Validation of the Center for Epidemiologic Studies Depression Scale in Black Single Mothers

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Abstract

Background and Purpose—The purpose of this study was to investigate the factor structure of the Center for Epidemiologic Studies Depression (CES-D) scale in a community sample of Black single mothers and to evaluate the scale's construct validity.

Methods—Principal components and exploratory factor analysis were used. The participants responded to the CES-D scale and Spielberger's State-Trait Anger Expression Inventory.

Results—The final sample consisted of 208 Black single mothers aged 18–45 years. A 2-factor structure was accepted. Construct validity was confirmed via significant correlations with the anger scales. A method artifact for the 2-factor solution was ruled out.

Conclusion—The CES-D scale is valid for use with Black single mothers. Additional psychometric evidence for the CES-D for Black single mothers is warranted.

Keywords

depression; factor analysis; single mothers; mental health

The Center for Epidemiological Studies Depression (CES-D) scale (Radloff, 1977) is the most widely used instrument to measure depression, largely because the instrument was designed for use with a community-dwelling population. The literature is replete with recent methodological studies that have examined the factor structure of the CES-D using exploratory factor analysis (EFA) with a wide variety of populations (Beseler & Stallones, 2006; C. H. Clark, Mahoney, Clark, & Eriksen, 2002; Kazarian, 2009; Yen, Robins, & Lin, 2000). However, methodological studies examining the factor structure of the CES-D for African Americans are limited (Callahan & Wolinsky, 1994; McCallion & Kolomer, 2000), and none of the studies have examined the factor structure in Black single mothers.

Depression is a serious mental illness that negatively impacts physical health, quality of life, psychosocial functioning, and causing disability and death for some sufferers (Borsbo, Peolsson, & Gerdle, 2009; Coyne, 2009; HealthyPeople.gov, 2013; National Institute of Mental Health, 2009). Depression in mothers contributes to their poor health and negatively impacts the health, well-being, and development of their children (Boyd, Zayas, & McKee,

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2006; Leschied, Chiodo, Whitehead, & Hurley, 2005; Scalzo, Williams, & Holmbeck, 2005). The devastating negative impact of depression on the health and well-being of individuals and families has made the identification and prevention of depression in those at-risk critical public health priorities (HealthyPeople.gov, 2013; World Health Organization, 2013).

Single mothers are a vulnerable population at risk for depressive symptoms. Published studies show that 20%–73% of single mothers report levels of depressive symptoms consistent with a diagnosis of mild to moderate depression (Peden, Rayens, Hall, & Grant, 2004; Samuels-Dennis, 2007). These numbers are slightly higher for Black single mothers who are at particular risk because studies examining depression in this population show that 47%–70% of these mothers report clinically significant depressive symptoms (Hatcher, 2008; Kneipp, Welch, Wood, Yucha, & Yarandi, 2007; Siefert et al., 2007). This rate is more than 6 times the rate of depression in the general population of U.S. adults (6.7%). Black single mothers disproportionately experience the socioeconomic, psychosocial, and cultural risk factors shown to increase depressive symptoms. These mothers disproportionately live in poverty with lack of social support (Mather, 2010; U.S. Census Bureau, 2007; U.S. Department of Health and Human Services, 2001). They also frequently perceive racism, a culturally specific psychological stressor, that additionally increases their risk for depressive symptoms (R. Clark, Anderson, Clark, & Williams, 1999; Pascoe, Stolfi, & Ormond, 2006; Thomas & Gonzalez-Prendes, 2011).

Despite the aforementioned facts, depression often goes unrecognized and untreated in Black women (Waite & Killian, 2007, 2008, 2009). Even though depression scales, such as the CES-D scale, are widely available, the validity of these scales for the measurement of depression in diverse groups requires constant evaluation. Diverse demographics, including culture, may influence the experience and expression of depression (Baker, 2001; Beauboeuf-Lafontant, 2007; Nicolaidis et al., 2010) and may subsequently contribute to construct bias (Kline, 2005). Because Black single mothers are at high risk for depression, establishing the validity of widely used measures of depression in this unique group is warranted.

As stated earlier, reliable and valid depression instruments are needed for Black single mothers to study the phenomenon in this subgroup of the Black population. The purpose of this study is to investigate the factor structure of the CES-D scale in a community sample of Black single mothers using EFA. The construct validity of the CES-D will also be evaluated via correlations with anger scales, based on theoretical propositions in the literature.

BACKGROUND

The CES-D scale is a 20-item self-report instrument designed to assess current levels of depressive symptoms (within the past week) in the general population (Radloff, 1977). When originally developed, content validity for the CES-D was shown when items for this tool were selected by Radloff (1977) from previously validated depression scales, and components of depressive symptoms were identified from both the clinical literature and factor analysis studies. Four items were worded positively to offset a response set and to

assess positive affect. The items in the scale represent the core components of depressive symptoms (Radloff, 1977).

Radloff (1977) provided evidence of construct validity via known groups when psychiatric inpatients had higher scores on the CES-D scale than a general population sample. Convergent validity was shown when the CES-D scale correlated strongly and positively with scales measuring symptoms of depression, such as the Bradburn Negative Affect ($r = .60$, $p < .05$), the Lubin Adjective Checklist ($r = .51$, $p < .05$), and the Bradburn Balance ($r = .61$, $p < .05$) in a sample of healthy adults and psychiatric inpatients. Concurrent validity was shown when the CES-D scale correlated negatively with the Bradburn Positive Affect scale ($r = -.21$, $p < .05$; Radloff, 1977).

When originally validated, a four-factor structure of the CES-D scale was found via principal components factor analysis (PCA) for three general population groups ($N = 2,514$, $N = 1,060$, $N = 1,422$) consisting of White, better educated, mainly middleclass young to old adults (Radloff, 1977). Four factors with eigenvalues greater than 1 were extracted accounting for 48% of the variance. After varimax orthogonal rotation, four factors were accepted. Item loadings higher than .40 were retained, and the four factors were easily interpretable and included (a) depressed affect, (b) positive affect, (c) somatic and retarded activity, and (d) interpersonal (Radloff, 1977). Radloff (1977) failed to report coefficient alpha reliabilities for the accepted factors. Because of the high internal consistency of the total scale ($\alpha = .85$), Radloff recommended use of total scale scores without emphasis on separate factors. In fact, Radloff (1977) reported coefficient alphas ranging from .84 to .85 for the entire scale for three samples of healthy adults from the community and a coefficient alpha of .90 for a sample of 70 psychiatric inpatients.

Factor Analysis Studies

Four- and Five-Factor Structure—Callahan and Wolinsky (1994) investigated the factor structure of the CES-D scale in samples of 446 White women and 179 White men. Using PCA analysis with orthogonal and oblique rotations, a four-factor structure was accepted for White women and a six-factor structure was accepted for White men based on eigenvalue analysis. Items were retained if the loadings were .40 or greater. However, cross-loading items (defined as items loading strongly on more than one factor), were not deleted and coefficient alphas for the factors were not reported. Radloff's (1977) four-factor structure was only supported in White women but not in White men.

Barlow and Wright (1998) investigated the factor structure of the CES-D scale using data from a sample of 244 women with arthritis aged 24–97 years ($M = 58$, $SD = 13.6$). Using PCA with varimax rotation, a four-factor solution accounting for 57% of the total variance was accepted. All items loaded higher than .40; however, three items were discarded because they loaded acceptably on more than one factor. The coefficient alphas for each factor were acceptable ($>.70$). The interfactor correlations were not reported, making it hard to determine if the factors are distinct.

Ying, Lee, Tsai, Yeh, and Huang (2000) investigated the factor structure of the CES-D scale using data from a sample of 353 Chinese American college students (M age = 20.23; $SD =$

0.77). Using PCA with varimax orthogonal rotation, five factors with eigenvalues greater than one were retained. All accepted items loaded at .40 or higher. Consistent with the findings for the original CES-D scale (Radloff, 1977), only two items ("unfriendly" and "people dislike me") loaded onto Factor 4 making up a unique "interpersonal" factor. However, by some standards, this factor may be considered trivial because it has only two items (Gorsuch, 1983). Coefficient alphas for each factor were not reported.

C. H. Clark et al. (2002) investigated the factor structure of the CES-D scale in a sample of 116 adult multiracial patients with chronic liver disease aged 27–63 years ($M = 46$). Using PCA with varimax rotation and Bartlett's test, a four-factor solution explaining 65% of the variance was accepted. All items accepted loaded higher than .50, and two crossloading items (i.e., "felt sad" and "couldn't get going") were deleted. Coefficient alphas for each factor were not reported.

Three-Factor Structure—Ghubash et al. (2000) investigated the factor structure of the translated version of the CES-D scale in sample of 450 Arab females (M age = 22.3; $SD = 3.1$). Using PCA with varimax rotation, a three-factor solution was accepted accounting for 52% of the variance. All items retained loaded higher than .46 on the accepted factors, but coefficient alphas were not reported.

Yen et al. (2000) investigated the factor structure of the CES-D scale in a sample of 1,240 Chinese university students. Using PCA with varimax rotation, a three-factor structure was accepted. Three cross-loading items (bothered, failure, and fearful) were deleted. Items accepted loaded at .40 or higher, but coefficient alphas for the factors were not reported.

Two-Factor Structure—Schroevers, Sanderman, van Sonderren, and Ranchor (2000) investigated the factor structure of the Dutch version of the CES-D scale using data from two Dutch samples: (a) patient with cancer sample ($N = 376$) and (b) healthy reference sample ($N = 209$). Using PCA with varimax rotation, a two-factor ordered solution explaining 40.6% of the variance in the patient group and 42.2% of the variance in the reference sample was accepted. All items loaded at .30 or higher on the accepted factors in both groups. In addition, negatively worded items loaded on one factor and the positively worded items on another for the analyses done on each samples. The coefficient alphas for the accepted factors were not reported for either sample. Beseler and Stallones (2006) investigated the factor structure of the CES-D scale in a sample of 684 Midwest male ($n = 442$) and female ($n = 242$) farm workers and their spouses. Using PCA with varimax rotation, a two-factor solution was accepted explaining only 5.3% of the variance. All accepted items loaded higher than .40 on the accepted factors, and three items loading less than .40 were deleted. Two additional items (i.e., "unfriendly" and "people dislike you") which loaded onto a factor with an eigenvalue less than 1, were deleted because this factor was not accepted. In addition, negatively worded items loaded on one factor and positively worded items on the other factor. The coefficient alpha for one of the accepted factors was less than adequate ($\alpha = .68$).

Kazarian (2009) investigated the factor structure of the Armenian translation of the CES-D scale using data from a sample of 172 Armenian community residents ($M = 36.08$; $SD =$

15.14). Using principal factor analysis with oblimin rotation, a two-factor structure explaining 36.3% of the variance was accepted. However, three of the accepted factor loadings as reported were less than .30. The coefficient alpha for one of the factors also was less than adequate ($\alpha = .62$). In addition, negatively worded items loaded on one factor and positively worded items on the other factor.

One-Factor Structure—Carpenter et al. (1998) investigated the factor structure of the CES-D scale using data from two samples: (a) 225 low-income, young single mothers (59% African American) and (b) another sample of 196 mothers of young children (56% African American). Using PCA with varimax orthogonal rotation, a one-factor solution was accepted for both samples. Seventeen of 20 items loaded higher than .40 on a single factor on the sample of single mothers and 16 of 20 items loaded higher than .40 on a single factor for the mothers of young children. The four-factor structure found by Radloff (1977) was explored for both samples but only partially fit the single mother sample because there were many cross-loading items resulting.

Factor Analysis Studies in Black Adults

Callahan and Wolinsky (1994) investigated the factor structure of the CES-D scale in a sample of 929 Black women and 365 Black men. Using PCA with orthogonal and oblique rotations, a four-factor structure was accepted for Black women and a seven-factor structure was accepted for Black men. Items were retained if the loadings were .40 or greater. However, cross-loading items were not deleted for Black men (i.e., "effort" and "dislike me"), and coefficient alphas for the factors were not reported. Radloff's (1977) four-factor structure was only supported in Black women but not in Black men.

McCallion and Kolomer (2000) investigated the factor structure of the CES-D scale in a sample of 393 African American grandmothers aged 40–82 years, most of whom were older than the age of 55 years. Using PCA with varimax orthogonal rotation, a four-factor structure accounting for 49% of the variance was accepted. Items were retained if the loadings were .40 or greater. Although the four-factor structure proposed by Radloff (1977) was accepted, two of the factors may be considered trivial because they only had two items each and very low coefficient alphas (.41 and .17).

Based on all of the EFA studies reviewed, it is clear that many of the results do not conform to the four-factor structure found by Radloff (1977), most likely caused by the wide variety of the characteristics of the samples studied and the different sample sizes. As is evident, studies exploring the factor structure of the CES-D scale in Black samples are limited and dated, and the findings are questionable (Callahan & Wolinsky, 1994; McCallion & Kolomer, 2000). There are no EFA studies of the CES-D scale in Black single mothers; the aim of this study is to produce evidence of reliability and validity for this subgroup of Black women.

Construct Validity

To provide additional evidence of construct validity for the CES-D scale, theoretical propositions suggesting relationships between anger, as conceptualized by Spielberger

(1999), and depression were tested. As per Spielberger (1999), some persons express anger outwardly in aggressive behavior (*anger-expression-out*; slam doors) toward other persons or objects in the environment, whereas others hold in or suppress angry feelings (*anger-expression-in*; keep things in). In addition, some persons control their angry feelings by calming down or cooling off (*anger-control-in*; take a deep breath), whereas others control their angry feeling by preventing the expression of anger toward other persons or objects in the environment (*anger-control-out*; being tolerant).

Theorists have proposed that suppression of anger (anger-in) is antecedent to depression. According to Greenberg and Safran (1987), suppressed anger can cause hopelessness and depressive sadness, which is a bad, dark, gloomy, self-destroying feeling. Dalrup, Beutler, Engle, and Greenberg (1988) proposed that depression is the result of failing to express angry responses to events in one's life (anger-in). Greenberg and Paivio (1997) proposed that chronic suppression of anger may inadvertently increase anger leading to maladaptive explosive expressions of anger (anger-out) and ultimately depression (Greenberg & Paivio, 1997). Because women are often socialized to internalize anger without directly expressing it, they are at particular risk for feelings of depression because of the ineffective expression of anger (Cox, Van Velsor, & Hulgus, 2004; Hatch & Forgays, 2001). Thus, it is expected that both anger-expression-in and anger-expression-out subscales will be positively associated with depressive symptoms in these women.

Theorists additionally proposed that under-controlled anger can lead to depression. According to Tavris (1989) and others (Greenberg & Paivio, 1997; Luutonen, 2007), anger leads to depression when it is not controlled effectively. Depression can become a sequel to maladaptive anger control of a chronic nature (Robbins, 2000; Tavris, 1989). Therefore, according to these theorists, the lack of appropriate control of anger is antecedent to depressive symptoms. Thus, it is expected that both the anger-control-out and the anger-control-in subscales will be negatively associated with depressive symptoms.

A qualitative report revealed that more frequent experiences of powerlessness, economic oppression, and perceived racism contribute to anger in African American women (Thomas & Gonzalez-Prendes, 2011). Reports additionally reveal that a cultural expectation that these women should be strong and endure adversity without help also fuels anger and places them at greater risk for depressive symptoms (Beauboeuf-Lafontant, 2007; Thomas & Gonzalez-Prendes, 2009). Despite these facts, the relationship between anger and depression has never been tested in a sample of solely Black women. Construct validation of the CES-D scale will provide new knowledge concerning the relationship between anger and depression in a sample of Black women who are single mothers.

METHODS

Research Design

For this study, a cross-sectional research design was used to evaluate the psychometric properties of the CES-D scale. This study is part of a larger study of depression in Black single mothers (Atkins, 2014).

Sample and Setting

Participants were recruited from 10 sites in two communities. The recruitment sites included 4 community sites (i.e., 2 daycares and a dance school), 3 private pediatric practices, and 3 social service agencies (i.e., women's shelter, soup kitchen, and welfare office). Exactly 312 women were approached to participate in this study. However, the final sample consisted of a sample of convenience of 208 Black single mothers from the community, aged of 18–45 years, who met the inclusion–exclusion criteria. These single mothers were either never married, widowed, divorced, or separated and had one or more minor or adult children living with them. The sample excluded mothers who were currently receiving psychiatric care or counseling, taking antidepressant medication, pregnant, or had children younger than 1 year (Nunnally & Bernstein, 1994) and exceeded the 5:1 participant to subject ratio recommended by Gorsuch (1983) for factor analysis.

Procedure

Approval to conduct this study was obtained from the university's institutional review board (IRB). Data collection took place over a 3-month period with the primary investigator present. The primary investigator approached potential subjects in the waiting areas before health and community visits or in the exam rooms after health visits were completed. Potential subjects were screened for delimitations and were explained the rights of human subjects. All women who met both the inclusion and exclusion criteria completed the data packets in a quiet well-lit area or room.

After informed consent was obtained in writing, the participants responded to self-report questionnaires, a demographic data sheet, and a self-generated identification code. The primary investigator was available to answer questions concerning the questionnaires as they arose. After completing the questionnaires, the participants were given $10 in cash.

Instruments

State-Trait Anger Expression Inventory—The Spielberger's State-Trait Anger Expression Inventory-2 (STAXI-2) is a 57-item self-report instrument designed to measure the experience (state-trait anger), expression (anger-out, anger-in), and control of anger (anger control-out and anger control-in) in normal and abnormal individuals (Spielberger, 1999). The STAXI-2 consists of six primary scales, one of which is an anger expression scale. The anger expression scale is composed of four subscales: (a) anger-expression-out (eight items), (b) anger-expression-in (eight items), (c) anger-control-out (eight items), and (d) anger-control-in (8 items). On these scales, respondents indicate on a 4-point scale (1 = *almost never* to 4 = *almost always*) the degree to which they agree with statements that ask about different components of anger. Total scores for each subscale are obtained by summing responses with higher scores indicating a higher degree of the use of certain methods for the expression or control of anger (Spielberger & Sydeman, 1988). The entire inventory was administered, but only the anger expression scales were used in this analysis.

Construct validity was established by Spielberger and Sydeman (1988). PCAs with promax rotation revealed an eight-factor structure for the entire STAXI in a sample of 1,644 normal adults (Spielberger, 1999). Martin and Dahlen (2007) provided evidence of concurrent

validity when the STAXI-2's anger-in and anger-out scale correlated as expected with measures of other psychosocial variables in a sample of 205 undergraduate psychology students.

Relative to reliability, Webb, Beckstead, Meininger, and Robinson (2006) reported a coefficient alpha for the anger-in subscale of .76 and the anger-out subscale of .67 for the STAXI-2 in a sample of 33 African American women. Culhane and Morera (2010) reported coefficient alphas of .75 for anger-out and .73 for anger-in, in a sample of 257 U.S. Hispanic undergraduate students. In this study, the coefficient alphas were as follows: (a) anger-expression-in = .75, (b) anger-expression-out = .77, (c) anger-control-in = .85, and (d) anger-control-out = .82.

Approaches to Reliability and Validity Assessment

Factor analysis was conducted using SPSS 20.1 computer program. In addition, Cronbach's alpha coefficient was used to determine the reliability of the total scale and the accepted factors of the CES-D. The method of extraction chosen was principal component analysis to get the most interpretable of results (Nunnally & Bernstein, 1994). As determined a priori, four criteria were established to use in analyzing and interpreting the results of the factor analysis procedures. The first two criteria were used to determine the number of relevant factors in the principal components analysis: (a) root-one criterion, which states that factors with eigenvalues equal to or greater than 1 should be rotated (Guttman, 1954), and (b) the scree test criterion by Cattell (1966), which states that factors should cease when the plotted graph of the eigenvalues levels off, forming a straight line with an almost horizontal slope. The third criterion applies to the retention of items in the accepted rotated factor solution. An item-factor loading of at least .40 on the primary factor and a difference of at least .20 between items loading on the primary factor and any other factor, referred to as cross-loading items, was used to determine item retention. As a fourth criterion, rotated factor solutions were considered if all factors had at least three items loading at .30 or higher and thus, were not trivial factors (Gorsuch, 1983). Because the factors were assumed to be uncorrelated, varimax orthogonal rotation was used, as was done initially by Radloff (1977) who developed the instrument. Pearson product-moment correlations were also used to assess the construct validity of the CES-D scale via correlations with the Anger subscales based on theoretical propositions.

RESULTS

Sample Characteristics

In this study, most of the 208 women were young adults with ages ranging from 18 to 45 years ($M = 30.55$, $SD = 7.08$). Most women (87.5%) reported that they were single having never been married, 6.7% were divorced, 5.3% were separated, and 0.5% were widowed. Most women also reported having between one and two children (61.1%), whereas 34.1% had three to four children, 3.8% had five to six children, and 1.0% had seven or more children. Most of the women (61.4%) had completed high school, 17.9% completed a technical school, 13.0% had a 2-year college degree, 3.9% had completed eighth grade, 1.9% completed a 4-year college degree, and 1.9% completed a master's degree.

Exploratory Factor Analysis

To determine the number of solutions to be examined, a principal component factor analysis was performed and resulted initially in the emergence of three factors with eigenvalues greater than 1 after scree plot analysis. This justified the ordering of two- to three-factor solutions and eliminated ordering of a four-factor solution. The three-factor solution did not meet three of the five criteria set forth a priori (see Table 1). Therefore, the two-factor solution was accepted after varimax orthogonal rotation, meeting all of the a priori criteria and being the most interpretable (see Table 1). Factor 1 had an eigenvalue of 8.9 and explained 44.44% of the variance. Fifteen items loaded on Factor 1 at .68 and higher. Because all of the items were negatively worded, the factor was named *negative affect*. Factor 2 had an eigenvalue of 2.43 and explained 12.18% of the variance. Five items loaded on Factor 2 at .61 or higher. Because all of the items were positively worded, the factor was named *positive affect*. The inter-factor correlation was negative and low to moderate and supported the distinct two-dimensional structure of the CES-D in this population ($r = -.38$, $p < .01$). The coefficient alpha for Factor 1 was .94, and the coefficient alpha for Factor 2 was .81 supporting the reliability of these two factors (see Table 2). Item–total scale correlations were all greater than .47, which is consistent with the very high alpha coefficients attesting to the reliability of the two factors.

Construct Validity

Evidence of the construct validity of the CES-D scale via correlations with the anger subscales was ascertained. As expected, the results indicated that both anger-expression- out ($r = .28$, $p < .01$) and anger-expression-in ($r = .32$, $p < .01$) were positively related to depressive symptoms (see Table 3). However, contrary to what was expected, anger-control-out ($r = -.12$, $p > .05$) and anger-control-in ($r = -.1$, $p > .05$) were not significantly related to depressive symptoms (see Table 3).

Rule-Out Method Artifact

All of the negatively worded items, except for Item 7, loaded onto Factor 1 and all of the positively worded items, and Item 7 loaded onto Factor 2 (see Table 2). These finding suggests the possibility of a method artifact, namely, a response set bias to the positive and negative way in which the items are worded on the instrument, which produced the second factor (Carmines & Zeller, 1979). According to Carmines and Zeller (1979), the first factor represents theoretically valid variance, whereby the second factor represents systematic error variance. Put another way, it is possible that the two accepted factors of the CES-D are in fact a unidimensional factor contaminated by a method artifact rather than being two independent factors.

To resolve this issue, the relationships between both factors and the subscales of the anger instruments were examined, as suggested by Carmines and Zeller (1979). If in fact there is a valid two-factor structure measuring different components of depression, these factors will relate differently to the anger measures. However, if there is unidimensional structure of the CES-D scale with a bifactorial structure caused by a method artifact, then the two factors will correlate identically in terms of strength, direction, and consistency with the anger subscales (Carmines & Zeller, 1979).

Pearson product-moment correlations were evaluated to determine the relationships between the CES-D factors and the anger subscales. The two factors of the CES-D scale were examined in relation to the four theoretically relevant anger subscales. The correlations are presented in Table 4. Both the anger-expression-out subscale ($r = .31$, $p < .01$) and the anger-expression-in subscale ($r = .33$, $p < .01$) were positively and moderately related to Factor 1 of the CES-D scale. The anger-expression-out ($r = −.04$, $p > .05$) and the anger-expression-in subscales ($r = −.04$ $p > .05$) were negatively associated with Factor 2, but these relationships were not statistically significant. Anger-control-out ($r = −.09$, $p > .05$) and anger-control-in ($r = −.05$, $p > .05$) had negative relationships with Factor 1 of the CES-D scale but were not statistically significant. However, the anger-control-out ($r = .17$, $p < .05$) and anger-control-in ($r = .20$, $p < .01$) subscales were positively and weakly related to Factor 2 (positive affect).

As is demonstrated, Factor 1 and Factor 2 related differently to the anger expression and control subscales. Because the two CES-D factors did not correlate with the anger subscales identically in terms of strength, direction, and consistency, the bifactorial structure of the CES-D scale is valid in this sample of Black single mothers (Carmines & Zeller, 1979).

Further evidence of the validity of the two-factor solutions was carried out by observing the relationship between the coefficient alpha reliabilities of the two factors and the correlation found between the two factors (Campbell & Fiske, 1959). If the coefficient alphas are high, a low correlation suggests two dimensions and a high correlation suggests one dimension. In this study, the high coefficient alpha reliabilities of the factors, which were .94 and .81, along with a weak to moderate negative correlation ($r = −.38$, $p < .01$) between the two factors additionally suggests bidimensionality of the CES-D scale (Campbell & Fiske, 1959).

DISCUSSION

This study was the first to examine the factor structure of the CES-D scale in a sample of 208 Black single mothers. A forced two-factor solution, using PCA with varimax rotation, resulted in the most interpretable solution. Both factors yielded high coefficient alpha reliabilities. Similar results were reported by Schroevers et al. (2000) who used the same factor analysis procedures with two different samples: patients with cancer and healthy adults. Given the disparate nature of the aforementioned samples, it is unlikely that culture influenced the two-factor structure of the CES-D scale in this study.

Previous methodological studies using a wide variety of samples have reported five-factor (Ying et al., 2000), four-factor (Barlow & Wright, 1998; Callahan & Wolinsky, 1994; C. H. Clark et al., 2002), three-factor (Ghubash et al., 2000; Yen et al., 2000), two-factor (Beseler & Stallones, 2006; Kazarian, 2009; Schroevers et al., 2000), and one-factor solutions (Carpenter et al., 1998) of the CES-D. A critique of these studies cannot determine the "true" number of factors underlying the CES-D instrument. Therefore, because factors (subscales) of instruments are often used to refine and/or clarify theory, it is recommended that researchers attempting to refine theory factor analyze the CES-D with their samples for accuracy purposes.

The bidimensionality of the CES-D scale was called into question because 14 of the 15 negatively worded items loaded onto Factor 1 and all 4 positively worded and 1 negatively worded item loaded onto Factor 2, suggesting a method artifact, namely, response set. Previous factor analytic studies of the CES-D scale were suggestive of this same method artifact when a two-factor structure was found in patients with cancer and healthy references (Schroevers et al., 2000) and Armenian community residents (Kazarian, 2009). However, these researchers did not explore the possibility of method artifact as was done in this study. Using the procedures outlined by Carmines and Zeller (1979), the results indicated that the two-factor solution was not caused by a method artifact because the two factors of the CES-D scale related differentially to the anger expression and control subscales. In light of this evidence, the dimensions have been labeled *negative affect* depressive symptoms (Factor 1) and *positive affect* in depressive symptoms (Factor 2). Both are consistent with two of the factors accepted by Radloff (1977), which include depressed affect and positive affect.

As expected, both of the anger-expression subscales were positively related to depressive symptoms at a statistically significant level. These findings are consistent with theory (Dalrup et al., 1988; Greenberg & Paivio, 1997; Tavris, 1989) suggesting that lack of control over anger (anger-out) and suppression of angry feelings (anger-in) may lead to depressive symptoms. Further, these findings provide evidence of construct validity for the CES-D scale for Black single mothers.

As theoretically expected, the direction of the relationship between the anger-control out and anger-control-in subscales and depressive symptoms was positive, but these relationships were not statistically significant. Greater clarity is needed regarding the theoretical relationship between anger control and depression before further hypothesis testing for construct validity of the CES-D scale takes place.

Limitations

The sample of convenience in this study consisted primarily of low-income Black single mothers educated at the high school level, which limits the generalizability of the findings. In addition, various recruitment sites used for the larger study introduced various environments to which the women responded to the CES-D. These different environmental factors may have influenced the current findings.

CONCLUSIONS AND RECOMMENDATION

Based on the psychometric properties provided in this study, the CES-D scale is a valid and reliable measure of depression in Black single mothers. The two-factor structure was most interpretable, evidence of construct validity was established for the instrument, and a method artifact was ruled out. To ensure the validity of this two-factor structure, this study should be replicated in another sample of Black single mothers. The next step would be confirmatory factor analysis of the CES-D in Black single mothers with the ultimate goal of providing accurate and valid results in depression studies for this vulnerable group.

Acknowledgments

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TABLE 1

Summary of Ordered Factor Extraction and Rotation Criteria

Factor Solution	Root-One Criteria (eigenvalue ≥ 1)	Scree Test Criteria	Trivial Factors	All Loadings .4 or greater	Cross-Loading Criterion
Two-factors	Yes	Yes	No	Yes	Yes
Three-factors	Yes	No	No	No	No

TABLE 2

Varimax Rotated Two-Factor Solution of the Center for Epidemiologic Studies Depression Scale

Items	Factor 1	Factor 2
I was bothered by things that usually don't bother me.	.714	−.146
I did not feel like eating; my appetite was poor.	.704	−.042
I felt like I could not shake off the blues even with help from my friends and family.	.795	−.181
I felt that I was just as good as other people.	−.106	.822
I had trouble keeping my mind on what I was doing.	.679	−.028
I felt depressed.	.813	−.213
I felt that everything that I did was an effort.	.107	.616
I felt hopeful about the future.	−.142	.794
I thought my life had been a failure.	.761	−.296
I felt fearful.	.735	−.209
My sleep was restless.	.598	.258
I was happy.	−.315	.721
I talked less than usual.	.632	.020
I felt lonely.	.731	−.106
People were unfriendly.	.595	−.219
I enjoy life.	−.325	.684
I had crying spells.	.775	−.253
I felt sad.	.809	−.138
I felt that people dislike me.	.701	−.330
I could not get going.	.741	−.188
Coefficient alpha	.940	.810

TABLE 3

Correlations Between Center for Epidemiologic Studies Depression (CES-D) and Anger Subscales

External Variables	CES-D Total Scale
AngExpOut	.28[*]
AngExpIn	.32[*]
AngConOut	−.12
AngConIn	−.10

Notes. AngExpOut = anger-expression out; AngExpIn = anger-expression-in; AngConOut = anger-control-out; AngConIn = anger-control-in.

[*] $p < .01$, one-tailed.

TABLE 4

Correlations Between Anger Subscales and the Two Factors on the Center for Epidemiologic Studies Depression Scale

	Depression	
External Variables	**Factor 1**	**Factor 2**
AngExpOut	.31**	−.04
AngExpIn	.33**	−.04
AngConOut	−.09	.17*
AngConIn	−.05	.20**

Notes. Factor 1 = negative affect; Factor 2 = positive affect; AngExpOut = anger-expression-out; AngExpIn = anger expression-in; AngConOut = anger -control-out; AngConIn = anger-control-in.

*
p < .05, two-tailed.

**
p < .01, one-tailed.