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Validity of the multidimensional fatigue symptom inventory-short form in an African-American community-based sample

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Objectives. This study examined the psychometric properties of the Multidimensional Fatigue Symptom Inventory-Short Form (MFSI-SF) in a community-based sample of African-Americans.
Design. A sample of 340 African-Americans (116 men, 224 women) ranging in age from 18–81 years were recruited from the community (e.g., churches, health fairs, and beauty salons). Participants completed a brief demographic survey, the MFSI-SF and the Positive and Negative Affect Schedule.
Results. The structural validity of the MFSI-SF for a community-based sample of African-Americans was not supported. The five dimensions of fatigue (General, Emotional, Physical, Mental, Vigor) found for Whites in prior research were not found for African-Americans in this study. Instead, fatigue, while multidimensional for African-Americans, was best represented by a unique four-four profile in which general and emotional fatigue are collapsed into a single dimension and physical fatigue, mental fatigue, and vigor are relatively distinct. Hence, in the absence of modifications, the MFSI-SF cannot be considered to be structurally invariant across ethnic groups. A modified four-factor version of the MFSI-SF exhibited excellent internal consistency reliability and evidence supports its convergent validity. Using the modified four-factor version, gender, and age were not meaningfully associated with MFSI-SF scores.
Conclusion. Future research should further examine whether modifications to the MFSI-SF would, as the findings suggest, improve its validity as a measure of multidimensional fatigue in African-Americans.

Keywords: fatigue; African-American; reliability; validity; community sample; factor analysis; multidimensional fatigue symptom inventory

Introduction

Fatigue is a subjective universal complaint that may be experienced by individuals who are healthy, who have a chronic or acute illness, or who are undergoing certain medical treatments. Fatigue has proven to be a difficult phenomenon to conceptualize and define, as it is complex and non-specific, can be multicausal, and can affect multiple dimensions of functioning (Tiesinga, Dassen, and Halfens 1996; Fu et al. 2001; Dittner, Wessely, and Brown 2004; Shen, Barbera, and Shapiro 2006; Jason et al. 2010). In healthy individuals,

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fatigue has been described as a normative physiological regulatory response to physical or psychological stress or exertion and the associated decrease in resources necessary to perform activity (Aaronson et al. 1999; Shen, Barbera, and Shapiro 2006; Jason et al. 2010). In this context, fatigue is an *acute* phenomenon that helps maintain a balance between activity and rest and tends to subside after a period of adequate sleep and restoration of resources (Glaus 1993; Pawlikowska et al. 1994; Aaronson et al. 1999; Shen, Barbera, and Shapiro 2006; Jason et al. 2010).

In contrast, fatigue experienced due to illness (physical or mental) or medical treatment is distinguishable from normal experiences of tiredness and sleepiness by its severity and persistence. In this context, fatigue presents as a *chronic* and *extreme* sense of tiredness or exhaustion that is distressing and debilitating, interferes with the capacity to engage in daily activities, and is not relieved by rest (Glaus 1993; Tiesinga, Dassen, and Halfens 1996; Fu et al. 2001; Dittner, Wessely, and Brown 2004; Jason et al. 2010). Chronic fatigue is prevalent among individuals with major depressive disorder, chronic illnesses (e.g., rheumatoid arthritis, multiple sclerosis, systemic lupus), and cancer (e.g., Tiesinga, Dassen, and Halfens 1996; Wagner and Cella 2004; Neill, Belan, and Ried 2006; Hofman et al. 2007; Bol et al. 2009; National Comprehensive Cancer Network 2013). Furthermore, in cases in which no underlying medical or psychiatric cause can be identified, the experience of chronic fatigue (at least six months) that is accompanied by cognitive, musculoskeletal, and sleep symptoms and results in significant functional impairment is classified as Chronic Fatigue Syndrome (Afari and Buchwald 2003; Christley, Duffy, and Martin 2012). Difficulties in defining and conceptualizing fatigue have contributed to the challenge of operationalizing and measuring fatigue. A review by Dittner, Wessely, and Brown (2004) indicates that there are approximately 30 different published measures of fatigue. Broadly, these measures conceptualize fatigue as unidimensional or multidimensional. Unidimensional measures often have the advantage of brevity and ease of administration, but they are limited in their ability to capture the full range of fatigue-related symptoms experienced by individuals, particularly those with a chronic illness or who are undergoing medical treatment (Whitehead 2009). In contrast, multidimensional measures of fatigue assess the wide range of domains in which fatigue may manifest, including physical, affective, cognitive, and functional symptoms (Stein et al. 1998, 2004; Whitehead 2009).

The debate on whether fatigue is more appropriately conceptualized as a unidimensional or multidimensional phenomenon is especially relevant to discussions of racial/ethnic variations in fatigue. A recent systematic review evaluating data from 33 studies conducted from 1992 to 2007 indicates that some racial/ethnic minorities, including African-Americans, report higher prevalence of chronic fatigue and Chronic Fatigue Syndrome, as well as greater symptom severity, relative to White individuals (Dinos et al. 2009). A limitation of this literature is that most population-based studies have assessed fatigue as a unidimensional construct (e.g., Jason et al. 1999, 2000; Resnick et al. 2006; Steele et al. 1998; Song, Jason, and Taylor 1999), thus limiting our understanding of the potentially complex and multi-faceted experience of fatigue among racial/ethnic minorities, including African-Americans. In fact, there is some debate on whether unidimensional measures primarily assess global/general (e.g., Banthia et al. 2006; Sobel et al. 2013) or physical aspects of fatigue (e.g., Minton and Stone 2009). Multidimensional assessment of fatigue can help clarify some of the ambiguity associated with unidimensional assessment. However, multidimensional fatigue in community-based

African-Americans remains poorly understood due to scarce research (Bardwell et al. 2006). A second limitation of this literature is highlighted by Dinos et al.'s caution that studies in the systematic review 'did not provide evidence on the cross-cultural validity of the instruments used, which could have impacted on the prevalence rates reported' (2009, 1568). Researchers have cautioned against the assumption of racial/ethnic or cultural homogeneity in measurement; however, the practice of using measures validated and normed with racial/ethnic majorities to the study of racial/ethnic minorities, without evaluating psychometric properties, remains quite common (Ramirez et al. 2005). Evaluating the cross-racial/ethnic equivalence of standard measures of fatigue is essential to ensuring estimates of prevalence and descriptions of severity are unbiased and accurate. However, none of the multidimensional measures of fatigue reviewed by Dittner, Wessely, and Brown (2004) have been validated in a community-based sample of African-Americans and only one measure specific to cancer-related fatigue, the Piper Fatigue Scale 12-item short form, has been validated in a sample of African-American cancer patients (Reeve et al. 2012). Consequently, examining and establishing the validity of a multidimensional measure of fatigue in a community-based sample of African-Americans is an essential precursor to future research in this area.

A commonly used multidimensional measure of fatigue is the Multidimensional Fatigue Symptom Inventory-Short Form (MFSI-SF), which assesses the following dimensions: general fatigue, physical fatigue, emotional fatigue, mental fatigue, and vigor (Stein et al. 1998, 2004). The MFSI-SF offers several advantages to other multidimensional measures of fatigue. First, the MFSI-SF has strong psychometric properties, including reliability, validity (concurrent, convergent, and divergent), and evaluation and support of the five-factor structure (Stein et al. 1998, 2004). In addition, compared to other lengthy multidimensional measures of fatigue that may be burdensome for already fatigued individuals to complete, the MFSI-SF offers the advantage of being both comprehensive and relatively short (30 items). Also, the MFSI-SF offers optimal clinical and research utility because, unlike other measure of fatigue, it can be used with both healthy and ill individuals as it is not disease-specific and it does not assume the presence of fatigue.

Despite these advantages, the MFSI-SF currently has limited utility when it comes to research with African-Americans, because its psychometric properties have only been evaluated with predominantly White samples (Stein et al. 1998, 2004). Therefore, it is unclear whether the MFSI-SF is a valid and reliable measure of fatigue for African-Americans. Additionally, it is necessary to gather normative descriptive data on fatigue in a community-based sample of African-Americans, as measured by the MFSI-SF. These data will be crucial for future comparative research. Further, it is important to examine how fatigue varies across demographic characteristics. Research suggests that age, gender, and socioeconomic status (SES) have significant associations with fatigue in community-based samples. However, the data on the directions of these associations are mixed and inconclusive, because findings vary depending on where the study was conducted (Europe vs. North America), sample characteristics, and the use of unidimensional versus multidimensional measures of fatigue (e.g., Pawlikowska et al. 1994; Song, Jason, and Taylor 1999; Watt et al. 2000; Schwarz, Krauss, and Hinz 2003; Bardwell et al. 2006; Resnick et al. 2006). To our knowledge, only one study has assessed the associations among age, gender, and fatigue in a community-based sample of African-Americans, using a unidimensional measure (Song et al. 2002). The study found that

African-American women reported greater fatigue than men, and that older men reported greater fatigue than younger men, but reported rates of fatigue did not differ for older and younger women (Song et al. 2002). Additionally, only one study has assessed the associations among SES, race/ethnicity, and fatigue using both a unidimensional measure of fatigue and the MFSI-SF. The study found that while there were no differences in unidimensional fatigue or the MFSI-SF general fatigue subscale as a function of social class among Whites, middle-to-high SES African-Americans reported significantly more fatigue than their White counterparts and than low SES African-Americans (Bardwell et al. 2006). No racial/ethnic or SES differences were noted for the other MFSI-SF subscales (Bardwell et al. 2006). Overall, additional research is needed to better understand demographic variations in the fatigue experience of African-American community members.

The present study aims to use data collected from an African-American community-based sample to: (1) examine the psychometric properties of the MFSI-SF, including internal consistency and convergent and structural validity; (2) provide descriptive statistics; and (3) examine the associations of age and gender to dimensions of fatigue (Sadler et al. 2005).

Methods

Sample

Participants were 340 adult community members (116 men, 224 women) from the greater San Diego area who self-identified as African-American. Ages ranged from 18 to 81 years (M = 41.88 years, SD = 13.98).

Measures

Demographics

All participants completed a brief demographic survey that collected data on age and gender. The study did not collect data on SES in order to increase study participation rates in this community-based sample.

Fatigue

Fatigue was assessed by the 30-item, empirically-derived MFSI-SF (Stein et al. 1998, 2004). Respondents rate, on a five-point scale ranging from 0 (Not at all) to 4 (Extremely), the extent to which they have felt a particular way (e.g., 'I feel run down') during the past seven days. Items are summed to obtain subscale scores (ranging from 0 to 24) for five dimensions (each assessed via six items): General Fatigue, Physical Fatigue, Emotional Fatigue, Mental Fatigue, and Vigor. Higher scores indicate more of that particular dimension. Additionally, a Total Fatigue score can be computed by summing General, Physical, Mental, and Emotional Fatigue, and then subtracting Vigor; higher scores indicate more overall fatigue. The psychometric properties of the MFSI-SF are well established for White Americans: each subscale has high internal consistency reliability (ranging from .87 to .96), adequate six to eight week test-retest reliability (r = .51 to .70), and the well-established concurrent, divergent, and convergent validities (Stein et al. 1998, 2004).

Positive and negative affect

The Positive and Negative Affect Schedule (PANAS; Watson, Clark, and Tellegen 1988) is a brief measure including 20 single-word items, 10 of which reflect positive affect and 10 of which represent negative affect. A five-point scale, ranging from 'very slightly or not at all' to 'extremely,' is used to rate the extent to which each particular emotion was experienced within the past week. Higher scores are indicative of greater positive and negative affect, respectively. The PANAS has strong psychometric properties (Watson, Clark, and Tellegen 1988; Crawford and Henry 2004). In this sample, internal consistency reliabilities for Positive Affect (α = .88) and for Negative Affect (α = .88) were very good.

Procedures

Data were collected as part of a larger community-based study on self-reported physical and mental health parameters in African-Americans. This study was approved by the University of California, San Diego Institutional Review Board. Data collection sites included beauty salons (56.2%), churches (22.9%), health fairs (16.2%), and other civic events/personal contacts (4.7%). Flyers were distributed and/or announcements were made about the opportunity to participate in a study of whether psychosocial instruments widely used in research were valid when used with African-Americans. In all settings, trained research assistants were present and invited individuals to participate in the study. If a person expressed interest in the study, the research assistant proceeded with the informed consent process. All data were de-identified. As an incentive, study participants were given a certificate for $5 ('scrip') that could be cashed at any bank.

Data analyses

To test structural validity, EQS 6.1 software was used to perform a confirmatory factor analysis (CFA) of the MFSI-SF. In CFA, a variance-covariance matrix is estimated from the raw data. The model tested included the 30 items from the MFSI-SF and factor loadings were constrained so that each item could only load on its associated factor (i.e., subscale). The model tested permitted factors to correlated, with factor correlations estimated rather than constrained, because the fatigue subscales are correlated both empirically and statistically. Use of the Chi-square likelihood ratio to assess model fit has been deemed unsatisfactory for numerous reasons (Tanaka 1993). Due to these limitations, many researchers (e.g., Tanaka 1993; Hoyle and Duvall 2004) suggest using multiple measures of model fit. In this study, the following measures were used: (1) the Comparative Fit Index (CFI; Hu and Bentler 1999), with values greater than .95 indicating adequate model fit and (2) the Root Mean Square of Approximation (RMSEA; Hu and Bentler 1999), with values less than .06 indicating adequate model fit. A model was deemed to fit well if both criteria were met, and to fit moderately well if one criterion was met.

SPSS version 16 was used to compute descriptive statistics, one-way between-subjects ANOVAs, and correlational analyses. The internal consistency reliabilities of all measures were assessed by computing Cronbach's alpha coefficients. The convergent validity of the MFSI-SF was evaluated by examining the correlations of fatigue dimensions to positive and negative affect. Fatigue includes both a physical and an

affective component (Stein et al. 1998, 2004). The affective component is evident in the large correlations of fatigue to depression, both in patient and healthy populations (e.g., Kroencke, Lynch, and Denney 2000; Lavidor, Weller, and Babkoff 2002; Lesley 2006; Mancuso et al. 2006). In the MFSI-SF, the affective component is most explicitly evident in the Mental and Emotional Fatigue subscales; however, it is represented in all dimensions (Stein et al. 1998, 2004). It was expected that General, Physical, Mental, and Emotional Fatigue would be associated with increased Negative and decreased Positive Affect; conversely, Vigor would be associated with increased Positive and decreased Negative Affect.

Results

Validation of the MFSI-SF

Structural validity

The five-factor model of fatigue previously derived using White American samples (Stein et al. 1998, 2004) was tested via CFA. Each factor (General, Physical, Mental, Emotional, Vigor) was indicated by six observed variables (i.e., items from the MFSI-SF). Moreover, inter-factor correlations were specified. Due to evidence of multivariate non-normality (Mardia's coefficient = 369.47, normalized estimate = 77.74), robust statistics were requested. This five-factor model did not fit well statistically, χ^2 (435, N = 340) = 4027.59, $p < .001$. Descriptively, the five-factor model did not fit well based on CFI (.73) or RMSEA (.09).

Due to evidence of poor fit in the CFA model, exploratory factor analysis (EFA) was conducted to examine the dimensionality of the MFSI-SF in this community-based sample of African-Americans. Principal axis factoring was selected as the data extraction method due to evidence of multivariate non-normality (Fabrigar et al. 1999; Tabachnick and Fidell 2001). An oblique rotation method was selected due to inter-correlations among fatigue dimensions (Fabrigar et al. 1999; Tabachnick and Fidell 2001). The variance accounted for by the solution, the variance accounted for by each individual factor, and the interpretability of the factors were all evaluated to determine the initial plausibility of the factor structure. Parallel analysis was used to further confirm the factor structure. Items were considered to have double loadings if they loaded > .30 on more than one factor.

Results are presented in Table 1. The EFA results support the multidimensional nature of fatigue; however, results do not support the five-factor dimensional structure previously found for the MFSI-SF. Instead, a four-factor solution offered the best fit for the data. The first factor incorporated all of the scale items proposed to constitute General Fatigue and most of the scale items proposed for Emotional Fatigue. Four out of the six Emotional Fatigue items had primary loadings on this factor, one ('I feel depressed') had double loadings on this factor and the factor representing Mental Fatigue, and another ('I am distressed') had a primary loading on Mental Fatigue. Post-hoc correlational analysis indicated a large, statistically significant correlation between General Fatigue and Emotional Fatigue [r (338) = .79, $p < .001$], which suggests a high degree of multi-collinearity and supports this pattern of factor loadings. The second factor included primary loadings for four of the six items purported to represent Vigor. These four items had no secondary loadings on any other factor. Two additional items proposed to represent Vigor ('I feel lively' and 'I feel cheerful') loaded on their own on a fifth factor

Table 1. Exploratory factor analysis of the MFSI-SF.

Item	Dimension in MFSI-SF (5-factor structure)	Modification (4-factor structure)	Factor loadings				
			1	2	3	4	5
I feel run down	General	General/Emotional	**.827**				
I feel fatigued	General	General/Emotional	**.821**				
I feel pooped	General	General/Emotional	**.723**				
I am worn out	General	General/Emotional	**.687**				
I feel sluggish	General	General/Emotional	**.670**				
I feel sad	Emotional	General/Emotional	**.647**				
I feel upset	Emotional	General/Emotional	**.613**				
I feel nervous	Emotional	General/Emotional	**.560**				
I feel tired	General	General/Emotional	**.551**				
I feel tense	Emotional	General/Emotional	*.460*			*.324*	
I feel depressed	Emotional	General/Emotional	*.455*			*.461*	
I feel calm	Vigor	Vigor		**.691**			
I feel energetic	Vigor	Vigor		**.691**			
I feel refreshed	Vigor	Vigor		**.618**			
I feel relaxed	Vigor	Vigor		**.387**			
I ache all over	Physical	Physical			**−.708**		
My legs feel weak	Physical	Physical			**−.689**		
My muscles ache	Physical	Physical			**−.652**		
My head feels heavy	Physical	Physical			***−.395***	*.302*	
My arms feel weak	Physical	Physical			**−.352**		
My body feels heavy all over	Physical	Physical	*.339*		*−.319*		
I am forgetful	Mental	Mental				**.662**	
I am unable to concentrate	Mental	Mental				**.658**	
I have trouble paying attention	Mental	Mental				**.579**	
I have trouble remembering things	Mental	Mental				**.549**	
I make more mistakes than usual	Mental	Mental				**.505**	
I am confused	Mental	Mental				**.475**	
I am distressed	Emotional	Mental				**.459**	
I feel lively	Vigor	–					**.854**
I feel cheerful	Vigor	–					**.794**
R^2	Relevant dimension		39.2%	8.65%	3.46%	3.03%	2.08%

Note: Primary loadings are in bold. Double-loadings are italicized. Loadings not included are all < .30.

and had negligible loadings on this second factor. The third factor included all six items representing Physical Fatigue. Four items had clean primary loadings while two items had double loadings (‘My head feels heavy’ had a double loading on the factor representing Mental Fatigue and ‘My body feels heavy all over’ had a double loading on the combined General and Emotional Fatigue factor). The fourth factor included all six items representing Mental Fatigue. All six items had clean primary loadings, while two items corresponding to Physical and two items corresponding to Mental Fatigue had double loadings on this factor.

Internal consistency reliability

Internal consistency reliability analyses were conducted for each of the four dimensions derived in the factor analysis. Alpha coefficients for General/Emotional Fatigue (α = .94), Physical Fatigue (α = .84), and Mental Fatigue (α = .88) all represented strong levels of internal consistency. The alpha coefficient for Vigor (α = .76) was lower, but still within acceptable limits. These findings indicate that, within each subscale, items are strongly associated and are measuring the same construct. In addition, the internal consistency reliability of the measure as a whole was high (Total Fatigue α = .92), which is consistent with the documented conceptual inter-relatedness and statistical inter-correlations among the fatigue dimensions (Stein et al. 1998, 2004).

Convergent validity was evaluated by examining the correlations of the four factors to Positive and Negative Affect (Table 2). It was expected that General/Emotional, Physical, and Mental Fatigue would be associated with increased Negative and decreased Positive Affect; conversely, Vigor would be associated with increased Positive and decreased Negative Affect. Overall, results provided evidence for convergent validity. General/Emotional, Mental, and Physical Fatigue had medium to large significant positive correlations with Negative Affect (*r*s ranged from .38 to .58) and Vigor had a large significant positive correlation with Positive Affect (r = .50). Additionally, General/Emotional, Mental, and Physical Fatigue had small significant negative correlations with Positive Affect, while Vigor had a small significant negative correlation with Negative Affect (*r*s ranged from −.19 to −.25).

Descriptive statistics

The mean fatigue ratings of African-Americans, using the modified, four-factor profile of the MFSI-SF, are presented in Table 3.

Table 2. Bivariate correlations among fatigue dimensions, positive and negative Affect, and social desirability.

Variable	1	2	3	4	5	6
1. Positive Affect	–	−.27*	−.25*	−.25*	−.19*	.50*
2. Negative Affect		–	.58*	.46*	.38*	−.21*
3. General/Emotional Fatigue			–	.80*	.68*	−.23*
4. Mental Fatigue				–	.67*	−.17*
5. Physical Fatigue					–	−.14*
6. Vigor						–

*p < .001.

Table 3. Descriptive data of Fatigue in African-Americans using the modified, four-factor MFSI-SF scores.

Fatigue dimension	Number of items	Possible range of scores	Males *M* (SD)	Females *M* (SD)	Total *M* (SD)
General/Emotional Fatigue	11	0–44	8.96 (9.17)	9.30 (9.82)	9.18 (9.58)
Mental Fatigue	7	0–28	5.15 (5.03)	5.13 (5.37)	5.14 (5.24)
Physical Fatigue	6	0–24	3.28 (3.84)	3.70 (4.76)	3.55 (4.46)
Vigor	4	0–16	7.48 (3.78)	7.38 (3.95)	7.41 (3.88)

Gender, age, and fatigue

One-way between-subjects ANOVAs revealed no differences in total or subscale fatigue ratings as a function of gender (all p-values < .05). Correlational analyses revealed a small and statistically significant positive correlation between age and Physical Fatigue, $r(312) = .16$, $p = .004$. When examined by gender, this positive correlation was found among women only, $r(224) = .20$, $p = .004$.

Discussion

The primary aim of this study was to examine the validity of the MFSI-SF for use with African-Americans. To date, the measure has only been validated with samples of mostly healthy White individuals, and mostly, cancer patients (Stein et al. 1998, 2004). The hypothesized five-dimension factor structure of the MFSI-SF was not confirmed in CFA, so EFA was used to identify underlying structure. Results of the EFA indicate that fatigue is expressed multidimensionally in this sample of healthy African-Americans; however, the factor structure differed from that found for Whites. Most notably, all of the items for General Fatigue and most of the items for Emotional Fatigue loaded on a single factor, suggesting that these two dimensions of fatigue are closely interconnected and may represent an experiential core for African-Americans, that is, the experience of general fatigue may be accompanied by or inextricable from emotional fatigue. A possible explanation for the combination of general and emotional fatigue in this population, which was not observed in studies of multidimensional fatigue in predominantly White individuals (Stein et al. 1998, 2004), involves cultural differences in illness attributions. Past research has noted that the Western conceptualization of illness tends to dichotomize causal factors as either physical or psychological; in contrast, non-dominant cultures tend to integrate a diverse set of causal contributors (e.g., physical, psychological, social, spiritual) to illness (Torres-Harding, Jason, and Taylor 2001; Vaugh, Jacquez, and Baker 2009). Thus, while White members of Western culture may dichotomize general fatigue as physical and emotional fatigue as psychological, African-American individuals may integrate these due to culturally specific illness attributions. A social and psychological factor that may be relevant to culturally specific illness attributions in African-Americans involves experiences with racial discrimination, as research suggests racial/ethnic minorities who report more perceived racial discrimination also report more fatigue (Thomas et al. 2006; Grandner et al. 2012). Perhaps the documented physical and psychological burden of racial discrimination (Pascoe and Smart Richman 2009) contributes to African-Americans' integration of general and emotional aspects of fatigue into an experiential core.

The factor representing Vigor included four of six items proposed by the MFSI-SF. The two items that did not load on the same factor were 'I feel lively' and 'I feel cheerful' and differ from the other four items in that they appear to incorporate positive mood. It is possible that positive mood, as an aspect of vigor, may not be culturally or experientially relevant to African-Americans, or that it is seen as distinct from vigor.

Using a four-factor profile, the modified MFSI-SF exhibits excellent internal consistency reliability both for the four fatigue dimensions and for total fatigue, indicating a high degree of cohesiveness among the items that compose each dimension and among all of the items in the measure. It is relevant to note that the high internal consistency of the measure as a whole is not necessarily indicative of unidimensionality

(Schmitt 1996), but likely due to measure length and the documented conceptual inter-relatedness and statistical inter-correlations among fatigue dimensions (Stein et al. 1998, 2004). Convergent validity for the modified MFSI-SF was examined by correlating fatigue dimensions with positive and negative affect. Theoretically, General/Emotional, Physical, and Mental Fatigue were expected to be associated with more Negative and less Positive Affect, and Vigor with more Positive and less Negative Affect. Findings were consistent with predictions, providing evidence of convergent validity.

The study also examined gender and age as potential correlates of fatigue in African-Americans. This study found no gender differences in fatigue. Although older age was associated with greater Physical Fatigue among women only, this relationship was quite small. Both findings are contrary to those of the Song et al. (2002) prior study of fatigue in a community sample of African-Americans, which found that African-American women reported greater fatigue than men, and that older men reported greater fatigue than younger men. However, since the Song et al. (2002) study used a unidimensional measure of fatigue, it is difficult to make direct comparisons. Alternatively, the sample in the Song et al. (2002) study was much larger, with power to detect even very small differences; the smaller sample size of this study affords less power to detect minor differences in fatigue due to age or gender. Further research with a larger and more representative sample of African-Americans is needed to clarify the association (or lack thereof) of gender, age, and fatigue dimensions.

Future research should evaluate factors that may account for the observed differences in the underlying structure of multidimensional fatigue in Whites and African-Americans. Specifically, cognitive interviews conducted with African-Americans can help enrich our understanding of fatigue in this population by qualitatively assessing potential cultural differences in the conceptualization of fatigue. This formative research may then inform a modification of the MFSI-SF for African-Americans or guide the development of a fatigue measure specific to this population. Furthermore, a more comprehensive understanding of how African-Americans experience fatigue would have implications for the clinical assessment and treatment of fatigue-associated illnesses, such as Chronic Fatigue Syndrome and cancer-related fatigue.

Several limitations of this study should be noted and represent potential avenues for future research. First, although this is a community-based sample of African-American individuals, they were all volunteers and residents of San Diego County; hence, this sample may not be representative of African-Americans in other regions of the United States. Furthermore, the study is limited by the fact that it did not collect data on SES, which past research suggests is an important determinant of racial/ethnic variations in fatigue (Bardwell et al. 2006). It is especially important for future research to expand our understanding of the associations between SES, race/ethnicity, and fatigue, and examine potential mediators and moderators of differences. Finally, as was the case with the original measure development and validation studies (Stein et al. 1998, 2004), this study's sample had an uneven gender distribution. Consequently, mean fatigue ratings may be more representative of the experience of African-American women than men. It is of particular importance for future research in this area to recruit a larger sample of African-American men, which would allow for an examination of cross-gender factorial invariance.

Despite these limitations, this is the first study to evaluate the reliability and validity of the MFSI-SF in a hard-to-reach and under-served community sample of African-Americans. Overall, the findings support the importance of multidimensional

measurement of fatigue. Although the original five-factor structure of the MFSI-SF was not confirmed, a modified four-factor structure exhibited good psychometric properties. The observed differences in the factor structure of the MFSI-SF among African-Americans, compared to previous findings with White Americans, highlight the importance of avoiding assumptions of racial/ethnic or cultural homogeneity in measures and of evaluating cross-racial/ethnic measurement equivalence and factorial invariance (Ramirez et al. 2005). This study raises questions about the validity of the MFSI-SF for African-Americans. Until additional research with a larger and more representative samples is conducted to further evaluate the psychometric properties of the MFSI-SF in African-Americans, this study's findings suggest that the existing measure may be used with some confidence in four (General, Physical, Mental, Vigor) of the five subscales (although the Emotional subscale combined with the General subscale, all General subscale items loaded together). However, researchers should proceed with caution and note that the clear distinction between general and emotional fatigue found in previous studies does not necessarily hold in African-Americans.

Key messages

(1) The study is the first to evaluate the psychometric properties of a multi-dimensional measure of fatigue, the MFSI-SF, among a community-based sample of African-Americans.
(2) The five-factor structure of the MFSI-SF was not supported in this sample of African-Americans. Instead, a four-factor profile (General/Emotional, Physical, Mental, Vigor) appears to better represent the multidimensional experience of fatigue among African-Americans.
(3) A modified, four-factor version of the MFSI-SF demonstrated good reliability and validity.

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