



A confirmatory factor analysis of the Beck Anxiety Inventory in African American and European American young adults

L. Kevin Chapman ^{*}, Sarah R. Williams, Benjamin T. Mast, Janet Woodruff-Borden

University of Louisville, USA

ARTICLE INFO

Article history:

Received 25 June 2008

Received in revised form 2 December 2008

Accepted 3 December 2008

Keywords:

Beck Anxiety Inventory (BAI)

Anxiety

African Americans

Factor analysis

ABSTRACT

The anxiety literature is particularly sparse as it relates to African Americans, and there are few studies to date that have examined the factor structure of anxiety assessment tools within this population. The current study investigated the original two-factor structure of the Beck Anxiety Inventory (BAI) in addition to two extant factor structures of the BAI in a non-clinical sample of African American and European American young adults. One hundred twenty one European American and 100 African American young adults completed the BAI. Results of a confirmatory factor analysis indicated that the previous factor structures of the Beck Anxiety Inventory do not provide the best fit for either the African American or the European American sample. An exploratory factor analysis revealed that an alternative, two-factor model provided the best fit for the sample, particularly for the African American sample. Implications and suggestions for future research are discussed.

© 2008 Elsevier Ltd. All rights reserved.

1. Introduction

The Beck Anxiety Inventory (BAI) has consistently been regarded as a strong tool for measuring cognitive and somatic aspects of self-reported anxiety symptomatology in both clinical and non-clinical populations (Beck, Epstein, Brown, & Steer, 1988; Creamer, Foran, & Bell, 1995; Kumar, Steer, & Beck, 1993; Morin et al., 1999; Osman, Kopper, Barrios, Osman, & Wade, 1997). Examination of the factor structure of the BAI has identified at least two factors that are endemic to the nomological network of anxiety, specifically, cognitive and somatic symptoms (Beck et al., 1988; Creamer et al., 1995; Kumar et al., 1993) whereas other studies have found multiple factors related to the construct of anxiety (Morin et al., 1999; Osman et al., 1997). Although the efficacy of the BAI's general utility in clinical and non-clinical populations is well-established, very little is known about its use in ethnic minority samples (Contreras, Fernandez, Malcarne, Ingram, & Vaccarino, 2004). The anxiety literature is particularly sparse as it relates to African Americans (Chapman, Kertz, Zurlage, & Woodruff-Borden, 2008; Chapman & Steger, 2008; Heurtin-Roberts, Snowden, & Miller, 1997; Horwath, Johnson, & Hornig, 1994; Lewis-Hall, 1994; Neal & Brown, 1994; Neal & Turner, 1991; Smith, Friedman, & Nevid, 1999). There are no known studies to date that have examined the factor structure

of the BAI in an African American sample. The current study conducts a confirmatory factor analysis by examining empirically supported factor structures of the BAI in a sample of African American and European American young adults.

1.1. Somatization of symptomatology

The anxiety literature as it pertains to African Americans remains relatively ambiguous with no clear conclusions being delineated. For example, it has been observed that African Americans have lifetime prevalence rates of anxiety disorders equal to or up to three times higher than that of European Americans (Cooley & Boyce, 2004; Heurtin-Roberts et al., 1997; Neal & Turner, 1991) and are noted as endorsing more agoraphobia than European Americans (Neal & Turner, 1991). In contrast, Last and Perrin (1993) were unable to reveal any significant differences between African Americans and European Americans with regard to simple and social phobias, when the groups were controlled for socioeconomic status. Neal and Turner (1991) concluded that African Americans also may not experience panic disorder in the same manner as their European American counterparts. It is important to note that the experience of these disorders is largely influenced by one's culture (Heurtin-Roberts et al., 1997; Kirmayer, 2001) and there are likely specific characteristics within this context to be taken into account in the assessment of panic disorder among African Americans versus European Americans. It is also known that African Americans report more somatic symptoms surrounding their experiences with anxiety than do European Americans (Heurtin-Roberts et al., 1997; Neal & Turner,

^{*} Corresponding author at: Department of Psychological and Brain Sciences, University of Louisville, Louisville, KY 40292, USA. Tel.: +1 502 852 3017; fax: +1 502 852 8904.

E-mail address: kevin.chapman@louisville.edu (L.K. Chapman).

1991), leading researchers to question the utility of anxiety assessments among ethnically diverse research and clinical populations.

1.2. The need for culturally sensitive measures of anxiety

In order to enhance our understanding of anxiety disorders with regard to ethnic minority samples, it is imperative to examine current measures that include somatic-related items, such as the Beck Anxiety Inventory (BAI; Beck et al., 1988). It has been postulated that many cases of anxiety disorders within the African American population go undiagnosed, simply because these individuals are more likely to report symptoms of “nerves” to their primary care provider than to a mental health professional (Neal & Turner, 1991) suggesting that African Americans may conceptualize anxiety difficulties much differently than their European American counterparts. Understanding underlying conceptual differences provides clinicians and researchers with a stronger avenue for approaching treatment options with their multicultural clients. Of particular importance may be somatization of anxiety symptoms by African Americans, since previously illustrated empirical work has noted that African Americans are more likely to report these symptoms to a primary care provider. Given that research on anxiety disorders includes predominantly European American samples, it is paramount to investigate whether the utilized measures are valid for use within these populations (Neal & Turner, 1991). Moreover, the deficiency of research pertaining to African American samples (Chapman et al., 2008; Chapman & Steger, 2008; Heurtin-Roberts et al., 1997; Horwath et al., 1994; Lewis-Hall, 1994; Neal & Turner, 1991; Smith et al., 1999) undoubtedly warrants additional examination of the construct of anxiety with existing measures that potentially capture anxiety symptoms endorsed by African Americans (Cooley & Boyce, 2004). Given that the BAI has been particularly adept at identifying somatic facets of anxiety, which African Americans have historically endorsed, it is therefore plausible to investigate anxiety symptoms in a sample of African Americans with the BAI.

1.3. The assessment of anxiety disorders: the Beck Anxiety Inventory

The BAI is a 21-item self-report questionnaire, used to measure the degree of severity of anxiety symptoms experienced. Each item is rated on a 4-point Likert-type scale with 0 being “not at all” and 3 being “severely, I could barely stand it.” The scores range from 0–63, with higher scores representing increased severity of the anxiety experiences (Beck et al., 1988). The items are tailored to include psychological complaints as well as somatic symptoms.

Developed in 1988, the primary purpose of the BAI was to bridge the gap that other measures left in the distinction between anxiety disorders and depression (Beck et al., 1988). A major problem in assessing the symptomatology experienced by individuals with anxiety disorders or depression is a measure's construct validity, more specifically the discriminant validity. The BAI was developed in hopes of alleviating the construct problems inherent in other measures of anxiety and related constructs. By measuring both psychological factors endemic to anxiety as well as somatic complaints, the BAI was able to distinguish between anxiety and depressive symptomatology. In addition to these strengths, the BAI's utility is further bolstered by having excellent convergent validity in the assessment of these anxiety symptoms (Beck et al., 1988), making it one of the most highly regarded measures for the assessment of anxiety.

When Beck et al. (1988) first developed the BAI, they conducted an exploratory factor analysis on the items included and found that a two-factor structure was the best fit. The items loading on factor one represent the somatic experiences associated with anxiety and

the items loading on factor two represent subjective symptoms of anxiety and panic (Beck et al., 1988). There is some particular question with the loading of a few items with the original factor structure in that some items appear to load similarly on both the cognitive and somatic factors (Beck et al., 1988; Hewitt & Norton, 1993). For example, Hewitt and Norton (1993) found that items 7 (“shaky”), 8 (“unsteady”), 12 (“hands trembling”), and 13 (“shaky”) loaded moderately on both the somatic and cognitive factors. Later studies were also not able to replicate the two-factor loading. A series of analyses by Osman and associates found that items on the BAI loaded on a four-factor structure when administered to a population of adolescents (Osman et al., 1997, 2002). Only one study to date has examined the factor structure of the BAI among a primarily non-European American sample (Contreras et al., 2004). In this study, the BAI was administered to a group of Latino university students as well as a group of European American students. Results supported the same two factors structure among the Latino students as well as the European American students. The authors also found that Latino students scored higher than their European American counterparts on nine of the items; five of those items being somatic complaints and four being psychological (Contreras et al., 2004). To date, no study has conducted a factor analysis of the BAI among African Americans.

Hoge et al. (2006) most recently reported that Nepali patients were more likely to endorse somatic items from the BAI when compared to American patients. The BAI was also administered to African young adults in South Africa (Pillay, Edwards, & Dhlomo, 2001). This study reported that 17.8% of their participants scored in the “severe” range on the BAI, illuminating the problem that this measure needs to be empirically tested and examined for its utility in the assessment of anxiety among culturally diverse populations.

1.4. Existing factor structures of the BAI

1.4.1. Beck et al. (1988): two-factor solution of the BAI

Beck and colleagues created the currently accepted factor structure of the BAI through examination of clinical anxiety through the use of items of from three existing measures of anxiety. The original sample was conducted with psychiatric outpatients meeting diagnostic criteria for either anxiety and/or depressive disorders according to the DSM-III criteria. The original item pool was comprised of 86 items and was statistically reduced resulting in the current structure of the BAI, which is comprised of 21 items. The final subsample from the original study carried out by Beck et al. (1988) was 160 subjects. Ethnic/racial group membership was not delineated in this study. An exploratory factor analysis using oblique rotation revealed two factors: somatic symptoms and subjective anxiety/panic. These two factors were moderately and positively correlated ($r = .56$).

There is a series of existing models that has yielded a two-factor structure similar to the original model described by Beck et al. (1988) (Contreras et al., 2004; Hewitt & Norton, 1993; Kumar et al., 1993; Osman et al., 1997; Steer, Rissmiller, & Ranieri, 1993) with minor exceptions of some items (e.g., somatic items) loading more heavily on the other factor (e.g., cognitive; Hewitt & Norton, 1993). Along these lines, the current investigators utilized these findings as additional rationale to examine the original two-factor structure of the BAI.

1.4.2. Osman et al. (2002): four-factor solution of the BAI

Osman et al. (2002) examined the factor structure of the BAI in both a psychiatric inpatient adolescent sample ($N = 240$) and a non-clinical high school sample ($N = 167$). The inpatient sample was comprised of 84.2% European Americans, 3.8% African Americans, 1.3% Latinos/Hispanics, and 5% of other ethnic groups. The high school sample included 79.6% European Americans, 8.4%

African Americans, 3% Asian Americans, 1.8% Latinos/Hispanics, and 7.2% from other ethnic groups. In attempts to replicate the two-factor structures described above using confirmatory factor analysis, Osman et al. (2002) found that the existing factor structure in their samples was inadequate. A subsequent EFA (principal axis factoring) with orthogonal and oblique rotations supported a four-factor solution for both samples which included neurophysiological, subjective, autonomic, and panic factors. However, because of moderate intercorrelations among these factors (ranging from .31 to .55) further analyses of the principal factors revealed the support for a higher order, single factor structure of the BAI which the authors labeled as anxious arousal. The authors note that the BAI appears to be an effective tool for screening anxiety symptoms in both clinical and non-clinical adolescent samples (Osman et al., 2002).

1.4.3. Morin et al. (1999): six-factor solution of the BAI

Morin et al. (1999) sought to examine the psychometric properties of the BAI in a non-clinical sample of 281 older adults recruited from both residential and community settings. Exploratory factor analysis (principal axis factoring) with orthogonal (varimax) rotation yielded a six-factor solution of the BAI which included the following factors: somatic (6 items), fear (3 items), autonomic hyperactivity (3 items), panic (4 items), nervousness (3 items), and motor tension (2 items). The authors note that their findings are consistent with the notion that older adult samples report more somatic complaints than younger populations (Morin et al., 1999). Ethnic/racial group membership was not delineated in this study.

1.5. Rationale for the current study

Studies to date underscore the importance of further investigating the utility of the BAI and related measures in diverse populations. The current study examines the factor structure of the BAI in a non-clinical sample of African American and European Americans. Further, we conducted a confirmatory factor analysis of the BAI based upon the three previously described existing factor structures of the BAI. First, the original two-factor structure yielded by Beck et al. (1988) was investigated. Second, given that the BAI was originally developed for use with both adolescents and adults (Beck et al., 1988) the more recent four-factor structure yielded by Osman et al. (2002) in a clinical and non-clinical sample of adolescents was also examined. Since the factor structure of the BAI has yet to be established in either a clinical or non-clinical sample of African Americans and given that the mean age of the current sample was 20 years of age, these factors provided additional rationale for examining the factor structure yielded by Osman and colleagues. Third, the six-factor solution yielded by Morin et al. (1999) in a non-clinical sample of older adults was also examined in the current non-clinical sample. As noted above, existing empirical literature, albeit substantially limited, alludes to African Americans experiencing anxiety symptoms predominantly through somatic complaints (Heurtin-Roberts et al., 1997; Horwath et al., 1994; Neal & Turner, 1991; Smith et al., 1999). Given that older adults have also been shown to endorse more somatic concerns than younger individuals, the six-factor structure yielded by Morin et al. (1999) was examined to assess whether somatically focused experience/expression of anxiety would better characterize the factor structure in a diverse sample.

2. Methods

2.1. Participants

The current study included a total of 221 undergraduate students from a medium-large public university. Students were

recruited from two sources, specifically an introduction to psychology course ($N = 130$) and an introductory-level Pan African Studies course ($N = 91$). Both African American and European American participants were derived from these two courses. The sample was comprised of 71 males and 150 females with a mean age of 20 years. Forty-five percent of the sample was African American while the remaining sample (55%) was comprised of European Americans. Participants completed the BAI in a group setting as a part of a larger study measuring ethnic differences in anxiety.

2.2. Measures

2.2.1. The Beck Anxiety Inventory (BAI; Beck & Steer, 1990)

There are specific psychometric properties of the BAI that are worth noting. The BAI has demonstrated excellent internal consistency in psychiatric samples ($\alpha = .92$) with adequate 1-week test-retest reliability ($r = .83$) in the original sample (Beck et al., 1988). The BAI has a stronger correlation with measures of anxiety ($r = .48$) than measures of depression ($r = .25$) in the original sample (Beck et al., 1988), although the BAI correlated significantly with measures of both anxiety ($rs = .51-.69$) and depression ($rs = .48-.56$) in a sample of college students (Osman et al., 1997).

2.3. Procedure

2.3.1. Approach to confirmatory factor analysis

Analyses in this study focused on establishing the best fitting factor for the BAI in African-American and European American samples combined and separately. A confirmatory approach was taken by testing several competing factor models using confirmatory factor analysis with a weighted least squares estimator (WLSMV) developed for categorical data within the *Mplus* software package (Muthen & Muthen, 1998). The three published factor models (Beck et al., 1988; Morin et al., 1999; Osman et al., 2002) were tested against each other both in African American and European American samples separately. In these models the intercorrelations among factors were freely estimated (i.e., factors were allowed to correlate with one another). In addition, we also conducted follow-up exploratory factor analyses of the BAI data using *Mplus* with ULS extraction and oblique rotation (promax) to determine if a more optimal factor structure could be identified in these samples. These exploratory models tested solutions ranging from one factor up to six factors. Confirmatory factor analysis of the best fitting EFA model was then conducted to provide estimates of global model fit by which all CFA models could be compared and evaluated. Global fit was measured by the chi-square goodness-of-fit test, the comparative fit index (CFI; Bentler, 1990), the root mean square error of approximation (RMSEA), and the incremental fit index (IFI; Bollen, 1989). Acceptable fit values for the global fit indices are close to 1.0 (Hoyle & Smith, 1994; Hu & Bentler, 1999) with acceptable RMSEA cutoff values being close to .06 (Hu & Bentler, 1999).

3. Results

3.1. Demographic comparisons

African American and European American participants were compared on demographic variables and the BAI measure. Results of the demographic comparisons indicated that African American and European American participants significantly differed with respect to age and income with African Americans reporting lower income ($\chi^2 = 25.21, p < .001$) and being older than the European Americans in the current sample ($t = -4.03, p < .001$). The two

groups did not significantly differ on living arrangements ($t = 3.35$) and gender ($\chi^2 = .106$). European Americans also reported significantly more anxiety than their African American counterparts ($t = 2.27$, $p < .05$). Partial correlations were conducted with each indicator along with participant age and income while controlling for ethnicity. Age and income were not significantly correlated with the BAI after controlling for ethnicity ($r = -.112$); accordingly age and income were not included in subsequent analyses.

3.2. Factor analytic model results

The three previously published factor models were tested using confirmatory factor analysis in the African American (AA) and European American (EA) samples separately. Tables 1 and 2 present both the originally published factor analysis results (Beck et al., 1988), along with the result from the current data from our sample ("Current"). In the AA sample (Table 1), each of the models provided acceptable fit. Global fit indices (χ^2 , χ^2/df , RMSEA, TLI, CFI) indicated that the six-factor model of Morin et al. (1999) provided the best fit to the data in that both TLI and CFI were greater than 0.9, RMSEA was less than 0.1, and the χ^2/df ratio was less than 2. The two- and four-factor solutions published by Beck et al. (1988) and Osman et al. (2002), respectively, provided acceptable fit to the data, but did not fit the data as well as the six-factor Morin et al. (1999) model. Within the Morin et al. model, all factor loadings were positive, statistically significant ($p < .05$) and were greater than 0.3. However, within the Morin model convergence problems were noted, and the standardized factor loading for BAI item 13 was greater than 1.0. Further analysis of the correlation matrix indicated that two items from the "motor tension" factor, BAI items 12 ("Hands trembling") and 13 ("Shaky"), were very highly correlated ($r > 0.77$) suggesting that these contributed to the convergence problems. The factor loadings in the two- and four-factor models were also positive and significant. As expected, all factor intercorrelations were

statistically significant, positive, and of similar magnitude to those reported in prior factor analytic studies of the BAI (ranging from .26 to .56). In the six-factor model two-factor intercorrelations were not statistically significant and of smaller magnitude ($r = .11$, .19).

A similar pattern emerged across models in the EA sample (Table 2) in that the global fit indices were strongest for the Morin et al. six-factor model compared to the Osman et al. four-factor and Beck et al. two-factor model. However, in general, each of these models yielded poorer fit in the EA sample than in the AA sample. Even the best of the previously published factor models yielded only acceptable, but not excellent fit (Morin six-factor: χ^2/df ratio > 2 , TLI = .93, CFI .92, RMSEA 0.9). Moreover, the two-factor model did not achieve acceptable fit in this sample (χ^2/df ratio > 2 , TLI = .86, CFI .88, RMSEA 0.12) and the four-factor model demonstrated only marginally acceptable fit (χ^2/df ratio > 2 , TLI = .91, CFI .89, RMSEA 0.105). Similar to the AA results, all factor intercorrelations were statistically significant, positive, and of similar magnitude to those reported in prior factor analytic studies of the BAI (ranging from .16 to .41). One factor intercorrelation in the six-factor model was not statistically significant.

3.3. Model revisions via exploratory factor analysis and confirmatory factor analysis

Because the previously published models did not achieve excellent fit in the current analyses, particularly in the EA sample, we used an empirically driven approach similar to that of Osman et al. (2002) to determine if there was a better fitting factor model for these two samples. Using Mplus we conducted an exploratory factor analysis on the full sample to determine if a more optimal factor solution might exist in these data and followed this with confirmatory factor analyses in each sample to estimate global fit indices as a point of comparison with the previously published factor models described above. Because BAI items 12 ("Hands trembling") and 13 ("Shaky") were very highly correlated

Table 1
Specific item loading comparisons for existing factor models and African Americans from the current sample on the BAI.

| Item | Two-factor model | | Four-factor model | | Six-factor model | | New model |
|-----------------------------|------------------|---------|-------------------|---------|------------------|----------|-----------|
| | Beck | Current | Osman | Current | Morin | Current | |
| 1. Numbness or tingling | .24 s | (.55) s | .42 b | (.60) b | .43 p | (.44) p | .59 s |
| 2. Feeling hot | .65 s | (.46) s | .55 p | (.48) p | .67 h | (.54) h | .50 s |
| 3. Wobbliness in legs | .44 s | (.70) s | .59 b | (.74) b | .65 s | (.72) s | .76 s |
| 4. Unable to relax | .60 c | (.79) c | .67 n | (.83) n | .74 v | (.85) v | .84 c |
| 5. Fear the worst happening | .87 c | (.69) c | .73 n | (.75) n | .49 v | (.74) v | .73 c |
| 6. Dizzy or lightheaded | .62 s | (.74) s | .56 b | (.77) b | .65 s | (.76) s | .78 s |
| 7. Heart pounding or racing | .42 s | (.78) s | .63 a | (.79) a | .40 s | (.80) s | .85 s |
| 8. Unsteady | .65 s | (.72) s | .66 b | (.75) b | .75 s | (.74) s | .79 c |
| 9. Terrified | .68 c | (.65) c | .63 n | (.71) n | .55 p | (.55) p | .73 c |
| 10. Nervous | .61 c | (.76) c | .61 n | (.80) n | .64 v | (.80) v | .79 c |
| 11. Feelings of choking | .32 c | (.46) c | .51 a | (.47) a | .63 p | (.40) p | .48 s |
| 12. Hands trembling | .71 s | (.94) s | .74 b | (.94) b | .77 m | (.93) m | – |
| 13. Shaky | .82 s | (.94) s | .79 b | (.95) b | .72 m | (1.04) m | – |
| 14. Fear of loss of control | .75 c | (.77) c | .67 n | (.83) n | .46 f | (.82) f | .80 c |
| 15. Difficulty breathing | .41 c | (.82) c | .65 a | (.82) a | .35 s | (.82) s | .86 s |
| 16. Fear of dying | .41 c | (.30) c | .45 a | (.29) a | .74 f | (.34) f | .32 c |
| 17. Scared | .76 s | (.62) s | .70 n | (.69) n | .66 f | (.71) f | .70 c |
| 18. Indigestion | .29 c | (.71) c | .41 p | (.73) p | – | – | .72 s |
| 19. Faint | .67 s | (.83) s | .51 b | (.85) b | .56 p | (.70) p | .87 s |
| 20. Face flushed | .67 s | (.62) s | .65 p | (.64) p | .61 h | (.72) h | .66 s |
| 21. Sweating | .68 s | (.52) s | .64 p | (.55) p | .77 h | (.61) h | .56 s |
| $\chi^2 =$ | | 89 | | 77 | | 48 | 44 |
| $\chi^2/df =$ | | 89/31 | | 77/31 | | 48/31 | 44/31 |
| RMSEA = | | .138 | | .122 | | .074 | .064 |
| TLI = | | .91 | | .94 | | .98 | .98 |
| CFI = | | .90 | | .92 | | .97 | .97 |

Note: BAI, Beck Anxiety Inventory. Item loadings and factor classifications for current study are listed second. Factors are classified by: s, somatic; c, cognitive; n, neurophysiological; b, subjective; p, panic; a, autonomic; f, fear; h, autonomic hyperactivity; v, nervousness; m, motor tension.

Table 2

Specific item loading comparisons for existing factor models and European Americans from the current sample on the BAI.

| Item | Two-factor model | | Four-factor model | | Six-factor model | | New model |
|-----------------------------|------------------|---------|-------------------|---------|------------------|---------|-----------|
| | Beck | Current | Osman | Current | Morin | Current | |
| 1. Numbness or tingling | .24 s | (.58) s | .42 b | (.63) b | .43 p | (.53) p | .68 s |
| 2. Feeling hot | .65 s | (.41) s | .55 p | (.51) p | .67 h | (.55) h | .48 s |
| 3. Wobbliness in legs | .44 s | (.58) s | .59 b | (.62) b | .65 s | (.61) s | .62 s |
| 4. Unable to relax | .60 c | (.60) c | .67 n | (.63) n | .74 v | (.66) v | .59 c |
| 5. Fear the worst happening | .87 c | (.77) c | .73 n | (.79) n | .49 v | (.83) v | .78 c |
| 6. Dizzy or lightheaded | .62 s | (.61) s | .56 b | (.66) b | .65 s | (.63) s | .68 s |
| 7. Heart pounding or racing | .42 s | (.75) s | .63 a | (.79) a | .40 s | (.79) s | .81 s |
| 8. Unsteady | .65 s | (.80) s | .66 b | (.85) b | .75 s | (.82) s | .80 c |
| 9. Terrified | .68 c | (.92) c | .63 n | (.95) n | .55 p | (.81) p | .93 c |
| 10. Nervous | .61 c | (.75) c | .61 n | (.77) n | .64 v | (.80) v | .76 c |
| 11. Feelings of choking | .32 c | (.41) c | .51 a | (.44) a | .63 p | (.39) p | .52 s |
| 12. Hands trembling | .71 s | (.78) s | .74 b | (.80) b | .77 m | (.88) m | – |
| 13. Shaky | .82 s | (.80) s | .79 b | (.84) b | .72 m | (.95) m | – |
| 14. Fear of loss of control | .75 c | (.61) c | .67 n | (.64) n | .46 f | (.75) f | .67 c |
| 15. Difficulty breathing | .41 c | (.62) c | .65 a | (.65) a | .35 s | (.64) s | .73 s |
| 16. Fear of dying | .41 c | (.45) c | .45 a | (.45) a | .74 f | (.57) f | .47 c |
| 17. Scared | .76 s | (.70) s | .70 n | (.74) n | .66 f | (.86) f | .74 c |
| 18. Indigestion | .29 c | (.55) c | .41 p | (.64) p | – | – | .61 s |
| 19. Faint | .67 s | (.30) s | .51 b | (.33) b | .56 p | (.25) p | .34 s |
| 20. Face flushed | .67 s | (.47) s | .65 p | (.58) p | .61 h | (.65) h | .44 s |
| 21. Sweating | .68 s | (.39) s | .64 p | (.48) p | .77 h | (.53) h | .43 s |
| χ^2 = | | 107 | | 89 | | 77 | 69 |
| χ^2/df = | | 107/38 | | 89/38 | | 77/37 | 69/36 |
| RMSEA= | | .122 | | .105 | | .094 | .087 |
| TLI= | | .86 | | .91 | | .93 | .93 |
| CFI= | | .88 | | .89 | | .92 | .92 |

Note: BAI, Beck Anxiety Inventory. Item loadings and factor classifications for current study are listed second. Factors are classified by: s, somatic; c, cognitive; n, neurophysiological; b, subjective; p, panic; a, autonomic; f, fear; h, autonomic hyperactivity; v, nervousness; m, motor tension.

($r > 0.77$) and led to convergence problems in previous models, we excluded these items from the EFA and revised factor model that resulted from it.

Based upon the eigenvalues (7.612 for Factor 1; 2.311 for Factor 2; 1.3 and smaller for remaining factors) and the pattern of factor loadings, a two-factor solution as a viable alternative to the previously published factor solution for the full sample. After using promax (oblique) rotation, each of the remaining 19 BAI items loaded distinctly on one of the two factors. This factor solution is presented in the last column of Tables 1 and 2. Confirmatory factor analyses of this new model in each sample separately demonstrated that this factor solution to the BAI items (minus motor tension items) provides the best fit to the data particularly in the African American sample (although this was the best fitting model among the EA group as well). Although some fit indices are higher than commonly accepted cutoff points for global fit indices (e.g., RMSEA $> .06$), these models provided the best fit to the data relative to other models. In addition, recent research on global fit indices suggests that standard cutoffs for RMSEA may be too conservative in small samples (Chen, Curran, Bollen, Kirby, & Paxton, 2008).

4. Discussion

To date, the current study is the first to examine the factor structure of the BAI in a sample of African American young adults as compared to European American young adults. The primary aim of the current study was to examine the existing factor structure of the BAI (two factors) via CFA in order to determine if the original factor structure holds in a diverse sample of African American and European American young adults. Further, we investigated whether other published factor structures of the BAI (Morin et al., 1999; Osman et al., 2002) would hold in a non-clinical sample of African American and European American young adults. Finally, we examined the best fitting factor structure of the BAI in

the current sample of African American and European American young adults.

Results of the initial CFA of the original two-factor structure yielded by Beck and colleagues indicated that the original model did not fit the current data well in either the African American or the European American samples. Moreover, two items in the original model that loaded on the somatic factor (i.e., unsteady, scared) loaded on the cognitive factor in the current sample. Second, three items in the original factor structure that loaded on a cognitive factor (i.e., feelings of choking, difficulty breathing, indigestion or discomfort in abdomen) loaded on the somatic factor. As previously noted, items 12 and 13 were omitted due to convergence problems in the current sample. The potential multicollinearity between these two items suggests that the individuals in the current sample may have viewed these symptoms as measuring the same phenomenon. These results support the rationale of further examination of factor structures of the BAI, particularly for African American samples.

The CFAs of the alternative BAI models (four- and six-factor models) indicated that these models yielded better fit than the Beck model, but did not achieve excellent fit in the current African American and European American samples. Again, these results provided the basis for EFAs to determine the best fitting model of the current data. In regard to the existing BAI models, the Morin et al. (1999) six-factor model provided the best overall fit for both the African American and the European American samples, but even this model did not achieve excellent fit. As such, an alternative empirically derived model indicated that a two-factor solution provided somewhat better fit in both samples, particularly in the African American sample. Interestingly the resulting two-factor model was disparate from the original Beck two-factor model in that several items (i.e., five) loaded on a different factor. Although this model provided the best fit in these samples, it should be noted that the fit was not dramatically better than the Morin model. Both of these models warrant further examination in future cross-validation studies.

These findings have a number of implications worth noting. First, there were more items from the BAI that loaded on the somatic factor (i.e., 11 items) versus the cognitive factor (8 items). This suggests that in the current sample of African American and European American young adults that anxiety may be reported and manifested more through somatic symptoms than cognitive complaints. These results are consistent with the African American literature in that African Americans have been shown to report anxiety through somatic complaints (Heurtin-Roberts et al., 1997; Horwath et al., 1994; Kirmayer, 2001; Neal & Turner, 1991) than through cognitive symptoms (i.e., uncontrollability and unpredictability). These results, however, are not strikingly consistent with previous work in that European Americans in the current sample endorsed more somatic symptoms than cognitive symptoms. There could be a number of explanations for these findings. First, the African American and European American young adults in the current sample may have more accurately reported their anxiety symptoms than previous samples indicated by the factor loadings from the current sample and the consistency with the semantics for each item. For example, feelings of choking, difficulty breathing, and indigestion are ostensibly physiological phenomena although these items loaded on the cognitive factor in the original Beck study. Presumably, one could argue that the factor structure from the current investigation more accurately portrays the cognitive and somatic aspects of the BAI. Second, the current results further suggest that item 12 (hands trembling) and 13 (shaky) should be potentially collapsed into a single item. These results are consistent with the Morin et al. (1999) findings in that item 13 yielded a factor loading greater than one. As such, items 12 and 13 seem to measure the same phenomena albeit in different bodily locations (i.e., general shakiness versus hands trembling).

Furthermore, the current results further suggest that the BAI may be a useful screening tool in African American young adults although several items may need to be modified to reflect the reported anxiety manifestation in African American samples. The reported physiological symptoms of anxiety in this sample are important to note given that the conceptualization of anxiety symptoms traditionally involves both somatic and cognitive components. The assessment of the physiological aspects of anxiety disorders in African American samples may further elucidate the phenomenology of anxiety disorders in this population which may have significant implications for culturally sensitive therapies (Nagayama-Hall, 2001).

There is a number of limitations in the current study worth noting. First, the two-factor solution from the EFA may be relatively sample specific in that both the derivation of the factor model and the confirmatory model fitting (via CFA) occurred on the same sample. In order to make firm conclusions about the best fitting factor solution, cross-validation using new samples will be necessary. Second, although the current sample was adequate for model estimation utilized in the current study, a larger sample would enhance generalizability of the results. Third, the sample was comprised of college students. This not only suggests the potential for a similar “culture” in both samples due to shared experiences as students, but also African American and European Americans from a community sample may yield different results.

References

Beck, A. T., & Steer, R. A. (1990). *Manual for the Beck Anxiety Inventory*. San Antonio, TX: Psychological Corporation.

- Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: psychometric properties. *Journal of Consulting and Clinical Psychology*, 56(6), 893–897.
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Quantitative Methods in Psychology Bulletin*, 107(2), 238–246.
- Bollen, K. A. (1989). A new incremental fit index for general structural equation models. *Sociological Methods and Research*, 17, 303–316.
- Chapman, L. K., Kertz, S. J., Zurlage, M. M., & Woodruff-Borden, J. (2008). A confirmatory factor analysis of specific phobia domains in African American and Caucasian American young adults. *Journal of Anxiety Disorders*, 22(5), 763–771.
- Chapman, L. K., & Steger, M. F. (2008). Race and religion: Differential prediction of anxiety symptoms by religious coping in African American and European American young adults. *Depression and Anxiety*, 0, 1–7.
- Chen, F., Curran, P. J., Bollen, K. A., Kirby, J., & Paxton, P. (2008). An empirical evaluation of the use of fixed cutoff points in RMSEA test statistic in structural equation modeling. *Sociological Methods and Research*, 36, 462–494.
- Contreras, S., Fernandez, S., Malcarne, V. L., Ingram, R. E., & Vaccarino, V. R. (2004). Reliability and validity of the Beck depression and anxiety inventories in Caucasian Americans and Latinos. *Hispanic Journal of Behavioral Sciences*, 26(4), 446–462.
- Cooley, M. R., & Boyce, C. A. (2004). An introduction to assessing anxiety in child and adolescent multiethnic populations: challenges and opportunities for enhancing knowledge and practice. *Journal of Clinical Child and Adolescent Psychology*, 33(2), 210–215.
- Creamer, M., Foran, J., & Bell, R. (1995). The Beck Anxiety Inventory in a non-clinical sample. *Behaviour Research and Therapy*, 33(4), 477–485.
- Heurtin-Roberts, S., Snowden, L., & Miller, L. (1997). Expressions of anxiety in African Americans: ethnography and the epidemiological catchment area studies. *Culture, Medicine, and Psychiatry*, 21, 337–363.
- Hewitt, P. L., & Norton, G. R. (1993). The Beck Anxiety Inventory: a psychometric analysis. *Psychological Assessment*, 5(4), 408–412.
- Horwath, E., Johnson, J., & Hornig, C. D. (1994). Epidemiology of panic disorder in African-Americans. *The American Journal of Psychiatry*, 150(3), 465–469.
- Hoge, E. A., Tamrkar, S. M., Christian, K. M., Mahara, N., Nepal, M. K., Pollack, M. H., et al. (2006). Cross-cultural differences in somatic presentation in patients with generalized anxiety disorder. *The Journal of Nervous and Mental Disease*, 194(12), 962–966.
- Hoyle, R. H., & Smith, G. T. (1994). Formulating clinical research hypotheses as structural equation models: a conceptual overview. *Journal of Consulting and Clinical Psychology*, 62(3), 429–440.
- Hu, L., & Bentler, P. M. (1999). Cut off criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(1), 1–55.
- Kirmayer, L. J. (2001). Cultural variations in the clinical presentation of depression and anxiety: implications for diagnosis and treatment. *Journal of Clinical Psychiatry*, 62(suppl 13), 22–28.
- Kumar, G., Steer, R. A., & Beck, A. T. (1993). Factor structure of the Beck Anxiety Inventory with adolescent psychiatric inpatients. *Anxiety, Stress, and Coping*, 6, 125–131.
- Last, C. G., & Perrin, S. (1993). Anxiety disorders in African-American and White children. *Journal of Abnormal Child Psychology*, 21(2), 153–164.
- Lewis-Hall, F. C. (1994). Use of the DSM in the diagnosis of panic disorder and obsessive-compulsive disorder. In: S. Friedman (Ed.), *Anxiety disorders in African Americans* (pp. 102–116). New York: Springer.
- Morin, C. M., Landreville, P., Colechi, C., McDonald, K., Stone, J., & Ling, W. (1999). The Beck Anxiety Inventory: psychometric properties with older adults. *Journal of Clinical Geropsychology*, 5(1), 19–29.
- Neal, A. M., & Brown, J. W. (1994). Fears and anxiety disorders in African American children. In: S. Friedman (Ed.), *Anxiety disorders in African Americans*. New York: Springer. pp. 65–75.
- Neal, A. M., & Turner, S. M. (1991). Anxiety disorders research with African Americans: current status. *Psychological Bulletin*, 109(3), 400–410.
- Muthen, L. K., & Muthen, B. O. (1998). *Mplus user's guide*. Los Angeles, CA: Muthen & Muthen.
- Nagayama Hall, G. C. (2001). Psychotherapy research with ethnic minorities: empirical, ethical, and conceptual issues. *Journal of Consulting and Clinical Psychology*, 69(3), 502–510.
- Osman, A., Hoffman, J., Barrios, F. X., Kopper, B. A., Breitenstein, J. L., & Hahn, S. K. (2002). Factor structure, reliability, and validity of the Beck Anxiety Inventory in adolescent psychiatric inpatients. *Journal of Clinical Psychology*, 58(4), 443–456.
- Osman, A., Kopper, B. A., Barrios, F. X., Osman, J. R., & Wade, T. (1997). The Beck Anxiety Inventory: reexamination of factor structure and psychometric properties. *Journal of Clinical Psychology*, 53(1), 7–14.
- Pillay, A. L., Edwards, S. D., & Dhlomo, R. M. (2001). Anxiety among university students in South Africa. *Psychological Reports*, 88(3), 1182–1186.
- Smith, L. C., Friedman, S., & Nevid, J. (1999). Clinical and sociocultural differences in African American and European American patients with panic disorder and agoraphobia. *The Journal of Nervous and Mental Disease*, 187(9), 549–560.
- Steer, R. A., Rissmiller, D. J., & Ranieri, W. F. (1993). Structure of the computer-assisted Beck Anxiety Inventory with psychiatric inpatients. *Journal of Personality Assessment*, 60(3), 532–542.