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Evaluating Short-Form Versions of the CES-D for Measuring Depressive Symptoms Among Immigrants From Mexico

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This article examines the feasibility of using a short-form version of the Center for Epidemiologic Studies–Depression Scale (CES-D) in community mental health research with Mexican immigrants. Several features of three published short versions of the CES-D were examined using data combined from seven diverse Mexican immigrant samples from across the United States ($N = 685$). Results indicate that published short-form versions of the CES-D are reliable, they account for most of the variance in scores from the full CES-D, and there is little evidence that the use of short forms attenuates associations with other concepts relevant to understanding the mental health of Mexican immigrants. Although additional validation research is necessary, the results of this study suggest that short-form versions of the CES-D can be used to study mental health among Mexican immigrants.

Keywords: *Mexicans; depressive symptoms; measurement; community research; immigrants*

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Research focused on the mental health of Mexican immigrants is growing. Although a portion of the attention may be attributable to the sheer growth of the immigrant population, interest is also being fueled by collective evidence suggesting that the mental health of Mexican immigrants, as well as other Latinos, deteriorates with greater time in the United States (see Escobar, Hoyos Nervi, & Gara, 2000). In light of this evidence, investigators around the country are designing studies to delineate the factors that undermine the mental health of immigrants from Mexico and to inform effective interventions and treatment. Recognizing that Mexican immigrants frequently have little formal education and are unaccustomed to completing lengthy and complex instruments for assessing mental health, a brief but valid instrument for assessing mental health would be invaluable to community-based researchers.

Several shortened versions of the Center for Epidemiologic Studies–Depression Scale (CES-D) have been created to advance mental health research among segments of the population for whom the full instrument may be too burdensome (Andresen, Malmgren, Carter, & Patrick, 1994; Cole, Rabin, Smith, & Kaufman, 2004; Kohout, Berkman, Evans, & Cornoni-Huntley, 1993; Santor & Coyne, 1997). Each of the different shortened versions of the CES-D has dramatically different physical qualities in terms of which items from the full CES-D are included (see Table 1) and their response categories. A particular note of interest among these items is the relative level of abstraction in the items contained in each form. The Boston Form, for example, is made up heavily of concrete experiences, such as "I felt depressed," "I was happy," or "People were unfriendly," whereas the other forms combine concrete experiences with more abstract items like "I felt I could not shake off the blues" or "I thought my life had been a failure." The meaning of such things such as "blues" or "failure" is subject to considerable interpretation. Nevertheless, evaluations of each form yield a common conclusion: Valid and reliable assessments of depressive symptoms can be obtained from CES-D short forms. It is important, however, that there has been no research examining how short versions of the CES-D perform in Mexican immigrant samples.

The purpose of this article is to determine the feasibility of using a short-form version of the CES-D in community mental health research with Mexican immigrants. Three different published short versions of the CES-D were evaluated using existing data from seven studies conducted with Mexican immigrants across the country over an 8-year period. Two versions of the Boston short-form CES-D (Kohout et al., 1993) and a new short-form developed by Cole and colleagues (2004) are evaluated (i.e., Cole form). The

Table 1
Summary of the Original Center for Epidemiologic Studies–Depression Scale (CES-D) Items, in English and Spanish, Used in Published Short-Form Versions of the Instrument

No.	Item	Iowa Form	Boston Form	Andresen Form	Santor and Coyne Form	Cole Form
1.	I was bothered by things that don't usually bother me.					
	Me molestaron cosas que normalmente no me molestan.			X	X	X
2.	I did not feel like eating; my appetite was poor.					
	No tenía ganas de comer; tenía poco apetito.	X				
3.	I felt I could not shake off the blues.					
	Sentí que no podía deshacerme de mis penas aún con la ayuda de mi familia o mis amistades.				X	X
4.	I felt as good as other people.					
	Sentí que yo era tan bueno/a como la demás gente.					X
5.	I had trouble keeping my mind on what I was doing.					
	Tuve dificultad en concentrarme en lo que hacía.			X	X	X
6.	I felt depressed.					
	Me sentí deprimido/a.	X	X	X	X	
7.	I felt everything I did was an effort.					
	Sentí que todo lo que hacía tomaba esfuerzo.	X	X	X	X	X
8.	I felt hopeful about the future.					
	Sentí esperanza en cuanto al futuro.			X		X
9.	I thought my life had been a failure.					
	Pensé que mi vida había sido un fracaso					X
10.	I felt fearful.					
	Sentí miedo.		X		X	
11.	My sleep was restless.					
	Dormí mal.	X	X	X	X	
12.	I was happy.					
	Estuve feliz.	X	X	X	X	
13.	I talked less than usual.					
	Hablé menos de lo normal.					
14.	I felt lonely.					
	Me sentí solo/a.	X	X	X		X

(continued)

Table 1 (continued)

No.	Item	Iowa Form	Boston Form	Andresen Form	Santor and Coyne Form	Cole Form
15.	People were unfriendly.					
	La gente no fué amistosa.	X	X			X
16.	I enjoyed life.					
	Yo gocé la vida.	X	X		X	
17.	I had crying spells.					
	Tuve momentos de llanto.					
18.	I felt sad.					
	Me sentí triste.	X	X		X	
19.	I felt that people disliked me.					
	Sentí que yo no le gustaba a la gente.	X	X			
20.	I could not get going.					
	No pude motivarme.	X	X	X		

Note: The Boston and Cole forms are described in Kohout, Berkman, Evans, and Cornoni-Huntley (1993). The remaining forms are described in Andresen, Malmgren, Carter, and Patrick (1994), Santor and Coyne (1997), and Cole, Rabin, Smith, and Kaufman (2004), respectively.

Boston form contains 10 items (see Table 1) selected based on the factor loadings originally presented by Radloff (1977) to ensure that the strongest items from each of the four dimensions of depressive symptomatology were included in the short form. The first version of the Boston form (i.e., Boston × 4 form) uses the four-category response set of the original CES-D (i.e., Boston × 4 form), whereas the second version uses a dichotomous (yes/no) response set. The third form we evaluate, the Cole form, contains 10 items identified using Rasch techniques (Cole et al., 2004; see Table 1 for items). The Cole form, which uses the four response categories of the original CES-D, was selected because it was developed and validated using the most modern techniques. We also selected the Boston and Cole forms because their item composition differs substantially. The Boston form is predominantly made up of relatively concrete experiences that participants could interpret in the context of their daily lives. By contrast, 5 of the 10 items in the Cole form are made up of relatively abstract experiences that can be difficult for Mexican immigrants to interpret. For example, previous research indicates that Mexicans have difficulty understanding the meaning of the "I felt I could not shake off the blues" item (Johnson et al., 1996).

Method

Data

The data for this study come from seven separate studies conducted in locations across the country between 1996 and 2003. In this section, we provide a brief overview of each study. Sampling and data collection protocols for each study were approved by an authorized Institutional Review Board.

Study 1: Acculturative stress in Los Angeles. This study examined the relationships among acculturative stress, depression, and suicidal ideation in a sample of 114 Mexican immigrants (76 females; 38 males) from an English as a Second Language (ESL) community adult school in Los Angeles (Hovey, 2000b). All participants were native speakers of Spanish. Five ESL classes participated in the study. At the beginning of each of these classes, the researcher notified students about the general topic of study and informed them that their participation was entirely voluntary, anonymous, and confidential. Those individuals willing to participate were provided with self-report questionnaires written in Spanish. The researcher and teachers read questionnaire items to those participants who needed assistance. The CES-D and other measures used in this study, as well as the remaining studies reported in this article, were translated into Spanish by a PhD-level bilingual researcher of Mexican descent. A second PhD-level bilingual researcher of Mexican descent then back-translated the materials to English. Content discrepancies were discussed by these two researchers, plus a third bilingual researcher, until conceptual equivalence of the measures was reached (Brislin, 1980). The Spanish CES-D used in this study was also used in all the studies reported below.

Study 2: Acculturative stress in southeast Michigan and northwest Ohio. The purposes of this study were to examine the relationships among acculturative stress, anxiety, and depression among Mexican migrant farmworkers in southeast Michigan and northwest Ohio and to qualitatively explore the stressors and coping mechanisms associated with living as a migrant farmworker (Hovey & Magaña, 2002a; Magaña & Hovey, 2003). Community agencies who had well-established ties with migrant farmworker camps helped coordinate participant recruitment and +data collection (N = 45; 20 females; 25 males) by accompanying the researchers to nine camps and introducing them to the farmworkers. All of the farmworkers included in the analyses for this article were immigrants. Data were collected by four bilingual

researchers who underwent intensive training on the administration of the instruments and issues of cultural competence. Each participant first completed an open-ended interview and then completed a self-administered questionnaire packet. The researchers read questionnaire items to those participants who needed assistance. Eighty-five percent (84.4%) of individuals in the sample participated in Spanish; 15.6% participated in English.

Study 3: Farmworker stress in Olathe and Montrose, Colorado. These data were from the 1st year of a two-phase project in the Montrose and Olathe area of Colorado (Hovey & Gibbs, 2003, 2004). This project was conducted in collaboration with the Midwestern Colorado Mental Health Center (MCMHC). The primary goal of this first phase was to capture an overall mental health picture of the Mexican migrant farmworkers in the area. Of particular interest was examining the relationship of migrant farmworker stress, defined as the stress that directly results from stressors inherent to the farmworker lifestyle, to anxiety, depression, and suicidal thoughts and behaviors. The sample included 116 farmworkers (40 males; 75 females), all of whom were immigrants. Questionnaires were administered in Spanish. Data were collected by *promotoras* who were employed by the MCMHC. Promotoras are former or current migrant farmworkers who are trained to provide health information and support to the farmworker community. The promotoras read questionnaire items to those farmworkers who needed assistance.

Study 4: Farmworker stress in Olathe and Montrose, Colorado. These data were from the 2nd year of Study 3 reported above and presented by Hovey and colleagues (2002). The goal of this phase was to identify at-risk farmworkers and to assess the effectiveness of interventions provided to farmworkers. The data used in this article represent data collected at the identification stage of the study. Data, which were collected by promotoras employed by the MCMHC, were collected from 48 Mexican farmworkers (22 males; 26 females) who did not participate in Study 3. All the data were collected in Spanish; promotoras read the questionnaire items to those farmworkers who needed assistance. All farmworkers in the sample were immigrants of Mexican descent.

Study 5: Farmworker stress in Grand Junction, Colorado. This study (Hovey & Davis, 2001) was conducted in collaboration with the Family Medicine Residency Program at St. Mary's Hospital in Grand Junction, Colorado. Similar to Study 3, the goal was to obtain an overall mental

health picture of the migrant farmworkers in the area. Questionnaire data were collected by promotoras employed by St. Mary's Hospital. All the data were collected in Spanish. The sample included 57 farmworkers (44 males; 13 females), all of whom were immigrants of Mexican descent.

Study 6: Acculturative stress in North Carolina. The study was designed to examine acculturation, acculturative stress, and mental health among recent immigrants (Grzywacz, Quandt, Arcury, & Marín, 2005). Structured face-to-face interviews were conducted with 150 immigrants (82 men and 68 women) from Mexico who had been in the United States for fewer than 5 years. A site-based sampling plan, a strategy recommended for studies focused on "hard-to-reach" populations (Faugier & Sargeant, 1997; Muhib et al., 2001), was used to identify a sample that is representative although not statistically random (Arcury & Quandt, 1999). *Sites* are places, organizations, or services used by the population of interest, such as churches, trailer parks, *tiendas* (stores), or health care facilities. With the assistance of cooperating community-based organizations, an extensive and diverse list of sites across three contiguous counties in western North Carolina was compiled. A rough estimate of the site composition (e.g., gender, duration of time in North Carolina) was made, and the number of persons to be recruited per site was designated. Trained interviewers who were native Spanish speakers recruited and interviewed participants. Recruitment continued until each targeted cell, 6 in this case (2 genders by 3 migration categories: < 1 year in United States, 1 to 3 years in United States, and 3 to 5 years in United States), was filled. All interviews were completed in Spanish.

Study 7: Farmworker stress in North Carolina. The goal of this study was to document the mental health of migrant farmworkers and evaluate how separation from family contributes to poor mental health (Grzywacz et al., 2006). Structured face-to-face interviews were conducted with 125 male immigrant farmworkers from Mexico during June and July 2003 in a four-county area of east central North Carolina. This region has the state's greatest concentration of migrant and seasonal farmworkers, estimated by the North Carolina Employment Security Commission at 14,075 workers. As with Study 6, a site-based sampling strategy was used to locate and select farmworkers; however, in this case, the primary sites of interest were farmworker camps, trailer parks, and rooming houses. Trained interviewers who were native Spanish speakers visited each of 26 sites to recruit and interview participants. All interviews were completed in Spanish.

Sample

Participants in the combined sample ($N = 655$), on average, were 32 years old (± 11.7), were predominantly male, and had been in the United States for approximately 7 years (see Table 2). There was variability among the studies in the demographic characteristics. Participants in Studies 6 and 7 were younger than the others. Participants in some samples, such as Study 7, were primarily men, whereas in others, the gender composition was more balanced (e.g., Studies 2, 4, and 6) or included a greater majority of women (e.g., Study 1). Participants in Studies 6 and 7 had been in the United States a significantly shorter time relative to participants in other studies.

Measures

Each study used the 20-item CES-D with a 4-point response set. From these data, eight variables were derived. First, a total depressive symptoms score was calculated by summing responses to all 20 items of the full CES-D. Next, a total depression score was created for the Boston × 4 form by summing the original responses to the 10 items included in the form (see Table 1). Third, a total depression score was created for the Boston × 2 form using a two-step process. For each of the 10 items, participants who reported either a 0 or 1 were recoded to 0 and those who reported either a 2 or 3 were recoded to 1 to approximate the yes/no response sequence. Responses to the 10 items were then summed. Fourth, a total depression score was created for the Cole form by summing the original responses to the 10 items included in this form (see Table 1). Finally, a dichotomous "caseness" indicator for clinically significant depressive symptoms was created for each summary score. For the full CES-D, we used a cut-point of 20 (Blank, Gruman, & Robison, 2004); for the short forms with four response categories, a cut-point of 10 was used; and a cut-point of 5 was used for the short form with two response categories.

Anxiety was assessed in each of the studies except for Study 1 using a Spanish translation of the Anxiety scale of the Personality Assessment Inventory (PAI) (Morey, 1991). This scale is made up of 24 items measuring symptoms of cognitive (e.g., "I often have trouble concentrating because I'm nervous"), affective (e.g., "Sometimes I am afraid for no reason"), and physical (e.g., "I often feel jittery") expressions of anxiety. Response categories for each item range from 1 (*false, not at all true*) to 4 (*very true*). Items are summed and raw values are transformed into *T*-scores to provide interpretation relative to a standard sample of community-dwelling adults. Higher

Table 2
Descriptive Statistics for all Variables for the Total Sample and by Study

	Total	Study 1	2	3	4	5	6	7
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
N	655	114	45	116	48	57	150	125
Age	32.15 (11.71)	33.70 (15.76)	33.53 (11.03)	32.63 (11.61)	35.55 (12.93)	35.46 (14.89)	29.67 (8.06)	29.92 (7.79)
Gender (% female)	42.7	67.0	44.4	66.0	54.0	23.0	45.0	0.0
Years in U.S.	6.81 (9.29)	9.27 (10.76)	11.71 (8.87)	12.00 (10.62)	13.68 (12.82)	6.57 (10.12)	1.93 (1.77)	2.35 (3.78)
CES-D total	17.11 (10.77)	19.67 (10.23)	14.62 (10.11)	17.97 (12.12)	14.25 (11.82)	18.01 (9.84)	18.27 (9.89)	14.35 (10.37)
Boston × 4[a]	9.29 (6.19)	10.48 (6.28)	8.09 (5.86)	9.82 (7.00)	7.83 (6.35)	10.28 (5.46)	9.72 (5.70)	7.85 (5.91)
Boston × 2[b]	2.71 (2.36)	3.06 (2.64)	2.51 (2.16)	3.07 (2.70)	2.29 (2.35)	3.02 (2.09)	2.63 (2.13)	2.30 (2.17)
Cole[c]	8.54 (5.40)	9.92 (4.85)	7.36 (5.26)	8.88 (6.08)	6.81 (5.86)	8.77 (4.92)	9.14 (5.04)	7.31 (5.29)
Anxiety	57.29 (12.58)	N/A	55.00 (13.99)	59.33 (13.56)	55.04 (14.56)	58.11 (12.50)	59.23 (11.50)	54.41 (10.92)
Acculturative stress	53.76 (20.99)	54.69 (19.32)	54.69 (25.85)	N/A	N/A	N/A	52.83 (20.62)	N/A
Farmworker stress	66.90 (26.03)	N/A	N/A	62.23 (28.53)	54.96 (21.63)	69.41 (27.06)	N/A	74.62 (22.06)
Social support	125.38 (23.57)	120.70 (26.41)	126.09 (33.24)	N/A	N/A	N/A	128.67 (16.35)	N/A

Note: Study 1 = Downtown Los Angeles, collected in 1996; Study 2 = Michigan and Ohio, collected in 1998; Study 3 = Olathe/Montrose, Colorado (phase I), collected in 2001-2002; Study 4 = Olathe/Montrose, Colorado (phase II), collected in 2002; Study 5 = Grand Junction, Colorado, collected in 2001; Study 6 = Eastern North Carolina, collected in 2002; Study 7 = Eastern North Carolina, collected in 2003. CES-D = Center for Epidemiologic Studies–Depression Scale. N/A= not applicable.

a. 10 items identified by Kohout, Berkman, Evans, and Cornoni-Huntley (1993) using four response categories.

b. 10 items identified by Kohout and colleagues (1993) using dichotomous response categories.

c. 10 items identified by Cole, Rabin, Smith, and Kaufman (2004).

scores indicate higher anxiety levels. The PAI Anxiety scale has been found (Fantoni-Salvador & Rogers, 1997; Rogers, Flores, Ustad, & Sewell, 1995) to have adequate internal consistency reliability, test-retest reliability, and construct validity among Mexican American samples.

Acculturative stress was assessed in three of the seven studies (see Table 2) using the SAFE acculturative stress scale (Mena, Padilla, & Maldonado, 1987), which measures acculturative stress in social, attitudinal, familial, and environmental contexts, in addition to perceived discrimination (majority group stereotypes) toward immigrant populations. Participants rate each item that applies to them on a 5-point scale (*not stressful* to *extremely stressful*). Items are summed, with higher scores indicating greater acculturative stress. The SAFE scale has been found to have adequate internal reliability and construct validity for Mexican Americans (Fuertes & Westbrook, 1996; Hovey, 2000a).

Farmworker stress was assessed in four of the seven studies (see Table 2) using the Migrant Farmworker Stress Inventory (MFWSI; Hovey, 2001), a 39-item self-report instrument that assesses the quality and severity of stress inherent in life as a farmworker. Participants rate each item that applies to them on a 5-point scale (*not at all stressful* to *extremely stressful*). Items are summed, with higher scores representing greater farmworker stress. The MFWSI has been found to have adequate internal reliability and construct validity (Hovey, 2001; Hovey, Magaña, Smith, & Gordon, 2001; Kim-Godwin & Bechtel, 2004).

Social support was assessed in three of the seven studies (see Table 2) by the Personal Resource Questionnaire–Part 2 (PRQ85; Weinert, 1987). This measures the perceived effectiveness of social support and comprises 25 items rated on a 7-point Likert-type scale (*strongly disagree* to *strongly agree*). Possible scores range from 25 to 175, with higher scores indicating higher levels of perceived social support. The PRQ85–Part 2 has been found to have adequate internal reliability (.87 to .93), test-retest reliability (.72), and construct validity in community and Mexican American samples (Hovey, 2000b; Hovey & Magaña, 2002b; Weinert, 1987).

Analysis Plan

Our evaluation follows several of the recommendations for short-form development (Smith, McCarthy, & Anderson, 2000). We consider the degree to which the measurement structure underlying each short-form maintains the integrity of the presumed four-factor model of the full CES-D. We evaluate several psychometric properties of each short form, including estimates of

alpha and 95% confidence intervals (Duhachek & Lacobucci, 2004) and the extent to which short-form items account for variation in scores from the full CES-D. Finally, we evaluate concurrent validity and precision by examining whether the magnitude of estimated correlations between depression scores derived from each short-form CES-D with other measures frequently used in studies of Mexican mental health (i.e., anxiety, acculturative stress, farmworker stress, and social support, all of which have been shown to be associated with depression) is attenuated in contrast with estimated correlations between these measures with depression scores obtained from the full CES-D.

Results

Results of exploratory factor analyses using varimax rotatation of the full CES-D and each short form are reported in Table 3. Underlying the full CES-D were three factors with eigenvalues greater than one. Focusing on items that have a primary loading of .50 or greater on one factor and lower than .40 on other factors, the first factor is primarily made up of items labeled "depressed affect" and "interpersonal relations" in the original scale (Radloff, 1977). The second and third factors are primarily made up of "somatic and retarded activity" and "positive affect" items, respectively. The Boston × 4 and Boston × 2 forms have factor structures similar to the full CES-D. The Cole form has a two-factor solution. The first factor includes depressed affect, somatic and retarded activity, and interpersonal relations items as well as some items (e.g., lonely) with high mutual loadings in Radloff's (1977) analysis. The second factor is made up of positive affect items.

Table 4 presents psychometric data for each short-form instrument for the combined sample and for each data source. The first column reports the estimated internal consistency for each short-form instrument. For the entire sample, the estimated alphas for the Boston × 4, Boston × 2, and Cole short forms are .789, .731, and .719, respectively. The 95% confidence intervals provide estimates of precision for each alpha. They suggest that the Boston × 4 short form has the most favorable internal consistency because it has the highest value and its 95% confidence interval is outside the confidence interval for the other two estimates.

The estimated internal consistency for each short form does not differ between specific samples. Across the seven studies, the estimated internal consistency for the Boston × 4 and the Boston × 2 short forms ranged from .711 to .836 and .636 to .799, respectively. The estimated internal consistency for the Cole short form ranged from .640 to .753. The estimated alphas for all

Table 3
Factor Loadings From Exploratory Factor Analyses of the Full and Short Forms of the Center for Epidemiologic Studies–Depression Scale (CES-D)

	Factor 1				Factor 2				Factor 3		
Item	Full CES-D	Boston × 4[a]	Boston × 2[b]	Cole[c]	Full CES-D	Boston × 4	Boston × 2	Cole	Full CES-D	Boston × 4	Boston × 2
2. Appetite	0.386				0.344				0.091		
9. Failure	0.469			0.666	0.364			0.157	0.177		
10. Fearful	0.542			0.710	0.399			0.086	0.120		
13. Talk	0.431				0.240				–0.068		
14. Lonely	0.596	0.549	0.527	0.664	0.317	0.425	0.409	0.044	0.095	0.168	0.129
15. Unfriendly	0.536	0.666	0.548	0.415	–0.008	0.003	0.073	–0.005	–0.035	–0.055	–0.080
17. Crying	0.614				0.293				0.139		
18. Sad	0.646	0.561	0.563		0.360	0.469	0.444		0.148	0.214	0.180
19. Disliked	0.772	0.787	0.801		0.039	0.091	0.039		0.051	0.085	0.034
20. Get going	0.613	0.637	0.643		0.194	0.227	0.121		0.094	0.177	0.117
1. Bothered	0.354			0.635	0.511			–0.002	0.044		
3. Blues	0.409			0.722	0.534			0.027	0.110		
5. Mind	0.448			0.680	0.494			–0.077	–0.021		
6. Depressed	0.374	0.287	0.251		0.644	0.671	0.613		0.107	0.254	0.214
7. Effort	0.081	0.078	0.027	0.527	0.668	0.710	0.710	–0.258	–0.085	0.017	–0.098

(continued)

Table 3 (continued)

	Factor 1				Factor 2				Factor 3		
Item	Full CES-D	Boston × 4[a]	Boston × 2[b]	Cole[c]	Full CES-D	Boston × 4	Boston × 2	Cole	Full CES-D	Boston × 4	Boston × 2
11. Sleep	0.150	0.090	0.112		0.683	0.773	0.731		0.041	0.070	0.103
4. Felt good	0.048			0.038	–0.139			0.783		0.662	
8. Hopeful	0.075			0.010	–0.170		0.821	0.733			
12. Happy	0.082	0.107	0.081		0.359	0.144	0.091		0.665	0.816	0.805
16. Enjoyed	0.059	0.081	0.031		0.339	0.081	0.058		0.613	0.843	0.837
% of variance	19.69	21.99	20.25	32.27	16.16	20.40	18.60	13.93	9.76	15.61	14.67
Overall % of variance	45.60	58.00	53.51	46.20							

a. 10 items identified by Kohout, Berkman, Evans, and Cornoni-Huntley (1993) using four response categories.
b. 10 items identified by Kohout and colleagues (1993) using dichotomous response categories.
c. 10 items identified by Cole, Rabin, Smith, and Kaufman (2004).

Table 4
Psychometric Properties of 10-Item Versions of the Center for Epidemiologic Studies–Depression Scale (CES-D) Among Mexican Immigrants by Study Site

	Alpha (95% CI)	Adjusted R^2 of Full CES-D	Sensitivity	Specificity	Positive Predictive Value
Boston × 4[a]					
Total sample	.788 (.763–.812)	89.5	94.0	83.4	76.5
Study 1	.792 (.734–.885)	88.0	91.7	84.7	83.0
Study 2	.786 (.699–.872)	87.2	100.0	93.3	88.2
Study 3	.836 (.790–.881)	93.5	95.5	87.1	82.4
Study 4	.786 (.699–.872)	91.5	100.0	94.4	85.7
Study 5	.711 (.595–.827)	88.1	87.5	81.3	77.8
Study 6	.758 (.700–.816)	86.7	93.3	72.2	69.1
Study 7	.794 (.739–.848)	88.6	96.9	83.9	67.4
Boston × 2[b]					
Total sample	.731 (.700–.762)	78.6	52.3	98.5	95.3
Study 1	.778 (.716–.841)	75.8	58.3	98.3	96.6
Study 2	.743 (.636–.851)	83.0	66.7	100.0	100.0
Study 3	.799 (.744–.854)	84.2	63.6	98.6	96.6
Study 4	.743 (.636–.851)	80.0	83.3	100.0	100.0
Study 5	.636 (.489–.784)	78.9	41.7	96.9	90.9
Study 6	.654 (.571–.737)	78.7	63.7	97.8	91.7
Study 7	.712 (.636–.788)	75.6	46.9	98.9	93.8
Cole form[c]					
Total sample	.719 (.687–.751)	88.0	84.7	89.3	81.9
Study 1	.640 (.541–.738)	82.2	83.3	89.8	87.0
Study 2	.753 (.653–.853)	82.1	86.7	93.3	86.7
Study 3	.749 (.683–.815)	90.6	81.8	94.3	90.0
Study 4	.753 (.653–.853)	88.6	75.0	94.4	81.8
Study 5	.652 (.514–.790)	86.1	83.3	81.3	76.9
Study 6	.693 (.620–.765)	88.2	91.7	85.6	80.9
Study 7	.747 (.681–.814)	89.6	81.3	88.2	70.3

Note: Adjusted R^2 estimates are from equations where 20-item summary scores are regressed on 10-item summary scores. Standard for sensitivity, specificity, and positive predictive value is caseness for clinically significant depression based on score of 20 or higher on the full CES-D, and using cut-point of 10 for Boston × 4 and Cole forms, and a cut-point of 5 for Boston × 2 form. Study 1 = Downtown Los Angeles, collected in 1996; Study 2 = Michigan and Ohio, collected in 1998; Study 3 = Olathe/Montrose, Colorado (phase I), collected in 2001-2002; Study 4 = Olathe/Montrose, Colorado (phase II), collected in 2002; Study 5 = Grand Junction, Colorado, collected in 2001; Study 6 = Eastern North Carolina, collected in 2002; Study 7 = Eastern North Carolina, collected in 2003. CI = confidence interval.

a. 10 items identified by Kohout, Berkman, Evans, and Cornoni-Huntley (1993) using four response categories.

b. 10 items identified by Kohout and colleagues (1993) using dichotomous response categories.

c. 10 items identified by Cole, Rabin, Smith, and Kaufman (2004).

three short forms in Studies 5 and 6 were outside the lower bound of the 95% confidence interval for the combined samples.

Each of the short forms accounted for a substantial portion of the variance in the depressive symptoms scores from the full CES-D (see column 2, Table 4). The 10 items in the Boston × 4 short form accounted for 89.5% of the variance in depressive symptomatology in the combined sample and 87.2% to 93.5% of the variance in depressive symptomatology within specific samples. The Boston × 2 form explained 78.6% of the variance in depression scores from the full CES-D in the combined sample and 75.6% to 84.2% of the variance in specific samples. Eighty-eight percent of the variance in depression scores from the full CES-D was explained by the 10-item Cole form in the combined sample, with a range of 82.1% to 90.6% of the variance across the seven studies.

The last three columns of Table 4 report the estimated sensitivity, specificity, and positive predictive value of the dichotomous versions of the short forms using scores of 20 or more on the full CES-D as the criterion variable. The Boston × 4 form, using a cut-point of 10 or higher to determine caseness, had the greatest sensitivity of the short forms in the combined sample (94.0% vs. 52.3% and 84.7% for the Boston × 2 and Cole forms, respectively) as well as across each of the study sites. The Boston × 2 form, using a cut-point of 5 or higher to determine caseness, had the greatest specificity of the short forms in the combined sample as well as across the specific samples. The positive predictive value of scores 20 or higher on the full CES-D was 76.5%, 95.3%, and 81.9%, respectively, for the Boston × 4, Boston × 2, and Cole forms in the combined sample. Across each of the specific samples, the Boston × 2 form consistently had the highest positive predictive value of the three short forms.

The estimated correlation of depression scores with anxiety, acculturative stress, farmworker stress, and social support is consistent, regardless of whether depression is measured with the full CES-D or short forms (see Table 5). Column 1 of Table 5 reports the estimated correlation coefficient between depression scores for the full CES-D with four criterion variables for the entire sample as well as each study where the criterion variable was included. Looking across the columns, there is little evidence that correlations are significantly attenuated when depression is measured with a short form of the CES-D. There were only two instances in which a correlation derived from a short form was statistically different (Howell, 2001) from the correlation derived from the full CES-D. In both the combined sample and the sample from Study 7, the correlation of anxiety with depression is significantly attenuated when depression is assessed with the Boston × 2 form.

Table 5
Estimated Correlation of Depression With Anxiety, Acculturative Stress, Farmworker Stress, and Social Support by Instrument Used to Measure Depression

	Full CES-D	Boston × 4[a]	Boston × 2[b]	Cole[c]
Anxiety				
Overall sample[d]	.710***	.669***	.600***	.672***
Study 2	.545***	.525***	.501***	.414**
Study 3	.774***	.744***	.682***	.743***
Study 4	.663***	.636***	.547***	.575***
Study 5	.692***	.632***	.608***	.660***
Study 6	.665***	.613***	.559***	.669***
Study 7[e]	.761***	.709***	.598***	.732***
Acculturative stress				
Overall sample	.455***	.426***	.431***	.440***
Study 1	.402***	.396***	.428***	.425***
Study 2	.548***	.525***	.561***	.517***
Study 6	.477***	.428***	.405***	.439***
Farmworker stress				
Overall sample	.358***	.378***	.342***	.329***
Study 3	.468***	.451***	.423***	.444***
Study 4	.279*	.386**	.404**	.141
Study 5	.494***	.565***	.468***	.445***
Study 7	.288***	.292***	.245**	.277***
Social support				
Overall sample	–.356***	–.308***	–.300***	–.341***
Study 1	–.315***	–.263**	–.255**	–.298***
Study 2	–.544***	–.436**	–.460***	–.544***
Study 6	–.321***	–.306***	–.267***	–.289***

Note: Study 1 = Downtown Los Angeles, collected in 1996; Study 2 = Michigan and Ohio, collected in 1998; Study 3 = Olathe/Montrose, Colorado (phase I), collected in 2001-2002; Study 4 = Olathe/Montrose, Colorado (phase II), collected in 2002; Study 5 = Grand Junction, Colorado, collected in 2001; Study 6 = Eastern North Carolina, collected in 2002; Study 7 = Eastern North Carolina, collected in 2003. CES-D = Center for Epidemiologic Studies–Depression Scale.

a. 10 items identified by Kohout, Berkman, Evans, and Cornoni-Huntley (1993) using four response categories.

b. 10 items identified by Kohout and colleagues (1993) using dichotomous response categories.

c. 10 items identified by Cole, Rabin, Smith, and Kaufman (2004).

d. r of Boston × 2 is statistically different from r of full CES-D: $z = 3.50$.

e. r of Boston × 2 is statistically different from r of full CES-D: $z = 2.40$.

*$p < .05$. **$p < .01$. ***$p < .001$ (one-tailed)

Discussion

The results of this study suggest that short-form versions of the CES-D can be used in Mexican immigrant populations without significant loss of measurement precision relative to the full CES-D. Each short form has acceptable reliability, and more than 75% of the variance in scores from the full CES-D was accounted for by the 10-item short forms. Although our single-method approach likely overestimates the true association (Smith et al., 2000), these results suggest that short-form versions of the CES-D are valid measures of total depressive symptomatology among Mexican immigrants. The short forms with a 4-point response set had good sensitivity and specificity in identifying potential cases of significant depressive symptoms. Finally, we find little evidence that the magnitude of correlations of depression with other concepts important to the mental health of Mexican immigrants differs depending on whether depression is assessed using the full or short-form versions of the CES-D.

The short forms performed consistently across the distinct study samples despite variation in gender composition, duration of time in the United States, region of the country reflecting distinct migrant streams, and whether data are from self- or interviewer-administered questionnaires. Most estimated alphas were within the 95% confidence interval of the alpha for the combined sample, suggesting that reliability of each short form is robust to variation in sample characteristics. The range of variance explained, sensitivity, specificity, and positive predictive value for each short form are also similar across samples. However, the performance of the short forms was consistently poorer in Studies 5 and 6. It is not clear why performance suffered in these samples because they are neither noticeably similar to each other nor noticeably dissimilar from the remaining samples in terms of size, sample composition, or method of data collection. Nevertheless, the results suggest that CES-D short forms will have adequate psychometric properties in diverse samples of Mexican immigrants.

Although each short form exhibited acceptable psychometric properties, the Boston form with four response categories appears strongest. Our exploratory factor analyses indicate that the Boston form yields a three-factor solution that parallels the solution obtained for the full CES-D as well as research using other samples (Guarnaccia, Angel, & Worobey, 1989). This suggests that the structure of the Boston form parallels the structure of the full CES-D among Mexican immigrants. The Boston $\times$ 4 form also produces the strongest reliability estimates, suggesting that this form assesses depressive symptomatology with less measurement error than the other forms. Finally,

the Boston × 4 explains a higher amount of variance in scores from the full CES-D and with somewhat greater sensitivity.

The results of this study must be interpreted within the context of its limitations. All data were collected at a single assessment using only the full CES-D; our results likely overestimate the association between the short- and long-form instruments (Smith et al., 2000). The single-assessment approach also did not allow a full evaluation of the Boston × 2 form because we cannot be sure that our collapsing of individuals' responses to a 4-point response set accurately reflects the way they would have responded if presented with two response options. It is not clear whether the short forms perform comparably in different subgroups of Mexican immigrants. We conducted post hoc gender-focused analyses because previous reports suggest that the CES-D performs differently for women and men (e.g., Posner, Stewart, Marin, & Perez-Stable, 2001). These analyses found that scores on each short form were greater for women than men, but the magnitude of the gender effect did not differ. There was also little evidence suggesting that the internal consistency of the short forms differed by gender. The final limitation is that we did not have an external indicator of depression to rigorously evaluate whether CES-D short forms were valid predictors of depression. Further research evaluating short versions of the CES-D with Mexican immigrants should use discrete short forms and valid assessments of clinical depression such as the Composite International Diagnostic Interview (Pennell et al., 2004; Vega et al., 1998).

In conclusion, the results of this study suggest that short-form versions of the CES-D can be used to study mental health among Mexican immigrants. Published short-form versions of the CES-D are reliable, they account for most of the variance in scores from the full CES-D, and they do not significantly attenuate associations with other concepts relevant to immigrants' mental health. Although each short form performed well, our results suggest that the Boston form with four response categories may perform best in samples of Mexican immigrants. Additional research needs to be done to further evaluate the reliability and validity of short-form versions of the CES-D. Nevertheless, the results of this study suggest that short-form versions of the CES-D can be used to study mental health in diverse samples of Mexican immigrants.

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