression and subclinical presentation of symptoms have been associated with a number of deleterious health-related effects including decreased quality of life, increased morbidity/ mortality, and increased healthcare expenditures (Pan, Sun, Okereke, Rexrode, & Hu, 2011). Disparities in the prevalence of depressive symptoms and rates of treatment exist by race/ ethnicity in the United States. Compared to non-Hispanic White and Black counterparts, Hispanic/Latino older adults are twice as likely to experience elevated symptoms of depression, with an 11.4% prevalence rate (Strine et al., 2015). Physical exercise is known to be an effective non-pharmacological treatment (Josefsson, Lindwall, & Archer, 2014). Considerable evidence exists on the preventative and therapeutic effects that physical activity confers to mental health and overall emotional well-being. Yet, Hispanic/Latino older adults are considerably less physically active compared to their aged-matched peers of European descent (August & Sorkin, 2011). Moreover, they experience significant disparities in access to and treatment for psychological distress (Rodriguez-Galan & Falcón, 2009). These phenomena coupled with the expected population growth of Hispanic/Latino older adults (Ortman, Velkoff, & Hogan, 2014) signals the necessity to understand how to meet the needs of an underserved segment of the U.S. population over the coming years.

Older Hispanic/Latino adults report lower expectations for aging, which may contribute to existing health-related inequalities (Shunkwiler, Mangione, & Sarkisian, 2003). For instance, they are more likely to assume that normative aging includes sedentarism, disability, and depression. Goodwin and colleagues found that older Hispanic/Latino adults were more likely to have fatalistic views about their health and to be more likely to attribute health problems to old age than non-Latino adults (Goodwin, Black, & Satish, 1999). Previous work suggests that having lower expectations regarding aging is associated with low physical activity levels, independent of age, physical and mental health status, and depression (Sarkisian, Prohaska, & Mangione, 2003).

Associating health-decline to the aging process can prove to be a self-fulling prophecy. Attribution theory of achievement motivation asserts that stable and immutable attributions negatively affect motivation and overall change behavior (Weiner, 1985). Indeed, viewing the aging process as a downward spiral may foster sedentarism and exacerbate the comorbid emergence of psychological distress. Hispanic/Latino older adults may benefit from an intervention aimed at raising aging expectations and increasing walking levels, which could have a salutatory effect on psychological ill-being and distress. Therefore, we examined the prospective effects of an evidence-based exercise intervention (¡Caminemos!) on depressive

symptoms in older Hispanic/Latino adults and the potential synergistic effects (if any) of an attribution-retraining component to counter negative ascriptions to the aging process.

MATERIALS AND METHODS

Study Population and Data Source

Conducted between August 2005 and 2009, the "¡Caminemos!" study is a double-blind randomized control trial (RCT) that assigned participants to receive either age reattribution training or generic health education, both in the context of a group-based exercise program [clinical trials.gov identifier: [NCT00183014]. The primary aim of the trial was to improve walking behavior and reduce bouts of sedentarism. Details of the study design for the "¡Caminemos!" trial have been previously published. Briefly, a total of 572 older Hispanic/ Latino adults were recruited from across 27 senior centers in the greater Los Angeles region. Inclusion criteria were as follows: (a) self-reported Hispanic/Latino heritage, (b) age 60 years, (c) conversational fluency in either English or Spanish, and (d) adequate cognitive functioning as measured using the Six-Item Screener (Callahan, Unverzagt, Hui, Perkins, & Hendrie, 2002). Survey and clinical exam data to assess intervention effects were collected in-person by a trained bilingual staff member at baseline, 1-, 12-, and 24-months. Participants were excluded if they were already participating in 20 minutes or more of physical activity at least 3 days a week. Approval for the "¡Caminemos!" study was obtained through the Institutional Review Board of the University of California at Los Angeles with written informed consent provided by all enrolled participants.

The final sample for the current study was limited to those with complete data on main variables of interest as collected at baseline (n=569). Sample reduction was a consequence of one participant missing data for the Geriatric Depression Scale (Hoyl et al., 1999) and two who did not report their current marital status.

Randomization and Study Treatment

After baseline assessments were completed, enrolled participants were randomized at the individual level in a 1:1 ratio using a random number sequence generator derived using SAS programming. The trial had two distinct arms. Specifically, participants were randomly assigned to either the intervention group—consisting of 4 weekly 1- hour group sessions teaching attribution retraining techniques to raise expectations for aging—or the control group who instead received 4 weekly 1-hour health education lectures. The goal of attribution retraining is to raise expectations for aging so that older adults do not attribute mutable age-associated conditions to aging. After attending their randomly assigned 1-hour group sessions (i.e., attribution retraining vs. health education), participants in both arms of the study participated in a 1-hour exercise class taught by a certified instructor. Therefore, the study arms were as follows: A) (intervention arm) receiving the group-based "attribution retraining" sessions and a 1-hour exercise class; B) (control arm) receiving a series of health education lectures and a 1-hour exercise class (with same frequency as the intervention group). The exercise class was a modified version of Enhance Fitness (previously Lifetime Fitness), administered by Senior Services of Seattle/King County, an evidence-based program including strength, endurance, and flexibility training, designed to be safe for

seniors with a wide range of physical abilities. Classes were weekly for the first month, then monthly for the next 11 months.

Study Measures

Depressive Symptoms—The 5-item Geriatric Depression Scale (GDS) was used to assess depressive symptoms at baseline and follow-up (1-, 12-, and 24-months) (Hoyl et al., 1999). Previous psychometric testing identifies the GDS as a valid and reliability instrument for use in older adult populations and in the Spanish language (Hoyl et al., 1999; Ortega Orcos, Salinero Fort, Kazemzadeh Khajoui, Vidal Aparicio, & de Dios del Valle, 2007). The scale consists of dichotomous (yes/no) response options to questions such as, "Are you basically satisfied with your life?" The GDS total score was treated as either a continuous score (0 to 5) and/or dichotomized to distinguish those with low versus elevated levels of depression (i.e., 2 classified as screening positive for depression).

Covariates—Covariates included baseline age [in years], sex [male, female], educational attainment [8th grade; some high school; high school/GED or more], income [<\$5,000; \$5,000 to <\$7,500; \$7,500 to <\$10,000; \$10,000 or more; not reported], and marital status [never married, married, separated/divorced, or widowed]. We additionally considered self-reported medical comorbidities at baseline as captured using a modified version of the Charlson Comorbity Index (Katz, Chang, Sangha, Fossel, & Bates, 1996) and levels of acculturation (Marin, Sabogal, Marin, Oterosabogal, & Perezstable, 1987). The following medical comorbidities were considered: hypertension, heart attack, congestive heart failure, stroke, diabetes, arthritis, hip fracture, fracture of the wrist/arm/spine, asthma or chronic obstructive lung disease, psoriasis, cancer, and bypass surgery.

Statistical Analyses

Descriptive statistics summarizing baseline characteristics for the final sample are reported for socio-demographic factors and medical comorbidities with stratification by depression status. Group differences in participant characteristics by depression status were examined using t-tests and χ^2 -tests as appropriate. Data analyses were conducted using statistical software (Stata/SE 14.2).

Mixed-effects linear regression models were used to analyze longitudinal changes in depressive symptoms as a result of intervention assignment, i.e., treatment vs. control arm (Verbeeke & Molenberghs). Across modeling procedures, depressive symptomatology was treated as a continuous score ranging from 0 to 5. Multivariate mixed-effects models included the following variables: intervention assignment (Group: age-reattribution or generic health education), time in months (Time point: Baseline, 1-, 12-, and 24-months), interaction of intervention assignment and time (Group x Time point), and terms capturing baseline age, sex, education, income, marital status, acculturation, and number of chronic conditions. Random effects for the intercept were included to allow individuals to vary in their scores for depressive symptoms at baseline. We tested whether to include random slopes to account for variability in the rate of change for depressive symptoms, but results based on R² and the Bayesian and Akaike information criterion indicated no improvements in model fit. For all regression models, we present the regression coefficients, 95%

confidence intervals, and *p*-values. However, to facilitate the interpretation of regression results, particularly interaction effects, we discuss the contrasts involving factor variables and their interactions using the "contrast" command and the linear predictions obtained with the "margins" command. We use the "marginsplot" command to graph effects of intervention assignment on depressive symptoms over time.

Finally, we conducted several sensitivity tests. First, a dichotomous variable was added to indicate those with complete data at all waves versus those with missing data for at least one follow-up. Then, we conducted mixed-effects regressions, which included this dummy term for incomplete versus complete data. To further evaluate the impact of missing data, we performed sensitivity analysis using multiple imputation procedures.

RESULTS

Characteristics of the Study Sample by Depression Status

Table 1 provides participant characteristics by depression status. The average age was 73.1 years (SD = 6.8) and largely included female participants (77.2%). Low socioeconomic status was evident with 59.2% reporting equivalence of an 8th grade education or less and 75.4% identifying an annual income below US\$20,000. A total of 28.8% older Hispanic/ Latino adults self-identified as married, with remaining participants classified as widowed (36.2%), separated/divorced (22.3%), and never married (12.7%). At baseline, 27.6% exhibited elevated symptoms of depression as measured by the Geriatric Depression Scale (GDS score 2). Compared to their non-depressed peers, those with elevated symptoms of depression displayed lower socioeconomic status as gauged by education and income, they were less likely to identify being married, and they reported a greater number of medical comorbidities. Depression status did not differ by age and sex.

Comparison of Intervention Effects on Depressive Symptoms Across Time

Of participants enrolled in the "¡Caminemos!" trial, 279 were randomly assigned to receive attribution retraining and 293 were randomized to the control arm and received generic health education. As published previously, no significant group differences were observed for baseline characteristics across the two arms of the trial. As identified previously, the current sample was limited to 569 with complete data on select variables of interest (277 in the intervention and 292 in the control arm). Table 2 shows the prevalence of elevated symptoms of depression (i.e., GDS 2) over the 24-month study period. The overall prevalence of depression declined for the entire cohort from 27.6% at baseline to 16.7% at 24-months.

As shown in Table 3, results based on linear mixed-effects indicate that participants in both the treatment and control groups displayed lower levels of depressive symptoms at 24-months when compared to original baseline scores. We found no significant differences in depressive symptoms between the treatment and control conditions, nor were any differences detected across groups over time. Figure 1 graphically depicts the decline in depressive symptoms over the study period across trial arms. Results in Table 3 additionally evidence significant association of depressive symptoms with educational attainment, acculturation,

and physical health. Specifically, higher depression scores were evident for participants with lower educational attainment, those with higher acculturation scores, and among older adults reporting a larger number of comorbid chronic conditions.

Sensitivity Analysis Considering Missing Data

We explored the presence of missing data at the follow-up periods and associated effects. We contrasted those with complete data (n=371, 65%) with those missing at least one follow-up (n=201, 35%) observation. Results indicated that those who had missing data were more likely to be older (OR=1.03, p=0.023), but there were no differences by group assignment, sex, education, income, marital status, acculturation level, or number of chronic conditions. Results from mixed-effects regressions which included a dummy variable for complete versus incomplete data, indicated that those who did not have complete data did not differ from those with complete data on GDS-5 scores (β =0.15, 95% CI –0.01, –0.31, p= 0.075). We additionally performed sensitivity analysis using multiple imputation. The results based on multiple imputation indicated reductions in depressive symptoms at 12- (β = –0.17, 95% CI –0.32, 0.01, p=0.037) and 24-months (β = –0.33, 95% CI –0.49, –0.17, p<0.001), whereas results without imputation only found a statistical significant decline at 24 months. Results based on the multiple imputation confirmed no group differences, nor group differences over time. All other statistical inferences remained the same.

CONCLUSION

The current study highlights the significant role of exercise program participation as a health promoting strategy for improving mental health and reducing depressive symptoms among older Hispanic/Latino adults. Older Hispanic/Latino adults in both arms of the study (both of which included the exercise class) displayed improvements in depressive symptoms at the 24-month follow up period. This finding is congruent with numerous previous studies, which show physical exercise to reduce depressive symptoms among those healthy enough to exercise (Josefsson et al., 2014). Organized physical activity also improves psychological well-being among older and old-old adults (Netz, Wu, Becker, & Tenenbaum, 2005). Our results indicate that physical activity programs can be useful in reducing depressive symptoms in older Latino adults who are physically able to exercise. We tested the role of age attribution in this study but found no differences. Attribution-retraining did not show an effect in reducing depressive symptoms over and above that explained by exercise program participation; no significant differences in depressive symptoms were seen between the treatment and control conditions, nor were any differences found across groups over time. In general, the current sample reflects the demographic features typical of the aging Hispanic/ Latino population (Andrade & Viruell-Fuentes, 2011) and highlights a feasible avenue to favorably impact physical activity and emotional well-being in an underserved and rapidly growing segment of the U.S. population.

Strategies to reduce depressive symptoms and improve emotional well-being in older Hispanic/Latino adults are largely absent from the scientific literature. Nonetheless, our results are consistent with previous research documenting the therapeutic health effects of structured exercise in older adults. Marquez and colleagues (2015) have pioneered the use of

Latin dance in older Hispanic/Latino adults with demonstrated promising health effects. Specifically, a 3-month Latin dance intervention (i.e., BAILAMOS) in older Hispanic/Latino adults that included Cha Cha Cha, Merengue, Bachata, and Salsa, resulted in reduced sedentarism and improved quality of life over time (Marquez et al., 2015). Culturally appropriate and cost-effective intervention modalities to reduce depression in Hispanics/Latinos are both needed and critical given the stigma associated with mental illness in this population and reluctance in taking antidepressant medication (Lewis-Fernandez, Das, Alfonso, Weissman, & Olfson, 2005). Our results provide additional evidence that structured exercise is a plausible therapeutic target for Hispanics/Latinos when treating depressive symptomatology. The current study demonstrates that benefits of exercise program participation extend beyond physical health and metabolic domains and seep into emotional and psychological domains. Since classes were only weekly for the first month and then monthly for the duration of the study, it is unlikely that physical activity alone was the cause of the decrease in depressive symptoms; instead it is likely that participants benefitted from the social and structural aspects of the program.

Although attribution-retraining did not yield significant benefits to mental health in this sample, its utility merits further discussion. Although statistically significant differences were not achieved, a trend was observed across time where lower depression scores were evident for participants assigned to the treatment arm at 1-, 12-, and 24-months. It is plausible that the exercise program with a large effect size, and which included regular reinforcement sessions, might have overshadowed the benefits derived from the attribution-retraining intervention. Additional research is needed to identify whether attribution-retraining truly has no impact on depressive symptoms or whether strategic enhancements that target modifications in content, modality of delivery, or length of contact time might lead to greater improvements in depressive symptoms than exercise alone. It is also plausible that differences might have emerged in a longer follow-up period since attribution-retraining is expected to target internal locus of control (i.e., self-responsibility) and therefore, may lead participants to display great self-efficacy in maintaining improvements over time and/or may result in healthier aging (Glanz, Rimer, & Viswanath, 2008).

Future trials should test enhancements or modifications to more definitely ascertain whether age-reattribution may serve as a novel therapeutic strategy to enhance the physical and emotional well-being of older Hispanic/Latino adults. Important queries remain that can elucidate the null findings of the current study and why age-reattribution evidenced minimal impact. First, its plausible that a ceiling effect was evident with minor changes in age-reattribution scores from baseline to follow-up due to the selection of healthy Hispanic/Latino adults with sufficient motivation and physical acuity as to frequent a senior center and its resources. Selective targeting of a frailer population may be warranted where expectations for successful aging are low at the outset, e.g., those with elevated symptoms of depression or with limitations in activities of daily living. Regardless of the populated targeted, the attribution retraining curricula might increase its impact with modifications to both content and modality of delivery to augment its overall impact and heighten the active ingredients across modules. For instance, might modules benefit from personalized diffusion through individual-level delivery vs. group and/or more frequent contact beyond 60 minutes per week for 4 weeks? Finally, integration of technology into non-pharmacotherapy

treatment is lagging. The current intervention may benefit from inclusion of components that utilize web-based or mobile platforms that older Hispanics/Latinos can access at home to enhance weekly in-person contact time.

The present study has multiple strengths. It is one of the few studies to explore the therapeutic effects of age-reattribution for depressive symptoms within a large population of community-dwelling urban older Hispanic/Latino adults. Given the geographic size of Los Angeles County and the draw across senior centers where subjects were recruited, it is likely that >27 neighborhoods were represented in this study and thus produced a heterogeneous sample of older Hispanic/Latino adults. Despite numerous strengths, several study limitations should be considered when interpreting study findings. Generalizability may be limited as older adults in the current study were recruited from senior centers and may systematically differ from Hispanics/Latinos not attending such public institutions and accessing their resources. The study lacked an attention placebo control arm that entirely omitted an exercise component, which negates the ability to disentangle direct effects of physical activity versus benefits derived from social contact alone. Indeed, a pre-post analysis was conducted that lacked a true control group. A valid and reliable testing instrument was used to capture depressive symptoms in this older adult cohort; yet, analyses could have benefited from a standard clinical assessment to identify those with diagnosed depression as detailed in the Diagnostic and Statistical Manual of Mental Disorders (Association, 2013). Findings may differ had clinical diagnostic guidelines been used.

In conclusion, for older Hispanic/Latino adults exercise holds much promise as a therapeutic target for reducing depressive symptoms. While targeting of preconceived notions of the aging process may not garner further benefits to that of structured exercise on depressive symptoms, the availability of a low-cost and evidence-based exercise program was associated with a substantial reduction in depressive symptoms in older Hispanics/Latinos, regardless of socioeconomic standing and the presence of comorbid chronic conditions.

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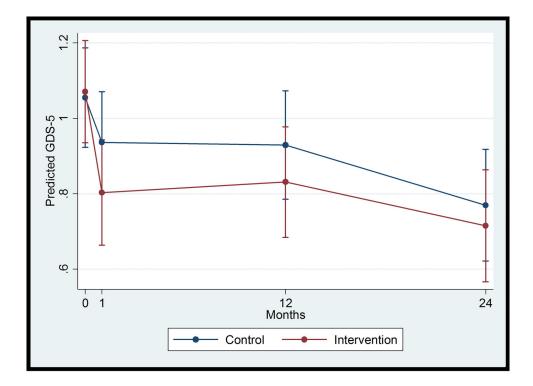


Figure 1. Predictive margins of GDS-5 scores with 95% confidence interval: "*Caminemos*!" *Study* (2005–2009)

GDS-5 = Geriatric Depression Scale

Table 1 Baseline Descriptive Characteristics of the Sample by Depression Strata (N = 569): "¡Caminemos!" Study (2005–2009)

Variable	Total (N = 569)	GDS < 2 (N = 412)	GDS $2 (N = 157)$	<i>p</i> -value
Socio-demographics				
Age, $M(SD)$	73.1 (6.8)	73.3 (6.5)	72.7 (7.4)	0.328
Female, n (%)	439 (77.2)	316 (76.7)	123 (78.3)	0.676
Education, n (%)				
No schooling completed	83 (14.5)	50 (12.1)	33 (21.0)	0.012
8 th grade	255 (44.7)	182 (44.2)	71 (45.2)	
Some High School or greater	233 (40.8)	180 (43.7)	53 (33.8)	
Income, n (%)				
Less than US\$5,000	88 (15.5)	56 (13.6)	32 (20.4)	0.002
US\$5,000 to under US\$20,000	341 (59.9)	246 (59.7)	95 (60.5)	
US\$20,000 to under US\$50,000	80 (14.1)	71 (17.2)	9 (5.7)	
US\$50,000 to under US\$100,000	10 (1.8)	8 (1.9)	2 (1.3)	
Not reported	50 (8.8)	31 (7.5)	19 (12.1)	
Marital status, n (%)				
Never married	72 (12.7)	41 (10.0)	31 (19.8)	0.009
Married	164 (28.8)	128 (31.1)	36 (22.9)	
Separated/Divorced	127 (22.3)	91 (22.1)	36 (22.9)	
Widowed	206 (36.2)	152 (36.9)	54 (34.4)	
Acculturation, Median (IQR)	1.2 (2.0)	1.4 (2.0)	1.2 (2.2)	0.702
Number of Medical Comorbidities, $M(SD)$	2.1 (1.2)	2.0 (1.2)	2.4 (1.3)	0.001

Table 2

Prevalence of Elevated Symptoms of Depression During the 24-month Trial: "Caminemos!" Study (2005-2009)

	Baseline	line	1-Month	nth	12-Months	nths	24-Months	nths
	N	%	N	%	Z	%	Z	%
All	695	27.6	531	20.3	445	22.0	419	16.7
Intervention Group	<i>LL</i> Z	27.4	254	18.1	219	21.0	212	15.6
Control Arm	262	27.7	<i>LL</i> 2	22.4	226	23.0	207	17.9
<i>p</i> value	0.936		0.222		0.610		0.527	

Table 3

Estimated parameters from repeated mixed-effects regressions on continuous GDS-5 depressive symptoms: "Caminemos!" Study (2005–2009)

	Coefficients	95% CI
Fixed effects		
Intervention (ref=control)	0.03	-0.16,0.21
Month (ref=baseline)		
1	-0.12	-0.25,0.01
12	-0.13	-0.27, 0.01
24	-0.28***	-0.43, -0.14
$Group \times month \\$		
Intervention x 1	-0.15	-0.34, 0.04
Intervention x 12	-0.11	-0.31,0.09
Intervention x 24	-0.07	-0.28,0.13
Age	-0.01	-0.02, 0.01
Female (ref=male)	-0.07	-0.26,0.12
Education (ref = no schooling)		
8 th grade	-0.34**	-0.56, -0.11
Some High School or greater	-0.53***	-0.77, -0.29
Income (ref=less than US \$5,000)		
US\$5,000 to under US\$20,000	0.13	-0.19, 0.45
US\$20,000 or more	-0.09	-0.36,0.18
Not reported	-0.23	-0.55, 0.09
Marital status (ref=never married)		
Married	-0.11	-0.36, 0.15
Separated/Divorced	-0.12	-0.38, 0.14
Widowed	-0.13	-0.37,0.12
Acculturation	0.11***	0.04,0.17
Medical comorbidities	0.15***	0.09,0.21
Intercept	1.57**	0.60,2.55
Random effects	Variance	
Intercept	0.60	
Residual	0.63	
Model fit	AIC	BIC
	5504.634	5627.398