The Relationship Between Physical Activity and Cognition in Older Latinos

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Objectives. The purpose of this study was to explore the relationship between minutes spent participating in light and moderate/vigorous-intensity physical activity (PA) and cognition in older Latinos, controlling for demographics, chronic health problems, and acculturation.

Method. A cross-sectional study design was used. Participants were self-identified Latinos, without disability, who had a score less than 14 on a 21-point Mini-Mental State Examination. Participants were recruited from predominantly Latino communities in Chicago at health fairs, senior centers, and community centers. PA was measured with an accelerometer, worn for 7 days. Episodic memory and executive function (inference control, inattention, and word fluency) were measured with validated cognitive tests.

Results. Participants were 174 Latino men (n = 46) and women (n = 128) aged 50–84 years (M = 66 years). After adjusting for control variables (demographics, chronic health problems) and other cognitive measures, regression analyses revealed that minutes per day of light-intensity PA (r = −.51), moderate/vigorous PA (r = −.56), and counts per minute (r=−.62) were negatively associated with lower word fluency.

Discussion. Findings suggest that the cognitive benefits of both light-intensity PA and moderate/vigorous PA may be domain-specific.

Key Words: Cognition—Latino/Hispanic—PA.

BACKGROUND

The number of older adults in the United States is rapidly growing, and it is expected to grow fastest among Latinos. Between 2008 and 2030, the Latino population 65 years and older is expected to increase by 224% compared with just a 65% increase of the non-Latino White population 65 years and older (Greenberg, 2009). Unfortunately, data from the Health and Retirement Study, a large nationally representative study of the 55 and older population, indicate that older Latinos are twice as likely as non-Latino Whites to exhibit cognitive impairment with age (17.5% vs. 8.8%; Alzheimer’s Association, 2010). Moreover, there is epidemiological evidence linking age-associated cognitive impairment to diabetes (Kodi & Seaquist, 2008), for which Latinos in the United States are more burdened compared with the dominant culture (non-Latino White men 6.7% vs. Latino men 11.0%; non-Latino White women 5.6% vs. Latina women 10.9%; Roger et al., 2011). Given the costs associated with care of the older people, it is imperative that we obtain a better understanding of modifiable health behaviors that can prevent or stabilize cognitive impairment through the middle and older years of life of our growing Latino population.

Physical activity (PA) is thought to be one means of attenuating cognitive decline and improving cognitive ability among older adults (Colcombe & Kramer, 2003). Research providing support for the beneficial effects of PA on cognitive function in older adults spans several decades but has recently been advanced by findings from observational prospective epidemiological studies (Hillman, Erickson, & Kramer, 2008). Hamer and Chida (2009) identified 10 prospective cohort studies with healthy participants at baseline that examined PA and cognitive decline. In nine of the 10 studies, an inverse relationship was found between PA and cognitive decline. None of the studies, however, indicated that Latinos were included or mentioned translation of instruments. The two studies that included race as a covariate simply identified White versus non-White populations (Albert et al., 1995; Sturman et al., 2005). Therefore, to our knowledge, a majority of what is known about the PA–cognition relationship has been derived from the non-Latino dominant culture, and little is known about the possible influence of acculturation on cognition in addition to the known influence of age and education (Plassman et al., 2007).
Closer scrutiny of these 10 studies revealed selected measurement issues that may have particular bearing for Latinos. First, all relied on self-report measures that focused heavily on leisure-time or structured PA obtained through exercise and sport. According to 2009 National Health Interview Survey, however, 44% of adult Latinos versus 28% of non-Latino White adults reported no light, moderate, or vigorous leisure PA (Roger et al., 2011). Furthermore, data from Latinos indicate that the prevalence of leisure-time PA is lowest among immigrants, and, although it increases over time since immigration, it remains lower than in nonimmigrants (Tremblay, Bryan, Peréz, Ardern, & Katzmarzyk, 2006). Conversely, the Latino population has been shown to engage in a high level of nonleisure-time lifestyle PAs that are a part of everyday life (Berrigan, Troiano, McNeel, DiSogra, & Ballard-Barbash, 2006). Unfortunately, the few studies that included lifestyle PA were restricted to a single item that queried participation in yard or garden work (Albert et al., 1995; Broe et al., 1998; Sturman et al., 2005; van Gelder et al., 2004). None of the studies addressed true lifestyle PA that incorporates all activity dimensions: leisure-time, household, occupational, and transportation PA. To gain a better understanding of the cognition–PA relationship for Latinos, we need measures of PA that adequately capture their lifestyle activity.

Another limitation of this group of studies examining the PA–cognition relationship has been the failure to adequately define intensity, frequency, and duration of PA. Therefore, it is unknown if the 2008 Physical Activity Guidelines for Americans by the U.S. Department of Health and Human Services (2008) calling for 150 min of moderate PA per week are protective for cognitive decline as well as for improving cardiovascular health. Only one study (Singh-Manoux, Richards, & Marmot, 2003) used a self-report measure that assigned PAs a metabolic equivalent intensity code (metabolic equivalent of task [MET], with 1.0 being approximately equal to energy cost while laying quietly) and then summed the amount of time spent in moderate/vigorous-intensity PA to provide a calculation of the minutes/hours per week of moderate/vigorous-intensity PA. They found that adults who spent the least amount of time in moderate-intensity (<2 hr) or high-intensity activity (<1 hr) over three 10-year points in time had greater cognitive decline, thus suggesting a protective effect for cognition as well as cardiovascular disease. A major limitation of self-report measures of PA, however, is that they are largely inaccurate for assessing the quantity of light- and moderate-intensity unstructured lifestyle activity frequently performed by older adults and immigrant populations (Brach, Kriska, Glynn, & Newman, 2008). The optimum intensity and duration of lifestyle PA needed to impact cognitive function requires further investigation and confirmation with objective measures.

Accelerometers, PA monitors that can detect/record the actual magnitude of acceleration, offer a more robust objective alternative to self-report (Hawkins et al., 2009). They are small and unobtrusive and can be worn throughout the day without interfering with everyday movement. Another unique feature is their ability to capture light-intensity PAs, such as household cleaning, which is difficult to recall on self-report questionnaires. Although it is well-established that moderate-intensity PA reduces the risk of cardiovascular disease and diabetes (U.S. Department of Health and Human Services, 2008), recent work has shown that light-intensity PA is positively associated with physical health and well-being (of which cognitive ability is one component) in persons more than 65 years of age (Buman et al., 2010). To date, the only study we identified that used accelerometers to relate PA with cognition found that total daily activity counts were related to higher cognitive levels (Buchman, Wilson, & Bennett, 2008). Unfortunately, intensity and duration of PA in minutes per day or week were not reported.

Finally, an additional issue was found with measures of cognition, in that over half of the 10 studies relied on either a single global measure of cognition (Ho, Woo, Sham, Chan, & Yu, 2003; Lytle, Vander Bilt, Pandav, Dodge, & Ganguli, 2004; Richards, Hardy, & Wadsworth, 2003; Schuit, Feskens, Launer, & Kromhout, 2001; Yaffe et al., 1999) or a composite measure (Albert et al., 1995; Sturman et al., 2005; Weuve et al., 2004). There is literature that suggests that some cognitive domains are affected by PA more than others (Colcombe & Kramer, 2003). Therefore, use of global and composite measures may obscure relationships between PA and cognition that differ based upon the cognitive domain.

The purpose of this study was to explore the relationship between minutes spent participating in light- and moderate/vigorous-intensity PA and different forms of cognition in older Latinos, controlling for sex and for factors shown to be associated with cognition. Our study extends previous literature because it examines an understudied, at-risk, rapidly growing population and uses accelerometers, an innovative, comprehensive means of measuring PA.

**Method**

**Design, Setting, and Sample**

A descriptive, cross-sectional study design was used. Inclusion criteria were 50 years of age or older, Latino, no ambulation disability or assistive walking device, no evidence of suspected dementia, and a Chicago metropolitan address. To assess for suspected dementia, we used a modification of the 30-point Mini-Mental State Examination (MMSE), a global measure of cognition, for telephone administration (Folstein, Folstein, & McHugh, 1975). The modified 21-point MMSE did not include items that could not be done over the telephone (9 points): orientation to room, naming a pencil and watch, following a three-stage command, reading
and obeying a command, writing a sentence, and copying a design. To date 1,451 older people in the Rush Memory and Aging Project have completed the standard 30-point MMSE as part of their baseline evaluation (Bennett et al., 2005). The Pearson correlation between the standard version and the 21-point MMSE is $0.968$ ($p < .001$). Previous studies on cognition and aging using the 30-point MMSE with participants of low-educational attainment have identified one-third incorrect as a cutpoint for impaired/poor cognition (Raji, Al Snih, Ostir, Markides, & Ottenbacher, 2010); therefore, below 14 was our cutpoint for suspected dementia.

Recruitment sites (5 senior centers, 2 community health care centers, 15 health fairs, 1 senior housing center) were located in 11 Chicago community areas that have a moderate-to-large Latino population (10%–89%) and in 1 suburban community that is 8% Latino but adjacent to a community that is 18% Latino (City of Chicago, n.d.). Recruitment materials, available in Spanish and English, were reviewed by four bilingual adults who met the study eligibility criteria but did not participate in the study. They reviewed both to determine comprehension and consistency between the versions. Sign-up sheets were available at the study sites.

Overall, 342 persons signed up on a recruitment sheet at all data collection sites; 282 were reached, and, of these, 224 agreed to be screened. Of those screened, 25 did not meet the inclusion criteria (11 a score of $<14$ on the short-ened MMSE, 6 too young, 6 used a walking assistive device, 1 not Latino, 1 lived outside area); of the 199 eligible volunteers, 18 decided not to participate and 7 could not schedule a time for an assessment, leaving 174 who participated. There were no significant differences between eligible volunteers who did and did not participate on either mean age (both 66 years) or MMSE scores (18.73 vs. 19.31).

Measures

Measures of background characteristics and cognitive function had been previously translated and were available in Spanish or English.

Background characteristics.—Background characteristics included demographics, chronic health problems, and acculturation.

Demographic variables were age, sex (1 = men, 2 = women), and educational level (1 = no high school degree, 2 = high school degree or higher). Descriptive demographic characteristics included marital status, employment status, and country of origin.

Chronic health problems. Both diabetes and stroke place persons at risk for cognitive decline (Haan et al., 2003). Participants were asked to respond yes or no if they were on medication for diabetes and/or hypertension. Blood pressure was taken with the Omron HEM-907XL automated blood pressure machine (Omron Health Care Inc., Vernon Hills, IL). It has reliability and reproducibility of mercury sphygmomanometer measurements (El Assaad, Topouchian, Darne, & Asmar, 2002). Blood pressure measurements followed the American Heart Association Recommendations for human blood pressure determination (Pickering et al., 2005), and the average of three measurements was recorded. Consistent with National Health and Nutrition Examination Survey (NHANES), a participant was identified as having hypertension if he or she was taking medication for hypertension or if the systolic blood pressure was $\geq 140$ mmHg or diastolic blood pressure was $\geq 90$ mmHg (Roger et al., 2011). Chronic health problems were 0 “does not have hypertension or diabetes,” 1 “has either hypertension or diabetes,” or 2 “has both hypertension and diabetes.”

Acculturation. The Acculturation Rating Scale for Mexican Americans—II measures orientation toward the Latino and the Anglo culture independently using two subscales: a Latino orientation subscale (17 items, original $\alpha = .88$) and an Anglo orientation subscale (13 items, original $\alpha = .83$; Cuellar, Arnold, & Maldonado, 1995). We revised this measure to include all Latino subgroups (e.g., Puerto Ricans, Dominicans). Acculturation was determined by subtracting the mean score for the Latino subscale from the mean score for the Anglo subscale. Based on the scores, Cuellar and colleagues (1995) identified five acculturative categories: very Latino oriented (less than $-1.33$), Latino oriented to approximately balanced bicultural (greater than or equal to $-1.33$ and less than or equal to $-0.7$), slightly Anglo oriented (greater than $-0.7$ and $<-1.19$), strongly Anglo oriented ($\geq 1.19$ and $<2.45$), and very assimilated ($\geq 2.45$). Good reliability was demonstrated in our study for the Spanish ($\alpha = .81$) and the English ($\alpha = .73$) versions.

Cognitive function.—Cognitive function was assessed with a battery of seven performance tests: two of episodic memory and five of executive function processes. Executive function tests were selected to represent domains of executive function including interference control, inattention, and verbal fluency (Murphy, Barkley, & Bush, 2001). All tests were chosen because they have been shown to test functions that decline in old age (Wilson, Beckett et al., 2002), shown to test functions that are likely to be related to PA (Kramer, Erickson, & Colcombe, 2006), and translated into Spanish and shown to be valid across ethnic and socioeconomic backgrounds (Krueger, Wilson, Bennett, & Aggarwal, 2009). The battery of tests met the practical demands of the study (i.e., brief, portable, acceptable to older people).

The bilingual data collectors participated in 1 day of training with follow-up observation. They were certified on each test using performance-based criteria before they
began data collection. The cognitive function tests are administered in the following fixed order: East Boston Memory Test (immediate recall), Stroop Neuropsychological Screening Test, East Boston Memory Test (delayed recall), numbers comparison, and category fluency.

**East Boston Memory Test.** Episodic memory was measured with the East Boston Memory Test, which involves immediate and delayed recall of a brief story (Albert et al., 1991). The story, which has 12 key elements, was read slowly to the participant. The participant was asked to immediately recall the story. After an approximate 3-min delay (during which time the Stroop was administered), the participant was asked to recall the story. Scores ranged from 0 to 12 story ideas recalled on immediate and delayed recall. The episodic summary score was the mean of the immediate and delayed recall.

**Stroop Neuropsychological Screening Test.** Interference control was measured with the modified color–word task (Wilson et al., 2005) of the Stroop Neuropsychological Screening Test (Trenerry, Crosson, DeBoe, & Leber, 1989). The participant named the color of ink in which a list of color names were provided. In some cases, the color of ink in which the word was printed was the same as the word and for others the color differed from the word. For example, the word red was in blue ink. The scores were the number of colors correctly identified in 30 s, the number of incorrect responses in 30 s, and the number of colors answered correctly minus the number of incorrect responses (Wilson et al., 2005). Prior to administration of the color–word task, the participant read a list of color names as quickly as possible for 30 s. According to Trenerry and colleagues (1989), the color task may have a priming effect on the interference shown in the color–word task. Three participants did not complete the measure due to literacy problems.

**Numbers Comparison Test.** The Numbers Comparison Test (Ekstron, French, Harmen, & Kermen, 1976), a measure of inattention, requires participants to classify pairs of 3- to 10-digit sequences as the same or different. The attention score was the number of pairs classified correctly in 90 s minus the number classified incorrectly.

**Category Fluency Test.** Word fluency was assessed by asking participants to generate as many examples as possible from two semantic categories (animals, fruits, vegetables) in separate 60-s trials (Welsh et al., 1994). The total number of unique examples was the performance measure. A word fluency score was arrived at by summing the number of animals generated to the number of fruits and vegetables generated.

**Physical Activity.** PA was monitored with the portable GT1M ActiGraph accelerometer (Tryon & Williams, 1996). The ActiGraph monitor provides a valid assessment of PA in adult men and women during treadmill walking/running and daily activity (Hendelman, Miller, Baggett, Debold, & Freedson, 2000). It records vertical accelerations as “counts.” Participants were instructed to monitor their hip counts for seven consecutive days. Participants were given an accelerometer log on which they recorded the hours they wore it. The monitor was initialized and set to collect count values at 1-min sampling intervals (epochs). To be included in the analyses, ≥10 hr of data or wear time had to be available in a 24-hr period on at least 3 days (Matthews, Ainsworth, Thompson, & Bassett, 2002). As in Troiano and colleagues (2008), nonwear time was defined as at least 60 consecutive minutes of 0 activity counts.

PA intensity was categorized by cutpoints of Miller, Strath, Swartz, and Cashin, (2010) used with persons 60–69 years of age. The mean number of minutes of PA was defined as: sedentary <100 counts/min, light 100–1,565 counts/min (≤3 METs), moderate 1,566–6,139 counts/min (3.0–6.0 METs), and vigorous ≥6,140 counts/min (≥6.1 METs). We report the number of minutes of light-intensity PA per day and combine the number of minutes of moderate and vigorous PA per day due to low participation in vigorous activity. In addition, we provide the number of activity counts per minute, which is an estimate that corrects for the amount of wear time.

**Procedures**

Interested volunteers were screened in person or over the telephone for age, ethnicity, and disability and for cognition with the MMSE. Eligible persons were scheduled for an appointment at a location of their choosing, including their homes (n = 65, 37%), one of the community recruitment sites (n = 99, 57%), or our program offices (n = 10, 6%). To closely simulate the privacy of the community sites and program office setting, participants who chose their home were asked to identify a room and time when there would be no outside interruptions. At the appointment, a bilingual staff member further explained the study and read the consent form aloud in the participant’s preferred language. After consent was given, the health and demographics questionnaire was administered followed by assessment of blood pressure, resting heart rate, height, weight, and waist circumference. Then the cognitive function measures were administered. Next, additional questionnaires related to determinants of PA and health (e.g., barriers to PA, social support, and nutritional history), to be reported in a later manuscript related to these issues, were administered. Once the questionnaires were completed, participants watched a demonstration of the accelerometer and were then asked to demonstrate their competence. Participants wore their accelerometer for the next 7 days. A second appointment was made to download the accelerometer data, go over the results, and complete any questionnaires administered after the cognitive function
tests that remained. At the end of the second visit, participants were given the oral and written results of their blood pressure, weight, and height information and PA information from the American Heart Association in Spanish or English. Participants were compensated $10 at the end of the first appointment and received another $10 at the end of the second appointment.

**Analyses**

All analyses were conducted using SPSS V16.0. The bivariate correlations between background/control measures and PA with the cognitive measures were conducted to determine if further multiple regression analysis was justified. Next, a multivariate multiple regression was done with episodic memory, interference control, inattention, and the two-word fluency measures (animals and fruits and vegetables) as the dependent variables and the background and PA variables as predictors. This was followed by a canonical correlation analyses to determine how the dependent variables were related to the predictors.

**RESULTS**

**Background Characteristics**

The mean age of the participants was 66 years ($SD = 9.12$, range 50–84 years; Table 1). The majority of the participants were women (74%), unmarried (59%), and not working (76%). Over half (56%) of the participants had not graduated from high school. The main country of origin was Mexico (55%). A total of 144 (83%) participants chose to respond in Spanish. The mean acculturation score was $-1.47$ ($SD = 1.16$, range $-3.23$ to $1.98$), which is in the “very Latino-oriented” range. Nearly 70% of the participants had a self-reported chronic health problem. Eight participants had diabetes only, 78 had hypertension only, and 35 had both hypertension and diabetes.

**PA and Cognitive Function**

Table 2 shows the mean score and standard deviation for minutes of accelerometer-assessed PA and cognitive function domains. Of the 174 participants, 151 had valid accelerometer data, 4 lost their accelerometers, 6 had no valid data due to accelerometer malfunctions, and 13 had only 1 or 2 days of valid data. More minutes were spent in light-intensity than in moderate/vigorous-intensity PA. There were no significant differences on background characteristics or cognitive function tests between the participants who had valid accelerometer data and those who did not. Test scores from one of the cognitive function domains (episodic memory) had a negatively skewed distribution, whereas the components of executive function (interference control, inattention, word fluency) were relatively symmetric.

**Correlations Among Background Characteristics, PA, and Cognitive Function**

Age was significantly negatively correlated with light-intensity PA, minutes of moderate/vigorous-intensity PA, and activity counts (Table 2). Correlations of small magnitude were found between chronic health problems and minutes of light-intensity PA a day ($r = -0.221$). There was a correlation between sex and moderate/vigorous-intensity PA, with men having more minutes in moderate/vigorous-intensity PA than women.

Correlations were assessed between the PA measures and cognitive measures. In addition, we looked at the composite scores for episodic memory (Boston immediate and Boston delay) and PA measures. The pattern of correlations for the component and summary/composite scores for episodic memory was nearly identical across all three PA measures. Consequently, the subsequent analyses examined only the episodic composite.
Table 2. Correlations Among Background Characteristics, Physical Activity (PA), and Cognition

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<tr>
<td>16. Word fluency</td>
<td>34.3 (8.7)</td>
<td></td>
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</tr>
</tbody>
</table>

Notes: n = 151.

*a = men; ** = women.

*b = no high school degree; 2. = high school degree or higher.

°Minutes per day at named intensity.

*p ≤ .05; **p ≤ .01; ***p ≤ .001.
Light-intensity PA had significant positive correlations with interference control. Minutes of light-intensity PA per day, minutes of moderate/vigorous PA per day, and PA counts/minute all had significant positive correlations with word fluency. PA was not significantly correlated with episodic memory or inattention.

Age had significant negative correlations, and education had significant positive correlations with interference control, inattention, and word fluency (animals, fruits, and vegetables), but not with episodic memory. Women had higher scores on tests of episodic memory and word fluency. Chronic health problems were significantly negatively correlated with only number of fruits and vegetables. Acculturation had significant positive correlations with both interference control and inattention but not with episodic memory or word fluency.

Note: Loadings above .40 are marked in bold.

### Discussion

The relationship between PA and cognitive function was examined in a sample of older Latinos who had low levels of education, were highly Latino acculturated, and most of whom were born in Mexico. These individuals were recruited from predominantly Latino Chicago communities and represent a population for which little is known about their cognition and its relationship to PA. Another distinctive feature of this study is that PA was assessed with accelerometers. We know of only one other study to date that has used accelerometers to measure PA and examined its relationship with cognition, and that study was restricted to a primarily non-Latino White (92%) sample (Buchman et al., 2008). Problems with misrepresentation of PA in Latinos using self-report PA measures are well-documented (Ham & Ainsworth, 2010). Although Latinos are shown to have lower levels of leisure-time PA than non-Latino White participants, recent evidence suggests that moderate/vigorous PA measured with an accelerometer is actually higher for Latinos than for non-Latino Whites (Troiano et al., 2008). This is thought to be due to the inclusion of occupational and transportation PA captured with accelerometers. Therefore, accelerometers may better capture the influence of lifestyle PA on cognition in this population.

Overall, scores on the cognitive tests from the current sample are comparable to previous work of Krueger and colleagues (2009) with older, nondemented community-based Latinos. With the exception of interference control, all cognitive function tests were slightly higher in our study (episodic memory: immediate recall 8.8 vs. 8.5, delayed recall 8.6 vs. 7.4; interference control: 14.8 vs. 15.0; inattention: number comparison 16.7 vs. 13.3; word fluency: category fluency 34.3 vs. 30.5). This slight discrepancy may be due to the lower age limit in our study compared with that of Krueger and colleagues (2009; 50 vs. 55 years of age).

Mean PA counts of Latinos in our study (263) were comparable to NHANES findings for Mexican Americans 60 years of age and older (283.5 men; 214.6 women) but higher than for non-Latino Whites (221.6 men; 208.7 women; Troiano et al., 2008). Participants in our study spent a lot of time performing light-intensity activities, similar to older adult participants in the senior quality-of-life study (Buman et al., 2010).

### Table 3. The Correlations Between Background and Physical Activity (PA) Predictor Variables and Canonical Functions

<table>
<thead>
<tr>
<th>Predictor variables</th>
<th>Canonical functions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Background</strong></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.81</td>
</tr>
<tr>
<td>Sex</td>
<td>.05</td>
</tr>
<tr>
<td>Education</td>
<td>−.72</td>
</tr>
<tr>
<td>Chronic health problems</td>
<td>.19</td>
</tr>
<tr>
<td>Acculturation</td>
<td>−.38</td>
</tr>
<tr>
<td><strong>Dependent variables</strong></td>
<td></td>
</tr>
<tr>
<td>Episodic memory</td>
<td>−.34</td>
</tr>
<tr>
<td>Interference control</td>
<td>−.83</td>
</tr>
<tr>
<td>Inattention</td>
<td>−.84</td>
</tr>
<tr>
<td>Word fluency animals</td>
<td>−.48</td>
</tr>
<tr>
<td>Word fluency fruits and vegetables</td>
<td>−.38</td>
</tr>
</tbody>
</table>

Note: Loadings above .40 are marked in bold.
We examined correlations between all study variables to identify congruence with prior studies on age, education, sex, PA, and cognition. As expected, age was negatively correlated and education positively correlated with the majority of the dimensions of cognitive function (Plassman et al., 2007). The lack of a correlation between age and episodic memory was surprising. There is evidence suggesting that frequent participation in cognitively stimulating activities is associated with reduced risk of dementia (Wilson et al., 2005). Therefore, we speculate that the rich tradition of oral history that is characteristic of the Latino community may provide some protective effects on episodic memory (Caspé, 2009).

As demonstrated in prior studies, there was a negative correlation between chronic health problems and all cognitive measures, but only one component of word fluency was significant (Kodl & Seaquist, 2008; Plassman et al., 2007). Findings related to sex have been unequivocal, with several prior studies on PA and aging in Latinos, we found a significant (Kodl & Seaquist, 2008; Plassman et al., 2007) prevalence data found no sex differences in cognitive function (Plassman et al., 2007). We found women perform better on episodic memory and word fluency. Consistent with prior studies on PA and aging in Latinos, we found a significant negative correlation between age and PA, and men tended to be more active than women (Troiano et al., 2008).

We selected tests that assess executive function because prior studies show it has the largest fitness-induced cognitive benefits (Colcombe & Kramer, 2003). Accordingly, we found PA (minutes of both light and moderate/vigorous PA) correlated significantly with two of the three domains of executive function (word fluency and interference control). Not surprisingly, there was no relationship with episodic memory, which does not tap into executive function.

Subsequently, in the regression analyses, only word fluency retained a relationship with PA, and the effect was larger for those with a more Latino orientation. It is uncertain why PA was more strongly related to rule-based retrieval of acquired knowledge (identification of animals, fruits, vegetables) compared with other aspects of executive function such as interference control and numbers comparison. Comparing our findings with studies of cohorts with healthy people at baseline was a challenge due to considerable variation in cognitive tests across studies and the use of single global and composite scores. There is a call for researchers to identify a small group of standard measurement instruments to allow for better comparison across studies (Snowden et al., 2011). Our findings seem to suggest that some domains of executive function may be more susceptible to PA and that, not all, may be equally affected. Further research is needed in identifying the effects of PA on specific domains of executive function.

We believe that this is one of the first studies to objectively measure light-intensity PA in relation to cognitive function. Our findings suggest that light-intensity PA may provide cognitive benefits for word fluency as does moderate/vigorous PA. This could be particularly important for older adults who, like participants in our study, tend to spend more time participating in light-intensity than more vigorous activities. We must keep in mind that our estimates between moderate PA and cognition may be somewhat misleading because of the floor effects. It may be that increases in moderate PA will lead to substantial increases in cognitive functioning, but we were not able to find this relationship due to the limited range of moderate/vigorous PA in this study. However, this needs further study using prospective research designs before substantive recommendations can be made.

Despite the unique findings, there are several limitations to this study. A major limitation is that it is cross-sectional; thus, we cannot identify the true direction of associations between PA and cognitive function. Another limitation is that the study is composed of volunteers, so the findings have to be cautiously generalized beyond the study population. The participants, however, were recruited from multiple communities in the Chicago area, thus reflecting those of Mexican, Puerto Rican, and other Latino backgrounds.

The strengths of this study include the inclusion of highly Latino–acculturated participants who had the opportunity to respond in their preferred language. Also, using accelerometers allowed us to assess lifestyle activity (i.e., activity during leisure, work, homemaking, walking for transportation). Unfortunately, the accelerometer does not allow us to identify the specific types of activity in which participants engaged.

In summary, we found an association between higher levels of PA and higher levels of cognitive function for word fluency in older Latinos similar to other cross-sectional and epidemiological studies. Most importantly, we found that cognitive benefits may be gained from both light-intensity and moderate/vigorous activity. Longitudinal work needs to be done to identify the effects of PA on the various domains of executive function.

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References
Further research is needed in identifying Our findings seem to suggest that some domains of executive a small group of standard measurement instruments to allow baseline was a challenge due to considerable variation in correlated significantly with two of the three domains of tending to be more active than women (Troiano et al., 2008).

As demonstrated in prior studies, there was a negative cognitive benefits may be gained from both light-intensity epidemiological studies. Most importantly, we found that of PA and higher levels of cognitive function for word fluency was (Caspe, 2009).

Despite the unique findings, there are several limitations of executive function. A major limitation is that it is cross-sectional; this study. However, this needs further study using prospec-

Validation of accelerometer for the assessment of moderate intensity physical activity in the field. Medicine and Science in Sports and Exercise, 32, S42–S49. doi:10.1097/01.MSS.0000175678-20000001-00002


