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Health Literacy Predicts Change in Physical Activity Self-efficacy Among Sedentary Latinas

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Abstract

Health literacy (HL) is associated with preventive health behaviors. Self-efficacy is a predictor of health behavior, including physical activity (PA); however, causal pathways between HL and self-efficacy for PA are unknown, especially among Latinas who are at risk for chronic disease. To explore this potential relationship, secondary analyses were conducted on data [Shortened Test of Functional Health Literacy in Adults (STOFHLA), PA self-efficacy, and socio-demographics] from a 6-month, randomized controlled trial of a print-based PA intervention ($n = 89$ Spanish-speaking Latinas). Linear regression models revealed associations between HL and baseline self-efficacy in addition to changes in self-efficacy at 6-months. After controlling for significant covariates, higher HL scores were associated with lower baseline PA self-efficacy. Regardless of treatment assignment, higher HL scores at baseline predicted greater changes in PA self-efficacy at 6-months. HL may contribute to Latinas' improved PA self-efficacy, though further research is warranted.

Keywords

Latinas; Health literacy; Self-efficacy; Physical activity

Background

Influence of Health Literacy on Health Disparities

The primary goal of advancing health literacy (HL) is to facilitate effective health communication strategies and health information technology to improve health outcomes, health care quality, and to achieve health equity [1]. Adequate HL reflects an individual's capacity to *independently* engage in effective health communication and utilization of health-related resources [2]. Individuals with limited HL are less likely to participate in preventive behaviors (i.e., health screens), have less disease specific knowledge, poor health management skills, and report greater barriers to preventive services [3–5].

The 2003 National Assessment of Adult Literacy (NAAL) estimates over one-third (36 %) of US adults have limited HL [6]. Socio-demographic variables including race/ethnicity (e.g., Hispanic/Latino), advanced age, and education (i.e., less than high school) are associated with limited HL, contributing to health disparities [6]. However, underlying psychosocial, cultural, and environmental factors likely influence disparities in preventive health behaviors and outcomes [7–9].

Self-Efficacy, Health Literacy, and Health Behavior

Rooted in Social Cognitive Theory, self-efficacy corresponds to a person's confidence in their ability to perform a health behavior [10]. Furthermore, knowledge of health risks and benefits can facilitate the precondition for behavior change [11]. Though results vary by individual behavior (e.g., smoking cessation, physical activity), studies have found self-efficacy to be a correlate of multiple health behaviors [12–15]. For example, Sarkar et al. [16] found self-efficacy was independently associated with diabetes self-management behaviors among an ethnically diverse sample (N = 408; 42 % Latino/a) but no significant interactions were found between self-efficacy and race/ethnicity or self-efficacy and HL on self-management behaviors. In another study, HL was not significantly associated with asthma self-efficacy; rather, asthma knowledge predicted successful patient self-management [17]. In contrast, Wolf et al. [18] found low literacy (i.e., <6th grade) significantly predicted lower patient knowledge of HIV treatment, lower medication self-efficacy, and medication non-adherence over a 4-day period. Further analyses demonstrated patient self-efficacy, but not knowledge, mediated the impact of low literacy on HIV medication adherence. In a cross-sectional study of older patients with coronary heart disease, Ussher et al. [19] reported lower HL score assessed by the Rapid Estimate of Adult Literacy (REALM) was significantly associated with several psychosocial variables, including less knowledge of heart problems, lower self-efficacy for exercise, and less social support.

Though health knowledge may be necessary for successful disease management and preventive behaviors [4, 17, 20], HL is necessary to facilitate adequate comprehension and improved knowledge of chronic disease and self-care skills [20, 21]. From the available literature, adequate HL may be important for improving self-efficacy to engage in preventive behaviors [3, 18, 19, 22]. Extending beyond clinical populations, however, little is known regarding the extent to which HL may be associated with physical activity self-efficacy; or

the extent to which HL may be associated with changes in self-efficacy over time. Furthermore, no research to date has explored these potential associations among healthy Latino populations.

Physical Activity, Health Literacy, and Self-Efficacy

Regular physical activity is known to reduce risk of developing cardiovascular disease, type 2 diabetes, and some cancers [23]. Though current recommendations suggest accumulating at least 150 min of moderate to vigorous physical activity each week, US adults remain largely sedentary [24, 25]. Furthermore, across gender and ethnic groups, minority females are the least likely of all subgroups to be physically active, contributing to related health disparities [26]. For example, Latinas are at increased risk for obesity, and diabetes [27, 28] compared to other groups (non-Hispanic White females, Latino males). With regard to health disparities, cultural and language barriers further confound the potential association between HL and preventive health behaviors [6, 8, 27, 28]. Assessing HL among Latinas may be prudent in identifying potential associations between psychosocial factors like self-efficacy and positive health behaviors including physical activity.

The purpose of this study was to explore the influence of HL on changes in physical activity self-efficacy among Latinas (N = 89) participating in a culturally adapted, print-based, randomized controlled trial of a 6-month PA intervention, *Seamos Activas* [29].

Methods

Participants

Data for this study were taken from a University approved, randomized controlled trial of a 6-month print-based culturally and linguistically adapted physical activity print intervention for Spanish speaking Latinas (N = 93) [29]. The current study focuses on a sub-sample of participants (n = 89) with available baseline HL scores. Healthy Spanish speaking women (18–65 years of age) who identified themselves as Latina/Hispanic and who did not engage in regular physical activity (i.e., participating in moderate or vigorous physical activity 2 days per week or less for 30 min or less each day) were recruited into the study.

Data Collection

Data collection and measurement procedures were conducted in Spanish by bilingual/bicultural research staff. Following a telephone screening interview to determine initial eligibility, participants attended an in-person orientation to further explain the study purpose and obtain informed consent. Because the intervention was print-based, all potential participants were required to read and write in Spanish; however participant eligibility was not dependent on HL score. Eligible participants were randomized to either physical activity intervention or wellness contact control conditions in which participants received either: (a) tailored information designed to motivate physical activity (tailored intervention), or (b) general health/wellness information (wellness contact control). Further detail regarding data collection procedures and additional measures used in the larger study are provided in Pekmezi et al. [29].

Tailored Intervention

The study—*Seamos Activas*—was based on the Transtheoretical Model [30] and Social Cognitive Theory [10] and emphasized behavioral strategies for increasing physical activity levels, such as goal-setting, self-monitoring, problem-solving barriers, increasing social support, and rewarding oneself for meeting activity goals. This 6-month program consisted of monthly mailings of physical activity manuals that were matched to a participant's current level of motivational readiness and individually tailored computer expert system feedback reports. Based on participants' monthly questionnaire responses, the expert system drew particular messages from a library of approximately 296 messages regarding motivation, self-efficacy, and cognitive and behavioral strategies for exercise adoption to generate individually tailored reports. To further encourage participants to use behavioral techniques, pedometers and physical activity logs were also provided [29].

Wellness Contact Control Condition

Control participants were mailed general health information on topics other than physical activity at the same intervals as the exercise group [29]. These pamphlets provided information on nutrition (e.g., dietary fat, sodium) and other factors associated with cardiovascular disease risk (e.g., smoking, cholesterol, and hypertension) and were specifically targeted to Latinos aged 18–54 years with low levels of acculturation, SES, and education. Self-efficacy and other cognitive and process variables were assessed via monthly questionnaires; however no tailored feedback reports were provided to control participants.

Measures

At baseline, participants completed a demographics questionnaire on age, race/ethnicity, education, marital status, number of young children in the home, whether only Spanish was spoken in the home, whether or not they were born outside the US, income, and employment status. Health literacy (HL) was assessed using the Spanish version of the validated Shortened Test of Functional Health Literacy in Adults (STOFHLA) [31]. Scoring for the STOFHLA is based on a 36-point scale, which categorizes HL as: inadequate (0–16), marginal (17–22), and adequate HL (23–36).

Self-efficacy or confidence in one's ability to exercise in various situations (e.g., feeling fatigued, encountering inclement weather, when on vacation) was administered to both groups each month for 6-months using a five-item instrument that included Likert-based response options ranging from 1 (Not Confident At All) to 5 (Extremely Confident) [32]. For this study, internal consistency ($\alpha = 0.67$) and test–retest reliability over a 2-week period (0.90) were high [29].

Physical activity was assessed at baseline and 6 months using the 7-Day Physical Activity Recall (7-Day PAR) which is an interview-administered instrument estimating weekly minutes of self-reported activities including time spent sleeping and in moderate, hard, and very hard activity [33, 34]. The 7-Day PAR has demonstrated consistent reliability, internal consistency, and validity with objective measures of physical activity [35].

Analysis

Baseline demographic variables were summarized using means (standard deviations) for continuous variables and percentages for categorical variables. Using a linear regression model, we assessed whether baseline HL was associated with physical activity at 6 months when controlling for treatment assignment, baseline physical activity and key confounders of the association.

To determine whether HL was associated with baseline self-efficacy, a linear regression model was used, which controlled for key baseline demographic characteristics of participants (born outside of the US, income, marital status, employment, years of schooling, whether or not there were young children in the house, and whether or not Spanish was the only language spoken at home). The potential confounders adjusted for in the model were determined a priori. Residual diagnostics and influence statistics assessed model fit (including potential outliers). Subsequently, we assessed whether baseline HL predicted changes in self-efficacy for physical activity over 6-months using a linear regression model that controlled for baseline participant characteristics, baseline physical activity self-efficacy, and treatment assignment (as self-efficacy was targeted by the physical activity intervention). Again, model fit was assessed using residual diagnostics and influence statistics.

Finally, using similar models to those described above, we assessed whether HL was associated with both baseline physical activity self-efficacy and changes in self-efficacy for physical activity (from baseline to 6 months) amongst intervention participants alone. Because power is limited for these subgroup analyses, our emphasis is on estimates of effect.

All statistical analyses were carried out using SAS version 9.2 and SPSS version 18.0. Statistical significance was determined using an a priori alpha level of 0.05 ($p < 0.05$).

Results

Demographic characteristics of the sample are presented in Table 1. Average age was 41.37 years ($SD = 11.18$) and most spoke only Spanish in the home (85 %) with nearly all having been born outside the US (95.5 %). Over half of the sample had 12 or more years of education (66 %) and over one-third (35 %) reported having at least one child under 5 living in the same household. Most participants identified themselves as Dominican (34 %) or Columbian 31 %). On average, baseline S-TOFHLA scores indicated most participants (81 %) had adequate HL ($M = 29.92$, $SD = 7.61$); whereas 19 % of participants had either marginal (9 %) or inadequate HL (10 %). Baseline self-efficacy for physical activity suggested participants were moderately confident that they could engage in moderate-to-vigorous physical activity ($M = 2.67$, $SD = 0.92$) with responses ranging from 1 (Not at all Confident) to 5 (Extremely Confident).

Linear regression analyses suggested a significant association between baseline HL score and baseline physical activity self-efficacy ($t = -2.99$, $p = 0.004$) when controlling for children in the home, whether the household was Spanish-speaking only and whether participants had less than 12 years of education. Additional covariates (born outside US,

income, marital status, and employment) were removed from the final model, as effect sizes were small, non-significant, and consequently did not impact key predictors under consideration. Residual diagnostics and influence statistics did not suggest departures from model assumptions nor potential outliers. Parameter estimates are presented in Table 2 and suggest higher HL scores at baseline are associated with lower baseline physical activity self-efficacy, when controlling for key covariates.

At 6 months, no significant association between HL and changes in physical activity were found when controlling for treatment assignment ($p > 0.05$). Results did demonstrate a significant association between baseline HL and changes in self-efficacy over 6-months, when controlling for potential confounders, as well as treatment assignment. Results presented in Table 3 revealed higher baseline HL score predicted greater change in mean self-efficacy over 6-months. Again, no departures from model assumptions were indicated. We analyzed the intent to treat sample with the assumption of no change in self-efficacy over time if 6-month scores were missing.

When linear regression models were run amongst the sample of intervention participants alone, there was no significant effect of baseline HL on baseline self-efficacy but effects remained in the same direction ($b = -0.02$, $se = 0.02$, $p = 0.42$). However, when assessing whether HL was associated with changes in self-efficacy, effects were similar to those presented in the aggregated sample ($b = 0.06$, $se = 0.03$, $p = 0.07$).

Discussion

Previous research has demonstrated adequate HL is associated with greater health-related knowledge [18, 19, 21, 36], while others report associations with improved self-efficacy and self-management behaviors [18]. However, these studies often occur in clinical settings and focus on disease-specific behaviors and outcomes [16, 18, 21, 37]. The present study explored the influence of HL on changes in physical activity self-efficacy among sedentary, healthy Latinas participating in a culturally adapted and individually tailored physical activity print intervention.

Ussher et al. [19] suggested low self-efficacy for exercise among patients with low HL may serve as a barrier for increasing exercise levels. However for the present study, most participants had adequate HL, with higher STOFHLA scores indicating Latinas were more likely to have lower perceived physical activity self-efficacy at baseline. This counterintuitive finding may suggest that participants with higher STOFHLA scores had a more realistic perception regarding their physical activity self-efficacy at the start of the study. Though this has not been empirically substantiated, it is possible that HL potentially influenced baseline self-efficacy perceptions. Conceptual models have proposed causal pathways between HL, knowledge, self-efficacy, and health behavior [3, 19, 22]; however no research has explored these potential relationships among Latinas with adequate HL, warranting further investigation.

Results following the 6-month intervention found higher baseline STOFHLA scores predicted greater increases in physical activity self-efficacy across *both* groups after

controlling for the effect of the intervention. Although the print-based physical activity intervention was specifically targeted to improve physical activity self-efficacy in the physical activity intervention group, Latinas in both groups with higher STOFHLA scores may have been better able to comprehend the health-related materials. It is also probable that the project name, *Seamos Activas (We Are Active)*, attracted sedentary Latinas who may have been highly motivated to become physically active.

Though changes in physical activity outcome were not statistically dependent on HL score, the physical activity intervention group did demonstrate increases in physical activity self-efficacy compared to those in the wellness control group [29]. Further research should examine Latinas' use of health-related information and cognitive processes, including HL and prior knowledge, which may influence behavioral intention to be physically active [19].

Future research should continue to investigate associations between HL and psychosocial influences on physical activity and other preventive behaviors (e.g., healthy diet). Moreover, investigators should test the possible moderating effect of social support between HL and self-efficacy. An empirical review by Lee et al. [38] found individuals with lower HL likely rely on social support from others, including family and friends; although the extent of support may be limited or perceived as such [19]. Regardless of literacy level, exploring Latinas' use of social support and social networks may provide useful information as their reliance on significant referents may facilitate how health information is obtained and health resources are relayed and utilized (including community-based resources for health promotion).

Strengths of this study include the longitudinal, prospective design and underserved, at-risk sample. Latinas report highly sedentary lifestyles and are disproportionately burdened by subsequent chronic diseases (e.g., diabetes). Thus research examining relationships between HL and psychosocial factors (i.e., physical activity self-efficacy) can shed light on how to address such health problems in this target population. To our knowledge, this is the first study to investigate the association between HL and changes in physical activity self-efficacy among healthy Latinas.

This study is not without limitations. Further investigation is warranted using a larger and more diverse sample. Because the print-based physical activity intervention targeted Latinas who could read and write in Spanish, it is possible that Latinas with limited literacy, even in their native language, may have been less likely to participate. Although HL score was not used to exclude participants, the potential for recruitment bias limits the generalizability of these results to Latinas with predominantly adequate HL. Future physical activity interventions should include Latinas with varying literacy skills (i.e., functional, marginal, inadequate). In addition, physical activity was assessed using the valid and reliable 7-Day PAR [33, 34]; however, the potential for recall bias also limits these findings. Future physical activity research should include more objective measures of physical activity (i.e., accelerometer). Finally, mediation and moderation could not be determined from these data; therefore it is recommended studies explore whether HL is a moderator of the effect of treatment on physical activity self-efficacy and whether physical activity self-efficacy is a mediator of the effect of HL on physical activity outcomes.

Conclusions

Health literacy is necessary for individuals to comprehend, communicate, and utilize health-related information. Physical activity interventions targeting Spanish-speaking Latinas should assess HL and physical activity knowledge as this could impact participants' ability to utilize self-help, print-based physical activity information, and thereby improve self-efficacy to become more active. While research in this area often takes cultural sensitivity into consideration, future physical activity interventions and related print-based materials should also accommodate for literacy skill.

Adequate HL is associated with improved knowledge about health risks and preventive behaviors [4, 5, 18, 20, 39]. Though increased health-related knowledge is associated with HL, further examination as to how these factors improve Latinas' self-efficacy for health behavior is warranted. Efforts to increase HL and context specific health knowledge (e.g., benefits/barriers to physical activity), and self-efficacy are necessary for individuals to exert greater personal control over their health and health-related decisions [2]. The results of this study add preliminary support to the literature regarding the influence of HL on psychosocial factors including self-efficacy which facilitate intention to engage in preventive health behaviors [18, 19].

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Table 1

Baseline participant characteristics

	Study sample (N = 89) % or mean (SD)
Age (years)	41.37 (11.18)
Education (at least 12 years)	66 %
High school graduate	14.6 %
Vocational/technical school	11.2 %
Some college	18 %
College graduate	15.7 %
Post-graduate studies	6.7 %
At least one child under the age of 5 living in the same household	35 %
0 Children	65.2 %
1 Child	25.8 %
2 Children	3.4 %
3 Children	4.5 %
4 Children	0 %
5 Children	1.1 %
Health literacy score (S-TOFHLA)	29.92 (7.61)
Adequate (23–36)	81 %
Marginal (17–22)	9 %
Inadequate (16)	10 %
Baseline self-efficacy score (1–5)	2.67 (0.92)
Country of origin	
Puerto Rico	10 %
Dominican Republic	34 %
Mexico	2 %
Cuba	1 %
Guatemala	10 %
Columbia	31 %
Other	12 %

Table 2

Predictors of baseline self-efficacy

	Parameter estimate	Standard error	t-value	p value
At least one child under five in the home	0.08	0.19	0.40	0.69
Spanish-speaking household	−0.38	0.20	−1.93	0.06
Less than 12 years of schooling	0.41	0.20	2.08	0.04
Baseline health literacy	−0.04	0.01	−2.99	0.004

p 0.05

Table 3

Predictors of change in self-efficacy over 6 months

	Parameter estimate	Standard error	t-value	<i>p</i> value
At least one child under five in the home	−0.20	0.21	−0.94	0.35
Spanish-speaking household	0.24	0.22	1.13	0.26
Less than 12 years of schooling	−0.17	0.22	−0.79	0.43
Baseline health literacy	0.04	0.01	2.84	0.006
Treatment assignment (intervention vs control)	0.27	0.21	1.28	0.20

Adjusted for $p = 0.05$