Development and Validation of the Lifestyle Self-Efficacy Scale for Latinos with Diabetes (LSESLD)

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Objectives: To develop and validate a self-efficacy measure of diabetes self-management, the Lifestyle Self-Efficacy Scale for Latinos with Diabetes (LSESLD), designed for low-income, Spanish-speaking Latinos with diabetes.

Design: Quantitative and qualitative methods.

Setting: Community health centers in central and western Massachusetts.

Participants: Low-income Latinos ($N=252$) enrolled in a randomized diabetes self-management intervention trial.

Measures: Construct validity, internal consistency, sensitivity to change over time.

Results: The LSESLD demonstrated good internal consistency (Cronbach's alpha = .85), reasonable construct validity (moderate, significant associations between the LSESLD and validated measures of diabetes knowledge, dietary intake, physical activity, blood glucose self-monitoring, and HbA1c values), and sensitivity to intervention-related changes over time.

Conclusion: The LSESLD is a reliable and valid research instrument assessing self-efficacy related to diabetes self-management among low-income, Spanish-speaking populations. (*Ethn Dis.* 2013;23[4]:428–435)

Key Words: Diabetes, Self-Efficacy, Self-Management, Scale, Latinos, Low-income

Introduction

Type 2 diabetes (hereafter referred to as diabetes) is a growing epidemic in the United States and the world,[1] contributing to significant premature disability, morbidity, and mortality[2] and resulting in staggering costs associated with excess medical care expenditures and reduced productivity.[3] The prevalence of diabetes among Latino adults in the United States (11.8%) is disproportionately higher than non-Latino White adults (7.1%).[4] Additionally, Latinos with diabetes tend to exhibit poor glycemic control,[5–7] resulting in higher rates of diabetes-related complications and mortality compared to non-Latino whites.[8,9]

Effective diabetes management includes consistent access to and receipt of preventive services as well as patient adherence to diabetes self-management (DSM) behaviors. The American Diabetes Association (ADA) guidelines[10] recommend DSM as integral to effective diabetes care. Specific DSM behaviors include self-monitoring of blood glucose (SMBG), regular physical activity, and consumption of a high quality diet, characterized by a balanced consumption of fiber, fruits, vegetables, whole grains, legumes, low-fat milk, and fish and low consumption of saturated fat, trans fat, cholesterol and sugar.

Many factors contribute to successfully managing diabetes, including diabetes-related knowledge; skills to adhere to specific behavioral prescriptions; and self-efficacy, defined as confidence in one's ability to achieve behavioral goals. Self-efficacy, a key construct in social cognitive theory (SCT),[11] is a strong predictor of behavior change.[11–14] DSM self-efficacy is associated with diabetes-related knowledge,[15] increased engagement in DSM behaviors[15–17] and improved glycemic control[18,19] among populations with diabetes. Thus, enhancing patients' DSM self-efficacy is thought to be critical to successful DSM and glucose control.

To date, there are relatively few studies that examine the role of self-efficacy in improving DSM among Latino populations, particularly among Caribbean Latinos.[17,20,21] Furthermore, a validated DSM self-efficacy scale that is culturally and linguistically appropriate for low-income Latinos currently does not exist. The availability of such a scale would be particularly useful for identifying specific areas for intervening to enhance DSM adherence. Our study addresses this gap by developing and testing the psychometric properties of the Lifestyle Self-Efficacy Scale for Latinos with Diabetes (LSESLD), a novel instrument designed to measure DSM self-efficacy among low-income, Spanish-speaking, Caribbean Latinos with diabetes. While not a rigorous psychometric study, the development and validation of the LSESLD is a practical, translational study that leveraged existing resources from the Latinos En Control Trial, a randomized trial targeting DSM among low-income, Caribbean Latinos with diabetes, to develop a tailored scale for the target population.

Specific aims of our study included developing items for the LSESLD and evaluating the LSESLD for internal consistency, construct validity, and sensitivity to change in self-efficacy over time. We hypothesize that the LSESLD is: 1) positively correlated with validated measures of related constructs, including diabetes knowledge, dietary intake, physical activity, and SMBG; 2) negatively correlated with hemoglobin A1c (HbA1c) levels; and 3) sensitive to change in self-efficacy, with change scores on the LSESLD expected to be greater among intervention participants than control participants from baseline to follow up.

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METHODS

LSESLD Development

The rationale for the development of the LSESLD was based on findings from cognitive testing of a related scale, the Insulin Management Self-Efficacy Scale (IMSES),[22] to determine its appropriateness for use with low-income Caribbean Latinos. Cognitive testing includes administering of scale items to participants and asking participants to explain their understanding of each item and corresponding response format. Cognitive testing of IMSES among a sample (n=5) of low-literate Spanish-speaking adults (Caribbean origin) with diabetes[23] revealed that participants experienced several challenges in completing its assessment, notably, difficulty with understanding of general instructions, incomplete or inadequate understanding of select terms (ie, diabetic diet), and invalid assumptions regarding respondents' DSM knowledge (ie, asking about self-efficacy to perform "tasks needed to manage your diabetes" without further clarification). Other items were found to be irrelevant to this population or assumed dietary knowledge beyond the level of many patients in this population (ie, exchange one food type for another in the same food group). These challenges indicated that the original scale was inappropriate for assessing DSM self-efficacy among a low-income Latino population.

Thus, a new scale, the LSESLD, was developed based on significant modifications to the IMSES[24] (only one item remained unmodified) that were informed by cognitive interviewing specifically aimed at improving item clarity and comprehension. Novel items were created by the study PI, a bilingual and bicultural researcher with expertise in developing materials appropriate for low-literate populations, and the study dietitian based on the original cognitive interviews, a review of the literature, and experiences gained from a previous pilot study[24] (ie, what particular foods and situations most challenged adherence among the target population). The LSESLD items were refined with input from three Latino community workers.

The scale was developed simultaneously in English and Spanish by the PI. Designed for verbal administration, the scale included 22 items on diet, physical activity, SMBG, and overall DSM self-efficacy. Diet-related questions were made more specific to assess self-efficacy to make specific changes, such as avoiding specific foods commonly consumed in this population (eg, fried foods, sugary drinks); eating smaller portions of commonly consumed foods (eg, rice), and increasing consumption of foods typically infrequently consumed (eg, vegetables). The LSESLD also added two novel items regarding self-confidence to follow dietary prescriptions in the face of common challenges (eg, stress, financial strain). Items were also developed to assess physical activity self-efficacy separately in the summer and winter months, as weather was a commonly reported barrier to exercise adherence among the target population. Items on self-efficacy for taking diabetes medication were not included in this scale, as validated items on this construct exist[25] and may be used in conjunction with the LSESLD. All items utilized a 4-point Likert scale (no seguro/not confident; poco seguro/a little confident; mas o menas seguro/somewhat confident; and completamente seguro/completely confident).

Participants and Procedures

Participants (N=252) were enrolled in a randomized clinical trial of a DSM intervention (Latinos en Control).[26] Participants for the trial were recruited from five urban community health centers in central and western Massachusetts, where the majority of the Latino population is of Caribbean origin. Inclusion criteria for study participants were: Latino/Hispanic ethnicity; aged ≥18 years; clinical diagnosis of type 2 diabetes; HbA1c level ≥7.5% in the previous seven months; functionally capable of meeting the DSM intervention goals (able to walk, no evidence of cognitive impairments, no medical contraindications); physician approval to participate in the study; no history of alcoholism or drug abuse, dementia, recent psychiatric hospitalization or suicidality; no current participation in cardiac rehab or formal weight loss programs; and no current pregnancy. The intervention, guided by the Social Cognitive Theory, consisted of 12 weekly group-based sessions followed by 8 monthly group-based sessions aimed at increasing self-efficacy (ie, promoting positive attitudes toward DSM) and facilitating behavior change in diet, physical activity, and SMBG through a variety of skill learning strategies (ie, direct instruction, modeling, and interactive skill-building activities). Additional details on participant recruitment, consent procedures, intervention and study design, and methods are described elsewhere.[26] The study was approved by the Institutional Review Boards of the University of Massachusetts Medical School and Baystate Medical Center.

Participants completed assessments at baseline, 4 months, and 12 months follow-up. Assessments included clinical measures (HbA1c), and standardized in-person surveys and telephone-administered measures. Data were collected by trained bilingual and bicultural research staff. Baseline scores on the LSESLD and other measures (described below) were used to conduct tests of reliability and validity on the LSESLD; 4 month and 12 month follow-up data were used to establish the scale's sensitivity to change in self-efficacy between control and intervention participants. All participants preferred to complete assessments in Spanish; thus, the psychometric data presented in this study is for the Spanish version of the LSESLD only.

Measures

Diabetes Self-management Knowledge

Diabetes self-management knowledge has been conceptually associated with DSM self-efficacy in predicting DSM.[15] Additionally, the association between knowledge and self-efficacy has been empirically established for hypertension self-management and for validation of a hypertension lifestyle and management scale.[27] Thus, a subset of twenty-five items specific to physical activity, diet, and reducing complication risks from the Audit of Diabetes Knowledge (ADK),[28] a validated instrument to assess DSM knowledge, were used to examine the construct validity of the LSESLD. The twenty-five item instrument was translated into Spanish and telephone-administered to participants with response options being: true, false, or unsure.

Diabetes Self-management Behaviors

Self-efficacy[11] has been empirically shown to be positively associated with and predictive of DSM behaviors.[13,16,17,29,30] Three domains of DSM behaviors were assessed: diet, physical activity, and SMBG. These domains were measured via unannounced 24-hour recalls.[31] Three recalls were administered at each timepoint (2 weekdays and 1 weekend day) to assess day-to-day intra-individual variations in the three behavioral domains.[32] Dietary data were collected using the multiple pass approach of the University of Minnesota Nutrient Database System.[32,33] The Alternate Healthy Eating Index (AHEI) was used as a summary measure of dietary quality[34,35] and assesses specific dietary components (vegetables, fruits, nuts and seeds, cereal fiber, fish/poultry to red meat ratio, polyunsaturated to saturated fat ratio, trans fat and alcohol) that have been consistently associated with lower chronic disease risk and with ADA dietary guidelines. Physical activity data were collected using a multiple pass approach,[31,36] which is similar to 24-hour dietary recall methodologies. Participants reported the number of minutes engaged in physical activity during the 24-hour recall period. Self-monitoring of blood glucose was assessed by asking participants if they had tested their glucose levels in the past 24 hours (yes/no) and the number of times. The average of each of the three behavior measures (AHEI score, number of minutes of physical activity engaged in, and number of times blood glucose was tested) was taken at each data assessment point. As self-report of SMBG is not highly reliable among adults with diabetes,[37,38] SMBG was analyzed dichotomously (blood glucose tested at least twice/day - yes/no) to address outliers.[39]

Glycemic Control

Higher levels of self-efficacy are associated with and predict improved glycemic control.[18,19] To assess glycemic control, HbA1c levels were collected during the clinical assessment and analyzed using standardized procedures.

Demographic Characteristics

Data on demographic characteristics were collected via in-person assessments conducted at the time of the clinical assessment and included: sex (male/female), age (years), marital status (married or living with partner, divorced, widowed, or separated, and never married), education (year/level completed), annual household income $\geq$ $10,000 per year (yes/no), current employment status (full or part-time, unemployed, disabled, retired, and housewife), country of origin, and number of years since diabetes diagnosis.

Statistical Analysis

Descriptive statistics were conducted to describe the study sample and the individual LSESLD items. Exploratory factor analysis on all items (N=19) with varimax rotation was used to determine the structure of the LSESLD. An unforced factor solution and a minimum eigenvalue criterion of 1.0[40] were used. To ensure each item's unique contribution, variables with factor loadings of .40 or greater were considered to load on a given factor.[41] Results from the factor analysis informed the composition of the scale and exclusion of specific items in the final version.

To determine the internal consistency of the final LSESLD, Cronbach's alpha was calculated for the study sample and by sex, age group, education level, and years since diabetes diagnosis. To assess construct validity, Pearson's correlations were used to examine associations between the final LSESLD and measures of DSM knowledge, the three domains of DSM behaviors, and glycemic control. The LSESLD scale's sensitivity to change was determined by examining the effect of the DSM intervention on participants' self-efficacy. We expected participants in the intervention group (n=124) to demonstrate significantly greater improvements in DSM self-efficacy from baseline to follow up than control participants (n=128). Linear mixed models were used to estimate differences in LSESLD scores between intervention and control participants from baseline to 4- and 12-month follow up.[42] Measures of test-retest reliability were not conducted

Table 1. Sample characteristics of low-income Latinos participating in the development and validation of the LSESLD (*N*=252)

Sociodemographic Measures	%
Sex	
Female	76.6
Male	23.4
Age, years	
18–44	16.3
45–54	29.8
55–64	32.9
≥ 65	21.0
Marital status	
Married or living with partner	39.0
Divorced, widowed, or separated	38.2
Never married	22.8
Country of origin	
Puerto Rico	91.5
Dominican Republic	4.5
Other	4.1
Highest level of education	
0–4 years	28.0
5–8 years	28.0
9–12 years (not HS graduate)	19.2
≥High-school or GED	24.8
Employment status	
Working full or part-time	11.3
Unemployed/looking for a job	3.5
Disabled	61.7
Retired	10.9
Homemaker	12.6
Household income/year[a]	
<$10,000	55.3
Years since diabetes diagnosis	
1–5	31.3
6–10	24.3
11–15	18.9
≥16	25.5

[a] 35 surveys missing this response.

due to lack of feasibility in scheduling an additional follow-up between established data measurement points for participants in the trial. All analyses were conducted using SAS, version 9.2.

RESULTS

Sample Characteristics

Of the 252 participants, 76.6% were female, over half (56.8%) reported less than a 9th grade level of education, and 50% reported an annual household income of less than $10,000. Detailed socio-demographic characteristics of the study sample are presented in Table 1.

Exploratory Factor Analysis

The results of the exploratory factor analysis supported a single factor solution for the LSESLD. Results did not differ by the three domains of DSM behaviors (diet, physical activity, SMBG). Of the 19 items, 17 had factor loadings of .40 or greater (see Table 2). Two items, avoid whole or 2% milk (loading = .29) and know what to do when blood sugar is high (loading = .30), were excluded, resulting in 17 items included in the final scale. Participants' LSESLD scores were calculated as a summary of the individual items (range: 17–68). The mean LSESLD score in the study sample was 50.3 (SD=10.0).

Internal Consistency

The overall standardized Cronbach's alpha (α) of the final LSESLD was .85, with standardized item-total Cronbach's α for each item ranging from .82 to .84. Tests of internal consistency yielded the same results (α = .85) across sex and all age groups. Similar coefficients were found by education level (α range of .80–.87) and by years since diabetes diagnosis (α = .83 for ≤5 years; α = .85 for >5 years).

Construct Validity

Table 3 presents Pearson's correlations of the LSESLD with validated measures of DSM knowledge, the three domains of DSM behaviors, and HbA1c levels. Each correlation coefficient was in the hypothesized direction and statistically significant at $P<.0001$. The strongest associations were observed for DSM knowledge (r=.49) and SMBG (r=.46), whereas the weakest association was HbA1c level (r=−.27).

Sensitivity to Change

Table 4 presents the results of the linear mixed model analysis comparing changes in participants' LSESLD scores from baseline to the 4- and 12-month follow-up assessments by intervention status. Consistent with our hypothesis, the intervention group demonstrated significantly greater improvements in LSESLD scores at both the 4-month (mean β change=.32, 95% CI = .19, .44) and 12-month follow-up (mean β change=.24, 95% CI = .09, .38) than the control group.

Table 2. Distribution of responses among low-income Latinos participating in a diabetes self-management intervention (*N*=252) and item factor loadings on the LSESLD

Item	Responses, %				Factor Loading
	Not at All Sure	*Little Sure*	*Somewhat Sure*	*Completely Sure*	
Diet					
1. Eat meals same time every day	55.4	13.6	10.8	20.3	.47
2. Avoid drinks that contain sugar	19.8	11.1	19.4	49.6	.59
3. Avoid sweets	21.9	12.8	21.9	43.4	.61
4. Avoid fried and fatty foods	17.9	18.3	23.9	39.8	.61
5. Eat vegetables in most meals every day	13.1	17.5	20.6	48.8	.51
6. Avoid white bread	20.5	16.1	22.5	41.0	.56
7. Limit white rice portions	19.8	12.7	15.1	52.4	.55
8. Avoid whole milk or 2%[a]	19.8	12.7	15.1	52.4	.29
9. Limit root vegetables or starchy dishes	8.0	14.3	33.5	44.2	.47
10. Maintain healthy diet during financial difficulties	37.3	21.0	19.1	22.6	.49
Physical Activity					
11. Exercise 3 times per week during summer	13.1	11.9	26.6	48.4	.49
12. Exercise 3 times per week during winter	33.9	25.5	17.1	23.5	.51
13. Maintain good diet and exercise when difficult life situations arise	35.7	20.6	25.4	18.3	.45
Blood glucose self-monitoring					
Test blood glucose every day	7.5	6.0	13.5	73.0	.43
Test blood glucose when not at home	31.7	12.5	12.9	42.9	.44
Test blood glucose more often when sick	20.3	12.0	20.7	47.0	.40
Prevent low blood sugar	35.9	11.2	21.1	31.9	.41
Prevent high blood sugar	34.1	13.9	25.8	26.2	.54
Know what to do when blood sugar is high[a]	43.7	7.5	17.9	31.0	.30

[a] Item not included in final scale.

DISCUSSION

While several validated measures assessing DSM self-efficacy have been developed for other populations,[43–45] DSM self-efficacy tools appropriate for low-income Latinos, a group that experiences a high risk for diabetes, high diabetes prevalence and high rates of diabetes-related complications have not previously been developed. Our study describes the development of the LSESLD, an instrument designed to measure self-efficacy of DSM behaviors among a sample of low-income, Spanish-speaking Caribbean Latinos with diabetes, and the results of psychometric tests of the LSESLD among the target population. Study findings indicated that the scale items are culturally- and linguistically-appropriate for assessing DSM self-efficacy among low-income, Spanish-speaking Latino adults with diabetes.

Findings support the reliability and validity of the LSESLD as measure of overall self-efficacy for DSM among low-income, Spanish-speaking Caribbean Latinos. With respect to construct validity, the moderate magnitude of the coefficient correlations between the LSESLD with validated measures of DSM knowledge, three domains of DSM behaviors, and glycemic control

Table 3. Correlations of the LSESLD with validated scales or measures of diabetes knowledge, diabetes self-management behaviors, and glycemic control

	Pearson Correlation Coefficient	*P*
Audit of Diabetes Dependent Knowledge scale	.49	<.0001
AHEI score, daily average	.38	<.0001
Duration of total physical activity, daily average	.30	<.0001
Frequency of blood glucose self-monitoring, daily average	.46	<.0001
HbA1c level	−.27	<.0001

Study findings indicated that the scale items are culturally- and linguistically-appropriate for assessing DSM self-efficacy among low-income, Spanish-speaking Latino adults with diabetes.

Table 4. Change in LSESLD scores from baseline to follow-up among low-income Latinos participating in a diabetes self-management trial (*N*=252)

	Control Group (*n*=128) β Change (95% CI)	Intervention Group (*n*=124) β Change (95% CI)	Intervention Effect Difference in β Change (95% CI)	*P*
4-month follow-up	.13(.04, .22)	.45(.36, .53)	.32(.19, .44)	<.001
12-month follow-up	.21(.11, .31)	.45(.035, .55)	.24(.09, .38)	.001

were anticipated given expected measurement error in the behavioral assessments, as many factors, in addition to self-efficacy, contribute to and shape individuals' dietary, physical activity, and SMBG behaviors.[46] While 3 subscales were considered for the LSESLD (diet, physical activity, and SMBG), results from the exploratory factor analysis supported a single factor solution for the scale. This finding is interesting given that self-efficacy is intended to be behavior-specific[11] and suggests that with respect to managing a chronic disease such as diabetes, which often requires multiple behavioral changes, participants may find that focusing their abilities to manage diabetes as a comprehensive entity, rather than focusing on distinct DSM behaviors, to be easier and/or more effective. The holistic approach to DSM (ie, behavior changes in diet, physical activity, and SMBG) may contribute to an iterative process in which confidence in DSM, DSM behaviors, and effectiveness in DSM reinforce one another.

The evaluation of the scale's sensitivity to change in DSM self-efficacy over time indicated significant differences in LSESLD scores between intervention and control participants from baseline to 4-month follow up (β difference = .32, $P<.001$) and to 12-month follow up (β difference = .24, $P=.001$) in a randomized DSM intervention. As expected, participants receiving the intervention indicated higher overall scores on the LSESLD as well as greater positive changes in LSESLD scores from baseline to follow up compared to control participants. This finding suggests that the LSESLD is sensitive to assessing changes in self-efficacy over time.

This study has several strengths, including the development of a novel, culturally- and linguistically-appropriate instrument assessing DSM self-efficacy through formative, qualitative research with Spanish-speaking Caribbean Latinos and the use of well-known standardized tests to examine the psychometric properties of the LSESLD scale among the target population. The LSESLD demonstrated sensitivity to capturing change in self-efficacy over time in response to a randomized DSM intervention. Furthermore, the methodology used to develop and validate the LSESLD utilized existing resources from a concurrent study, the Latinos En Control trial, highlighting the practical and translational nature of the current study.

A main study limitation was that only the Spanish version of the LSESLD was used for psychometric testing. Language variations may make the instrument less generalizable to other Spanish-speaking cultures, as the Spanish used in the design and testing of the LSESLD was based on jargon/dialect common to the Caribbean. While specifically designed for Caribbean Latinos, the English version of this scale holds potential for adaptation for an ethnically-diverse population of low-income adults with type 2 diabetes. Other study limitations include: the LSESLD does not measure self-efficacy for additional DSM behaviors such as adherence to oral medications or insulin use; results of this analysis may have been biased by the predominantly female sample, although internal consistency of the final scale was similar among men and women; and lack of conducting measures of test-retest reliability because this was not feasible. Future research should assess the reliability and validity of the LSESLD using the English version among bilingual and English-speaking Latinos.

Findings from this study indicate that the LSESLD is a reliable, valid, and culturally- and linguistically-appropriate instrument that may be particularly useful as a research tool to identify specific areas for improvement in DSM, tailoring DSM intervention efforts, assessing immediate DSM intervention outcomes, and predicting DSM adherence among low-income Latinos. The LSESLD may also be useful for future research studies examining the effectiveness of DSM programs on addressing participants' self-efficacy.

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