

## **Technical Report**

### **Construct Validity of the Center for Epidemiological Studies Depression 7 Item Scale in the Mexican Population**

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#### **Introduction**

The International Tobacco Control Policy Evaluation Survey (ITC) assesses depressive symptomatology among smokers using an abbreviated version of the “Center for Epidemiological Studies Depression” Scale (CES-D; Radloff, 1977). The original CES-D scale is comprised of 20 items that measure major components of depressive symptomatology including depressed mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance (Radloff, 1977). Four items in the scale are worded in the positive direction to break tendencies toward response set as well as to assess positive affect (or its absence) (Radloff, 1977).

The purpose of the current study was to examine the construct validity (Devellis, 2012) of the seven items selected from the CES-D 20 item scale for use in the ITC survey in Mexico (and other ITC countries). To do this, we analyzed data from the 1998 National Survey on Addictions (Encuesta Nacional de Adicciones [ENA]) in Mexico, where the CES-D 20 was assessed along with other constructs of interest with which depressive symptoms should be associated or unassociated. We examined the association between depressive symptoms and these other constructs using the full CES-D 20, and whether the pattern of results was similar to that found when using the seven items used in the ITC Mexico survey (i.e., CES-D 7) (See scale items in Table 1).

## **Hypotheses**

We hypothesized the following:

- 1) Smoking status and smoking intensity will be associated with elevated depressive symptoms as measured by the CES-D 20 and the CES-D 7. More specifically, active smokers and those who smoke at greater intensity will have greater likelihood of elevated depressive symptoms.
- 2) Socio-demographics variables of gender, education, and income will be associated with elevated depressive symptoms as measured by the CES-D 20 and the CES-D 7. That is, women, those with lower education and lower income will have greater likelihood of elevated depressive symptoms.

## **Methods**

### **Data and Sample**

We used data from the 1998 National Addictions Survey (ENA according to its Spanish language initials). This population-based survey of the Mexican population aged 18–64 years, provides nationally and regionally representative data on the prevalence of drug, alcohol and tobacco use for urban areas. It was estimated that about 75% of the Mexican population lived in urban areas (Benjet, Wagner, Borges, & Medina-Mora, 2004). The study used a probability, multi-stage, stratified sampling design that was based on the Master Sample Framework of the National Health Surveys System in Mexico (Tapia, Cravioto, Medina-Mora, Hoy, & Kuri, 2000). Data were collected by face to face interviews. More detailed description of the survey has been published elsewhere (Tapia et al., 2000; Kuri, Hoy, & Tapia, 2000).

### **Measures**

**Depressive symptomatology:** Depressive symptoms were assessed using all 20 items of the Spanish-language version of the Center for Epidemiological Studies Depression Scale (CES-D 20). The Spanish-version of the scale has been evaluated and utilized in various studies with the Mexican adult population (Mondragón, Borges, & Gutiérrez, 2001). The scale assessed the frequency of depressive symptoms in the previous week. Positively worded items were reverse coded and individual responses to the 20 items were summed to create a total score. Higher scores indicate greater depressive symptoms. Then, respondents

were categorized into those with low depressive symptoms vs. those with elevated depressive symptoms using the cutoff point that equals the sample mean plus one standard deviation as was done in prior research in Mexico (Benjet et al., 2004) (Mean = 7.7, SD = 9.8 for the 20 item CES-D scale). The same method for deriving low vs. elevated depressive symptoms was then repeated for the CES-D 7 items used in the ITC study (Mean = 2.6, SD = 3.7).

**Table 1.** Items of the CES-D 20 from the National Addictions Survey (ENA), Mexico, (1998), and item subset for the CES-D 7

20 item CES-D scale	CES-D 7
1. You were bothered by things that usually don't bother you	
2. you didn't feel like eating, your appetite was poor	X
3. You felt that you could not shake off the blues even with help from your family or friends	X
4. You felt that you were just as good as others <sup>a</sup>	
5. You had trouble keeping your mind on what you were doing	
6. You felt depressed	X
7. You felt that everything you did was an effort	X
8. You felt hopeful about the future <sup>a</sup>	X
9. You thought that your life was a failure	
10. You felt fearful	
11. Your sleep was restless	
12. You were happy <sup>a</sup>	
13. You talked less than usual	
14. You felt lonely	
15. You felt that people were unfriendly	
16. You enjoy life <sup>a</sup>	
17. You had crying spells	
18. You felt sad	X
19. You felt that people disliked you	X
20. You could not get going	

*Note.* Response options range from 0-3 as follows: 0= rarely or none of the time (less than 1 day), 1 = some or a little of the time (1-2 days), 2 = occasionally or moderate amount of the time (3-4 days), 3 = most or all of the time (5-7 days); <sup>a</sup> positively worded items

## **Smoking status and smoking intensity**

Respondents were categorized into three groups: non-smokers, ex-smokers, and current smokers. Respondents who had never smoked or had smoked less than 100 cigarettes in their lifetime were coded as “non-smokers”. Respondents who smoked more than 100 cigarettes, but did not smoke in the previous 30 days were categorized as “ex-smokers”. Current smokers were defined as those who have smoked 100 cigarettes or more in their lifetime and have smoked in the previous 30 days.

Smoking intensity among current smokers was derived from average cigarettes smoked per day: 5 cigarettes per day or less; 6-15 cigarettes per day; 16 or more cigarettes per day.

## **Socio-demographics**

Data were collected on sex, education, and income. Education was categorized into 1) no schooling; 2) primary school; 3) middle school; 4) high school or vocational; and 5) university level education or higher. Income was measured in increments of minimum wage and was categorized into 1) less than the minimum wage; 2) minimum wage; 3) twice as high as the minimum wage; 4) four times as high as the minimum wage; and 5) five times or more higher than the minimum wage.

## **Statistical analysis**

We began with descriptive statistics to understand the data distribution by depressive symptoms and gender. Chi square tests were performed to assess statistically significant differences in the sample characteristics between those with low vs. elevated depressive symptoms. Then, bivariate and multivariate logistic regression models predicting elevated depressive symptoms from smoking-related and socio-demographic variables were estimated using the full version of the CES-D 20 item scale. First, bivariate and multivariate models regressed depressive symptoms on smoking status (i.e., non-smoker, ex-smoker, and current smoker), gender, education, and income. Second, bivariate and multivariate models regressed depressive symptoms on indicator variables for smoking intensity (i.e., non-smoker, ex-smoker, current smoker (5 cigarettes per day or less); current smoker (6-15 cigarettes per day); and current smoker (16+ cigarettes or more a day)), gender, education and income. Finally, all models were estimated for men and

women separately to evaluate the possible modification effect of gender (Benjet et al., 2004). The same models were then estimated using the CES-D 7. All analyses were unweighted using STATA version 11.2.

## Results

Results from chi square tests show that depressive symptoms measured using the CES-D 20 were associated with gender, education, and income (Table 2). Similar results were obtained when using the CES-D 7 (Table 2). Chi square tests stratified by gender show that depressive symptoms measured using the CES-D 20 were associated with income among men and women, however, depressive symptoms were associated with education and smoking status among women only (Table 3). Similar results were obtained when using the CES-D 7 (Table 3). Depressive symptoms were associated with gender, education, and income in bivariate logistic regression models but unassociated with smoking status or smoking intensity (Table 4) when using both the CES-D 20 item and the CES-D7. Multivariate logistic regression models, however, reveals that depressive symptoms were associated with smoking status, smoking intensity, gender, and income. Females and people with lower income were more likely to have elevated depressive symptoms than males and people with higher income (Table 4). Current smokers (AOR = 1.61, 95% CI 1.14, 2.28), smokers who smoke 1-5 cigarettes per day (AOR = 1.67, 95% CI 1.13, 2.46) were more likely to have elevated depressive symptoms (Table 4) compared to non-smokers. Results were similar when using the CES-D 7.

In both bivariate and multivariate analysis stratified by gender (Table 5) depressive symptoms were associated with education, and income and with smoking status, smoking intensity among women. Current female smokers (AOR = 2.29, 95% CI 1.52, 3.46) and women who smoke 1-5 cigarettes per day (AOR = 2.46, 95% CI 1.54, 3.93) were more likely to have elevated depressive symptoms compared to non-smokers women. Among males, depressive symptoms were associated with income only. Similar results were obtained using the CES-D 7 (Table 5).

**Table 2.** Sample characteristics by low and elevated depressive symptoms using the CES-D 20 item scale and the CES-D 7 item scale, n=1970

		CES-D 20		CES-D 7	
		Elevated depressive symptoms (n=263/1970)		Elevated depressive symptoms (n=243/1970)	
		%	P value	%	P value
<b>Sex</b>	Male	8	0.000	7	0.000
	Female	18		17	
<b>Age</b>	18-29	14	0.093	13	0.373
	30-39	15		13	
	40-49	9		10	
	50-65	13		13	
<b>Education</b>	No Formal education	18	0.002	21	0.000
	Primary school	17		15	
	Middle school	11		10	
	High/Vocational school	13		11	
	University	8		7	
<b>Income</b>	< Min. Wage	20	0.000	24	0.000
	min. Wage	17		15	
	< 2 min. wage	16		14	
	< 4 min. wage	13		11	
	5+ min. wage	6		6	
<b>Smoking Status</b>	Non-Smoker	14	0.905	13	0.711
	Ex-Smoker	13		12	
	Current Smoker	13		12	
<b>Number of cigarettes per day</b>					
	1-5 cigs per day	14	0.442	12	0.6787
	6-15 cigs per day	9		9	
	16+ cigs per day	14		12	

*Note.* Income was measured in increments of minimum wage; Low depressive symptoms vs. elevated depressive symptoms were determined using the cutoff point that equals the mean plus one standard deviation (mean = 7.7, SD = 9.8 for the 20 item scale and mean = 2.6, SD = 3.7 for the CES-D 7). Positively worded items were reversed coded; Chi square omnibus test tests differences in sample characteristics between those with low depressive symptoms vs. those with elevated depressive symptoms.

**Table 3.** Sample characteristics by low and elevated depressive symptoms using the CES-D 20 item scale and the CES-D 7 item scale

		Women				Men			
		Elevated depressive symptoms				Elevated depressive symptoms			
		CES-D 20 (n=199/263)		CES-D 7 (n=187/243)		CES-D 20 (n=64/263)		CES-D 7 (n=56/243)	
		n	%	n	%	n	%	n	%
<b>Age (years)</b>	18-29	80	17	68	15	37	10	36	10*
	30-39	60	22	55	20	10	5	8	4
	40-49	27	13	29	13	8	5	7	4
	50-65	32	18	35	20	9	7	5	4
<b>Education</b>	No Formal	17	25*	19	27*	2	5	3	8
	Primary school	94	22	88	20	24	9	19	7
	Middle school	40	13	40	13	18	8	15	6
	High/Vocational	33	16	28	14	15	9	14	9
	University	15	13	12	10	5	4	5	4
<b>Income</b>	< Min. Wage	17	21*	21	26*	6	19*	6	19*
	min. Wage	25	23	24	22	3	5	1	2
	< 2 min. wage	78	20	70	18	26	10	21	8
	< 4 min. wage	62	18	53	15	24	8	23	7
	5+ min. wage	17	9	19	10	5	3	5	3
<b>Smoking Status</b>	Non-Smoker	123	16*	118	15*	20	8	17	6
	Ex-Smoker	32	19	30	17	23	9	19	8
	Current Smoker	44	27	39	24	21	6	20	6
<b>Number of cigarettes per day</b>	1-5 cigs per day	32	29	27	24	14	6	14	6
	6-15 cigs per day	6	16	7	18	5	6	4	5
	16+ cigs per day	5	38	4	31	2	6	2	6

*Note.* Low depressive symptoms vs. elevated depressive symptoms were determined using the cutoff point that equals the mean plus one standard deviation (mean = 7.7, SD = 9.8 for the 20 item scale and mean = 2.6, SD = 3.7 for the CES-D 7). n's indicate respondents with elevated depressive symptoms; Chi square omnibus test for men and women separately; tests differences in sample characteristics between those with low depressive symptoms vs. those with elevated depressive symptoms; \*  $p < .05$

**Table 4.** Logistic regression models predicting elevated depressive symptoms measured by the CES-D 20 item scale and the CES-D 7 item scale, n=1970

Variables	Elevated depressive symptoms measured by the CES-D 20					Elevated depressive symptoms measured by the CES-D 7				
	%	Unadjusted OR	95% CI	Adjusted OR	95% CI	%	Unadjusted OR	95% CI	Adjusted OR	95% CI
<b>Smoking status</b>										
Non smoker	14	1.00	-	1.00	-	13	1.00	-	1.00	-
Ex-smoker	13	0.94	0.67, 1.31	1.40	0.98, 2.00	12	0.88	0.62, 1.25	1.34	0.92, 1.94
Current smoker	13	0.94	0.68, 1.28	1.61 <sup>b</sup>	1.14, 2.28	12	0.90	0.64, 1.24	1.57 <sup>a</sup>	1.09, 2.25
<b>Number of cigarettes per day</b>										
Non smoker	14	1.00	-	1.00	-	13	1.00	-	1.00	-
Ex-smoker	13	0.94	0.67, 1.31	1.40	0.98, 2.00	12	0.88	0.62, 1.25	1.33	0.92, 1.93
1-5 cigarettes	14	1.01	0.71, 1.45	1.67 <sup>b</sup>	1.13, 2.46	12	0.95	0.65, 1.38	1.58 <sup>a</sup>	1.05, 2.37
6-15 cigarettes	9	0.65	0.34, 1.24	1.24	0.63, 2.44	9	0.70	0.36, 1.33	1.37	0.69, 2.69
16+ cigarettes	14	1.05	0.46, 2.38	1.82	0.77, 4.33	12	0.94	0.39, 2.25	1.67	0.66, 4.18

*Note.* Separate models were estimated for smoking status and for number of cigarettes per day as independent variables; All models adjusted for gender, education, and income; %= percentage of respondents in each category who had elevated depressive symptoms; <sup>a</sup>  $p < .05$ , <sup>b</sup>  $p < .01$ , <sup>c</sup>  $p < .001$



**Table 5.** Unadjusted odds ratios (OR) and adjusted odds ratios (AOR) from logistic regression models, stratified by gender, predicting elevated depressive symptoms measured by the CES-D 20 item scale and the CES-D 7 item scale, n=1970

Variables	Women						Men					
	Elevated depressive symptoms measured by the CES-D 20			Elevated depressive symptoms measured by the CES-D 7			Elevated depressive symptoms measured by the CES-D 20			Elevated depressive symptoms measured by the CES-D 7		
	%	OR 95% CI	AOR 95% CI	%	OR 95% CI	AOR 95% CI	%	OR 95% CI	AOR 95% CI	OR 95% CI	AOR 95% CI	
<b>Smoking status</b>												
Non smoker	16	-	-	15	-	-	8	-	-	7	-	-
Ex-smoker	19	1.23 [0.80, 1.89]	1.37 [0.88, 2.14]	17	1.19 [0.77, 1.86]	1.35 [0.86, 2.13]	9	1.20 [0.64, 2.24]	1.15 [0.61, 2.18]	8	1.16 [0.58, 2.28]	1.11 [0.56, 2.23]
Current smoker	27	1.96 <sup>b</sup> [1.32, 2.91]	2.29 <sup>c</sup> [1.52, 3.46]	24	1.75 <sup>b</sup> [1.16, 2.64]	2.06 <sup>b</sup> [1.35, 3.16]	6	0.79 [0.42, 1.49]	0.81 [0.42, 1.55]	6	0.89 [0.46, 1.74]	0.93 [0.47, 1.84]
<b>Number of cigarettes per day</b>												
Non smoker	16	-	-	15	-	-	8	-	-	7	-	-
Ex-smoker	19	1.23 [0.80, 1.89]	1.37 [0.88, 2.14]	17	1.19 [0.77, 1.86]	1.35 [0.86, 2.12]	9	1.20 [0.64, 2.24]	1.15 [0.61, 2.18]	8	1.16 [0.58, 2.28]	1.12 [0.56, 2.23]
1-5 cigarettes	29	2.16 <sup>b</sup> [1.37, 3.40]	2.46 <sup>c</sup> [1.54, 3.93]	24	1.80 <sup>a</sup> [1.12, 2.90]	2.07 <sup>b</sup> [1.26, 3.38]	6	0.80 [0.39, 1.64]	0.80 [0.39, 1.66]	6	0.96 [0.46, 2.00]	0.97 [0.46, 2.06]
6-15 cigarettes	16	1.01 [0.41, 2.47]	1.37 [0.54, 3.46]	18	1.28 [0.55, 2.97]	1.77 [0.74, 4.26]	6	0.80 [0.29, 2.21]	0.83 [0.30, 2.34]	5	0.75 [0.24, 2.31]	0.80 [0.26, 2.50]
16+ cigarettes	38	3.37 <sup>a</sup> [1.09, 10.5]	2.85 [0.89, 9.17]	31	2.52 [0.76, 8.32]	2.18 [0.63, 7.49]	6	0.70 [0.15, 3.12]	0.80 [0.17, 3.65]	6	0.83 [0.18, 3.76]	0.99 [0.21, 4.59]

*Note.* All models adjusted for education and income; Low depressive symptoms vs. elevated depressive symptoms were determined using the cutoff point that equals the mean plus one standard deviation (mean = 7.7, SD = 9.8 for the 20 item scale). Positively worded items were reversed coded; % = percentage of respondents in each category who had elevated depressive symptoms; <sup>a</sup>  $p < .05$ , <sup>b</sup>  $p < .01$ , <sup>c</sup>  $p < .001$

## **Conclusions**

The purpose of this study was to determine the construct validity of the CES-D 7 item scale. The patterns of results on associations between depressive symptoms, socio-demographic variables and smoking related variables were similar when using the CES-D 20 item scale and the CES-D 7 item scale. Overall, the results were consistent with regard to the significance, strength, and direction of the associations between the variables. That is, the results provide evidence that support the construct validity of the CES-D 7 item scale as a measure of depressive symptomatology in the Mexican population. Our results using both the 20 item CES-D scale and the CES-D 7 item scale are consistent with those reported by Benjet et al., (2004). The difference in the magnitude of estimates between our study and those reported by Benjet et al., (2004) might be related to the difference in the sum of the CES-D items obtained. The mean score reported in Benjet et al., (2004) indicates that positively worded items might have not been reversed coded, however, those were reversed coded in our study.

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