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Assessment of Daily and Weekly Fatigue among African American Cancer Survivors

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Abstract

This investigation evaluates two common measures of cancer-related fatigue, one multidimensional/retrospective and one unidimensional/same-day. Fifty-two African American survivors of diverse cancers completed fatigue visual analogue scales once daily, and the Multidimensional Fatigue Symptom Inventory (MFSI) once weekly, for four weeks. Zero-order correlations showed retrospective fatigue was significantly related to average, peak, and most recent same-day fatigue. Multilevel random coefficient modeling showed unidimensional fatigue shared the most variance with the MFSI's General subscale for three weeks, and with the Vigor subscale for one week. Researchers and clinicians may wish to prioritize multidimensional measures when assessing cancer-related fatigue, if appropriate.

Keywords

fatigue; cancer survivorship; African American; multilevel random coefficient modeling; assessment

Among the numerous side effects of cancer and its treatment, fatigue has been identified in multiple investigations as the most commonly reported symptom (Cella, 1997; Cella, Davis, Breitbart, Curt, 2001; Vogelzang et al., 1997). Cancer-related fatigue often interferes with usual functioning and involves excessive physical, emotional, and/or cognitive weakness and tiredness associated with cancer and its treatment that does not subside with adequate sleep and rest, and is not proportional to exertion (Cella et al., 2001; National Comprehensive Cancer Network, 2012; Taylor, Jason, & Torres, 2000). While percentages vary across studies, it has been consistently demonstrated that a large portion of cancer patients report fatigue at diagnosis, and the majority of individuals being treated with radiation or chemotherapy experience fatigue (Hofman, Ryan, Figueroa-Moseley, Jean-Pierre, & Morrow, 2007; National Comprehensive Cancer Network, 2012; Stasi, Abriani, Beccaglia, Terzoli, & Amadori, 2003; Stone & Minton, 2008). Recently, increased attention has been paid to the role of fatigue post-treatment and into long-term cancer survivorship.

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Conflicts of Interest

The authors declare that they have no conflict of interest.

Reports have indicated that 17 to 53% of long-term cancer survivors report fatigue, depending upon the diagnostic criteria used (National Comprehensive Cancer Network, 2012). Unlike other side effects, such as nausea, mouth sores, and hair loss, fatigue often does not abate over time in the aftermath of treatment (Curran, Beacham, & Andrykowski, 2004; Stone et al., 2000). Rather, prior findings have indicated that fatigue may continue or even increase in severity with time (Bower et al., 2000; Cella et al., 2001; Hofman et al., 2007; Reinersten et al., 2010). Furthermore, research has demonstrated that fatigue is significantly inversely related to quality of life among cancer survivors (Bower et al., 2000; Dittner, Wessely, & Brown, 2004; Fernandes, Stone, Andrews, Morgan, & Sharma, 2006; Portenoy & Itri, 1999; Stone et al., 2000). Specifically, fatigue has been associated with poor physical and mental health outcomes in a variety of domains, including work productivity; body image; sexual enjoyment; future perspective; and physical, role, emotional, and cognitive functioning (Kim et al., 2008; Lavigne, Griggs, Tu, & Lerner, 2008; Schmidt et al., 2012).

While the relationship between cancer survivorship and fatigue has repeatedly been demonstrated in prior research (Bower et al., 2000; Bower et al., 2006; Cella et al., 2001; Fossa, Vassilopoulou-Sellin, & Dahl, 2008; Fu et al., 2009; Jefford et al., 2008; Minton & Stone, 2008), the nuances of cancer-related fatigue among survivors remain poorly understood. This is, in part, due to limitations in how fatigue has been measured. Given its high prevalence and large impact (National Comprehensive Cancer Network, 2012), fatigue is frequently assessed among cancer survivors for diagnostic, treatment, and/or research purposes (Jean-Pierre, Figueroa-Moseley, Kohli, Fiscela, Palesh, & Morrow, 2007); however, no agreement regarding the optimal measurement of fatigue has been reached (Minton & Stone, 2009). Thus, the aim of this investigation was to evaluate the relationship between two commonly used methods for measuring survivor fatigue, as well as to provide descriptive data on cancer-related fatigue as self-reported by a sample of African American survivors of diverse cancers.

Given its nature as a subjective experience, fatigue is almost always evaluated via self-report (Dittner et al., 2004; Jean-Pierre et al., 2007). While this is both logical and appropriate, the often-retrospective nature of these reports may lead to biased estimates (Dittner et al., 2004; Schwarz, 2007; Smith, Leffingwell, & Ptacek, 1999; Stone et al., 1998). Research has demonstrated that retrospective assessment of symptom intensity and duration are often influenced by a *peak-and-end* phenomenon (Schwarz, 2007). In this phenomenon, individuals are most likely to report either their most recent level of fatigue at the time of recall or the strongest level of fatigue experienced during the solicited recall interval. It has further been shown that average ratings of intensity or duration of a symptom such as fatigue can bias retrospective reporting as well (Hedges, Jandorf, & Stone, 1985).

At present, the comparability of retrospective and concurrent assessments of fatigue remains unresolved as it applies to cancer survivors. One study, conducted by Banthia and colleagues (2006), did address this question in a cohort of cancer survivors, utilizing zero-order correlations to examine the concordance between seven same-day reports of fatigue and one end-of-week report of fatigue reflecting the same time period. Banthia et al. (2006) collected data for one month and found that retrospective fatigue was significantly related to average, peak, and most recent same-day fatigue at all four weeks assessed. These analyses, however, were limited. Only 25 participants were examined, all of whom were female breast cancer survivors and the majority of whom (80%) were White/Caucasian, limiting the generalizability of the findings. Further research is warranted to explore the comparability of retrospective and concurrent assessments of fatigue as it applies to other ethnicities and survivors of other cancer types.

In addition to the debate regarding retrospective and concurrent measurement, fatigue has been previously conceptualized, and thus assessed, as both a unidimensional/global and a multidimensional construct (Dittner et al., 2004). Unidimensional measures, such as single-item visual analog scales (VAS), are frequently utilized with cancer survivors because they are often quick, inexpensive, psychometrically sound, and simple to administer (Barsevick et al., 2010; Minton & Stone, 2009; Wewers & Lowe, 1990; Winstead-Fry, 1998). However, although unidimensional VAS questionnaires have been supported by prior literature, there has been debate as to what precisely these scales assess. For example, some researchers have postulated that these assessments measure fatigue as a global construct (Banthia et al., 2006), while others have suggested that a VAS assesses just the physical impact of fatigue (Minton & Stone, 2009). Furthermore, due to the subjective, interpretive nature of VAS instruments, it can be difficult to conclusively determine how fatigue is being conceptualized, and thus rated, by a given respondent (Brunier & Graydon, 1996; Wewers & Lowe, 1990; Youngblut & Casper, 1993).

Conversely, a number of researchers have conceptualized fatigue as a multidimensional construct, including such subdomains as physical, social, functional, cognitive, and affective (Minton & Stone, 2009). Many assessments have been introduced to evaluate this more complex model of fatigue (Mendoza et al., 1999; Smets, Garssen, Bonke, & De Haes, 1995; Stein, Marin, Hann, & Jacobsen, 1998). Although such measures have generally shown good psychometric properties, their evaluation of a broadened theoretical framework of fatigue frequently results in an increase in length and difficulty of assessment. In addition, the advantages of measuring fatigue subdomains remain unclear (Minton & Stone, 2009). Prior research has questioned whether these instruments actually contaminate measurement of fatigue by incorporating measurement of its covariates and correlates (e.g., depression, mental confusion) in addition to the central aspects of the construct itself (Banthia et al., 2006). Thus, while there is evidence suggesting that unidimensional measures, such as VAS instruments, may under-assess fatigue and/or result in incomparable subjective interpretations of the construct, there is simultaneously unresolved confusion regarding the value and accuracy of multidimensional assessment. Further, the relationship between unidimensional and multidimensional measures remains unclear.

In addition to examining the concordance of same-day and end-of-week reports of fatigue among breast cancer survivors, Banthia and colleagues (2006) also addressed the topic of unidimensional versus multidimensional self-reports of fatigue in their investigation. Using hierarchical linear modeling, these authors compared daily VAS scores to weekly Multidimensional Fatigue Symptom Inventory-Short Form (MFSI) scores collected over the course of one month. VAS reports did not equally reflect each of the five dimensions of fatigue (i.e., General fatigue, Emotional fatigue, Mental fatigue, Physical fatigue, and Vigor) assessed by the MFSI. Across the four weeks, VAS reports were more strongly related to General fatigue than any other subdomain. Further, mean daily fatigue was not significantly associated with Emotional fatigue at any week evaluated. These findings warrant further research into the nature of the relationship between unidimensional and multidimensional fatigue among more diverse samples of cancer survivors.

Building on the approach employed by Banthia et al. (2006), the present study aimed to further examine measurement of fatigue in cancer survivorship. Specifically, the analytic strategy Banthia et al. (2006) used to examine the concordance between daily and weekly self-reports of fatigue, and the relationship between unidimensional and multidimensional assessments of fatigue, was repeated with a larger, mixed-gender sample of African American survivors of a variety of cancers. This was done in an effort to investigate the broader applicability of their findings. It is hoped that the subsequent results will provide insight into how two common methods for measuring fatigue may relate to each other, thus

informing future investigatory and diagnostic approaches employed by researchers and clinicians.

Methods

Participants

A total of 57 survivors were originally enrolled in the study; however, due to missing data on this investigation's target variables, five participants were excluded from the present analysis. Therefore, the final sample included 52 African American survivors of a variety of cancers. Demographic characteristics including age, gender, education level, and annual household income, and cancer-related variables including length of treatment, cancer type, and stage of cancer at diagnosis, were also collected. Basic descriptive statistics for the study sample are presented in Table 1.

Eligibility requirements included completion of cancer treatment at least three months prior to enrollment in the study, and self-reported experience of at least three episodes of debilitating fatigue in the past month (i.e., that interfered with activities of daily living). Additionally, participants had to be 18 years of age or older, self-identify as African American, read and write English with sufficient fluency to complete the study questionnaires, and reside in San Diego County. All cancer types were included in recruitment with the exception of non-invasive basal and squamous cell skin cancers, and in situ breast cancer.

Procedure

Approval for human subjects research was obtained from all related Institutional Review Boards prior to participant enrollment. Specific efforts were made to recruit a socio-demographically representative sample of African American cancer survivors. Participants were recruited from local medical facilities, military medical centers, and various other community-based clinics and health organizations, as well as by word-of-mouth.

Potential participants met individually with a trained research assistant (RAs) in the participant's home or a mutually convenient location. They were told they would be asked to provide daily and weekly reports of fatigue over a period of four weeks. Once written informed consent was obtained, RAs instructed participants regarding proper daily monitoring of fatigue symptoms, emphasizing the importance of recording responses within assigned time periods. Each participant was provided with 28 separate VAS questionnaires (one for each day) to use for the daily recording of fatigue-related experiences over the one-month period. Participants also completed the MFSI on the 7th, 14th, 21st, and 28th days of the study. RAs contacted participants weekly to address questions and concerns, and to promote protocol compliance. Subjects were given \$100 as a demonstration of appreciation for their participation.

Measures

Visual Analogue Scale (VAS)—This measure required respondents to rate the average level of fatigue experienced during the preceding 24-hour period by marking any point on a 10-centimeter line at the same time each day. The 10-centimeter line was anchored on each end by the statements "No fatigue" and "Severe fatigue." This technique for measuring fatigue is frequently selected for its low participant burden; respondents can indicate levels of fatigue relative to the anchors in seconds (Banthia et al., 2006). Many studies have demonstrated the reliability and validity of such VAS assessments for self-reports of intensity and frequency of fatigue or other symptoms (Crawford, Piault, & Bennett, 2011; Hauser, Walsh, Rybicki, Davis, & Seyidova-Khoshknabi, 2008; Lee, Hicks, & Nino-Murcia,

1991; Marshall, Paul, McFadyen, Rafferty, & Wood, 2010; Strasser, Müller-Käser, & Dietrich, 2009; Winstead-Fry, 1998), and the high correlation of the VAS with other fatigue measures has established its concurrent validity in past studies (Brunier & Graydon, 1996; Greenberg, Gray, Manniz, Eisenthal, & Carey, 1993; Strasser et al., 2009; Wewers & Lowe, 1990). In the present study, participants were asked to select one convenient time of day at which to record consistently their fatigue each day for a 28-day period.

Multidimensional Fatigue Symptom Inventory-Short Form—(MFSI; Stein et al., 1998; Stein, Jacobsen, Blanchard, & Thors, 2004). This self-report questionnaire has been validated in multiple cancer populations for use in the assessment of cancer-related fatigue. The 30-item MFSI is sub-divided into five factor analytically derived subscales: General fatigue, Physical fatigue, Emotional fatigue, Mental fatigue, and Vigor. Participants rate the applicability of each statement for the past week along a continuum (0 = not at all; 4 = extremely). Scores for each subscale are computed by summing individual responses to each statement within a subdomain, and can range from 0 to 24. Cronbach's alpha values, averaged across the four weeks for the current sample, demonstrated strong internal consistency reliability (General: $\alpha = .94$; Physical: $\alpha = .88$; Emotional: $\alpha = .93$; Mental: $\alpha = .92$; Vigor: $\alpha = .90$).

Analytic Plan

Zero-order correlations were calculated to examine the relationships of weekly MFSI retrospective subscale ratings to the average, peak, and most recent same-day VAS scores for that same week. Average fatigue was considered the mathematical mean of the VAS scores reported during the previous seven days, peak fatigue was considered the highest VAS score reported during the previous seven days, and recent fatigue was considered the last VAS score, reported on the seventh day of each of the four weeks. Therefore, there was a single average fatigue score, a single peak fatigue score, and a single recent fatigue score for each participant for each of the four weeks assessed.

Multilevel random coefficient models were utilized to examine the correspondence between unidimensional and multidimensional reports of fatigue. Multilevel random coefficient modeling was prioritized over a statistical technique reliant upon ordinary least squares estimation as it has been demonstrated to yield better parameter estimates when data are hierarchically structured (Bryk & Raudenbush, 2002; Nezlek, 2001). For the present investigation, two-level models were primarily analyzed. The level-1 variable (i.e., within-person variable) was the VAS measure of daily fatigue, whereas the level-2 variables (i.e., between-person variables) were the *single* weekly administrations of the MFSI. The statistical significance of the multilevel regression coefficient relating each weekly measure of the MFSI to daily fatigue was of primary interest. In addition, the reduction in the proportion of variance explained (or error) index is presented as an indicator of effect size for all statistically significant effects. This index is analogous to R^2 from linear regression (see Bryk & Raudenbush, 2002 and Nezlek, 2001 for a full discussion of this index).

Results

The reliability across seven days for the VAS daily ratings was extremely high for each of the four weeks, with Cronbach's alpha values ranging from .88 to .96. There was a total of 1,451 observations (i.e., daily VAS ratings completed) for the 52 participants, with an average of 27.90 observations per participant.

Descriptive Statistics of Cancer-Related Fatigue

Basic descriptive statistics for the target study variables are presented in Table 2. In examining the VAS scores, the present participants reported an average of 4.94 cm; in comparison, those from Banthia et al.'s (2006) study reported an average of 4.32 cm. The means on the General, Physical, Emotional, and Mental fatigue subscales were greater than those reported by Stein et al. (1998) for non-cancer subjects and breast cancer patients, and the mean on the Vigor subscale was lower. Conversely, as compared to Banthia et al.'s (2006) sample of 25 breast cancer survivors, the present participants demonstrated lower scores on General, Mental, and Emotional fatigue, as well as Vigor; Physical fatigue scores were slightly higher for the present sample.

Relationships of Weekly Retrospective MFSI Scores to Average, Peak, and Recent Daily VAS Scores of Fatigue

Zero-order correlations were calculated to examine the relationships of weekly retrospective MFSI subscale scores to average fatigue, peak fatigue, and most recent fatigue evaluated daily over the prior seven days for each of the four weeks. The results of these analyses are presented in Table 3. MFSI General, Physical, Emotional and Mental fatigue were all significantly and positively correlated with average, peak and recent fatigue at all four time-points. MFSI Vigor was significantly and *negatively* correlated with peak fatigue at weeks one, three and four, and with average and recent fatigue at all four weeks.

Relationship Between Unidimensional (VAS) and Multidimensional (MFSI) Reports of Fatigue

The results from the multilevel random coefficient model analyses relating mean daily VAS fatigue ratings to weekly MFSI subscale scores are presented in Table 4. General, Emotional, Mental, and Physical fatigue subscales were significantly and positively related to average daily fatigue for all four weeks. Vigor was significantly and *negatively* related to average daily fatigue at all four weeks. For the first three weeks, the proportion of shared variance between an MFSI subscale and the mean daily VAS ratings was highest for General fatigue. The second highest proportion of variance was typically shared by either Emotional or Mental fatigue, followed by Physical fatigue. Vigor was the exception to this pattern, showing a steady increase in proportion of shared variance. At weeks one and two, the proportions of shared variance between the Vigor subscale and the mean daily VAS ratings were lower than for any other subscale; however, at week three this value was comparable to those for Emotional and Mental fatigue, and at week four it was higher than for any other subscale of the MFSI.

Discussion

The primary aim of this investigation was to evaluate the relationship between two common methods for assessing survivor fatigue. One central topic addressed was the correspondence between daily and weekly self-reports of fatigue by cancer survivors. In the present analysis, all three dimensions of daily fatigue that were reported were consistently and significantly correlated with weekly fatigue ratings at all four of the time periods assessed. In general, the average VAS score for a given week was more strongly correlated with that week's MFSI subscale scores than were the peak or most recent VAS scores. These results are consistent with Banthia et al.'s (2006) findings, and support the use of retrospective scales to capture average experiences over preceding time periods, at least on a short-term basis. Banthia et al. (2006) also reported an observed increase in the strength of the relationship between most recent daily reports and weekly reports of fatigue over the course of the four weeks examined. This was found in the present analysis for some subscales of the MFSI; however, the degree of change did not appear to be as large as that seen in the previous investigation.

This suggests that, while the present participants became increasingly reliant upon their memory of the most recent single-day fatigue report as the study progressed, they did so to a lesser extent than prior participants had. Regardless, as was the case in Banthia et al.'s (2006) study, overall these findings support the conclusion that retrospective weekly ratings of fatigue as measured by the MFSI provide a good overall evaluation of the previous seven-day time period being assessed.

Examining the mean VAS scores reported by this sample as compared to previous research (Banthia et al., 2006) yields some interesting comparisons. The current participants reported more severe unidimensional fatigue than prior research (Banthia et al., 2006), and the current sample's mean VAS score of 4.94 is indicative of moderate fatigue in accordance with guidelines proposed by Portenoy and Itri (1999). With regard to multidimensional fatigue, there are no clinical cut points for the MFSI subscale scores. However, the survivors included in the present study consistently reported more severe fatigue symptoms than did cancer patients from the MFSI's validation sample, who were either receiving treatment or had previously completed treatment (Stein et al., 1998). Conversely, as compared to Banthia et al.'s (2006) sample of breast cancer survivors, the current sample reported less severe fatigue on all subscales excepting Physical fatigue, where scores were slightly higher. This inconsistency supports the idea that distinct groups of cancer survivors experience fatigue differentially. It is also important to note that, as stated, the present sample reported more severe unidimensional fatigue as measured by the VAS questionnaires, but less severe multidimensional fatigue on most subscales of the MFSI as compared to Banthia et al.'s (2006) sample. This provides preliminary support for the hypothesis that the different measures of fatigue may, in fact, be conceptualized and interpreted differently by different survivors.

Building on this hypothesis, the multilevel random coefficient models demonstrated that unidimensional fatigue as measured by the VAS was more strongly related to certain subdomains of fatigue than others. The degree to which unidimensional and multidimensional ratings of fatigue corresponded was slightly lower in the present investigation as compared to Banthia et al.'s (2006) results. Banthia et al. (2006) found shared variances ranging from 18 to 64%, while the present analysis found shared variances ranging from 10 to 44% across the five MFSI subscales. As was the case in Banthia et al.'s (2006) investigation, overall the General fatigue subscale shared more variance with unidimensional fatigue than did any other subscale. The strength of the relationship between VAS scores and General Fatigue suggests that the term "fatigue" as presented by the VAS prompted participants to think of the more generic aspects of the construct that are best represented by the General fatigue subscale. It is interesting to recognize that Physical fatigue, the subdomain which had previously been hypothesized to be the target of unidimensional measures (Minton & Stone, 2009), was in no case the subdomain most highly related to the more broadly defined construct of fatigue as presented in the VAS; instead, it often shared the lowest amount of variance with daily fatigue. Similar to Banthia et al.'s (2006) findings, the present investigation found that Mental and Physical fatigue consistently shared moderate amounts of variance with the VAS questionnaires.

A unique pattern regarding the relationship between the VAS questionnaires and the Vigor subscale was found in this study that was not present in the previous Banthia et al. (2006) investigation. As the 30 day study period progressed, the proportion of variance shared by the VAS reports and the Vigor subscale increased to such a point that in the fourth week the Vigor subscale shared more variance with unidimensional fatigue than did any other subdomain of multidimensional fatigue. Examining the individual items comprising the MFSI demonstrates that those in both the General fatigue and Vigor subscales are rather generic and vague, (e.g., "I am worn out" [General] and "I feel lively" [Vigor]) while those

contributing to the Emotional fatigue, Mental fatigue and Physical fatigue subscales are more specific (e.g., “I feel depressed” [Emotional], “I have trouble remembering things” [Mental], and “My legs feel weak” [Physical]). This provides support for the hypothesis that participants thought of the generic aspects of fatigue, both throughout the study with regard to the General subscale, as well as increasingly as the study progressed, with regard to the Vigor subscale. Additionally, a distinguishing feature between the General fatigue and Vigor subscales is the valence of the items presented; the General fatigue questions assess negative concepts while the Vigor questions target positive ones. Prior research has demonstrated that exercises such as journaling and mood monitoring can have a positive impact on one’s general mental status. For example, Tanabe et al. (2010) found that, among sickle cell disease patients, self-awareness and journaling were used as daily tools to maintain optimal health. Therefore, it is possible that the intrinsic therapeutic influence of documenting fatigue on a daily basis led study participants to develop a more positive outlook, bringing their unidimensional ratings more in line with their assessment of Vigor as the study progressed.

These findings suggest that the individuals comprising this study’s sample interpreted the term “fatigue” as presented by the VAS differently at different time points. Given the absence of such a pattern in Banthia et al.’s (2006) results, this suggests that female breast cancer survivors of mixed ethnicity responded differently to the act of documenting fatigue as compared to the male and female African American cancer survivors in the present study. The differentiation of the two study samples is further supported by the fact that Banthia et al. (2006) found that Emotional fatigue had almost no relationship with the unidimensional VAS measure of fatigue, while the present investigation found that Emotional fatigue consistently shared a moderate amount of variance with VAS ratings. The reasons behind this finding are unclear, demonstrating the need for further examination of fatigue among diverse samples of cancer survivors.

The current results must be interpreted within the context of relevant limitations. Primarily, although daily reports of fatigue were considered an adequate concurrent measure in this investigation, they are intrinsically prone to a degree of retrospective reporting bias. Moment-specific assessments may have captured more precise data. For example, an approach such as Ecological Momentary Assessment (Curran et al., 2004; Hacker & Ferrans, 2007; Okifuji, 2011) could theoretically provide fatigue reports at specific and/or targeted moments throughout a particular time period. Such techniques prompt respondents to report sensations as they are being experienced, which can reduce, if not negate, the recall biases inherent in retrospective reporting. Future studies may wish to employ such moment-specific strategies to improve the reliability of reporting results, or to examine the concordance between Ecological Momentary Assessment and end-of-day or weekly reporting. In addition, although specific efforts were made to ensure maximum compliance with study protocol, there is no way to be sure that participants completed their daily or weekly ratings at the assigned times. Therefore, it is possible that the time of day at which participants reported their fatigue varied throughout the course of the study, both between and within subjects. Also, because participants had access to their report diaries until the end of the study, it is possible that exposure to previous reports of fatigue may have jeopardized the independence of each individual VAS and MFSI completion. Further limitations were that participants were all recruited from one geographic region, the total sample size was too small to permit analysis of demographic or medical moderators such as cancer type, almost half of the sample was comprised of breast cancer survivors, and there was a broad range in length of treatment.

Despite these limitations, the results contribute to the literature on assessment of fatigue in cancer survivors and provide insight into the generalizability of Banthia et al.’s (2006)

findings. Furthermore, they provide valuable information regarding the relationship of daily to weekly ratings of fatigue, as well as of unidimensional to multidimensional ratings. They suggest, as did Banthia et al.'s (2006) results, that retrospective weekly reports of fatigue capture comparable information to same-day reports of fatigue, providing support for the use of retrospective measures to assess fatigue experienced over a seven-day time period. However, they also raise questions about unidimensional measures of fatigue, as the VAS reports appeared to reflect different subdomains of fatigue at different time points during the study. The VAS reports from this study also appeared to differentially reflect subdomains of multidimensional fatigue as compared to Banthia et al.'s (2006) investigation. Given these considerations, if it is appropriate to the question of interest, it may be advisable to employ a multidimensional measure such as the MFSI despite the increased burden and length of such assessments when assessing cancer-related fatigue in survivors. Alternatively, or in combination, researchers or clinicians interested in the fatigue experiences of survivors may opt to utilize a series of VAS questions, one relating to each subdomain of fatigue. Such an integrated approach could allow for a more fine-grained analysis, combining the breadth of multidimensional measures with the ease of implementation of unidimensional measures, when examining the highly relevant construct of fatigue among cancer survivors.

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Table 1
Demographic Characteristics of the Study Population (N = 52)

Age	
M(SD)	57.78 (13.33)
Range	28 – 84
Length of treatment (months)	
M(SD)	7.95 (9.49)
Range	< 1 – 60
Gender (%)	
Female	63.5
Male	36.5
Education (%)	
Grade school	1.9
High school/Tech school graduate	13.5
Some college	34.6
College graduate	19.2
Graduate school	30.8
Income (%)	
< \$10,000	3.8
\$10,000–\$19,999	7.7
\$20,000–\$29,999	17.3
\$30,000–\$39,999	25.0
\$40,000–\$49,999	7.7
\$50,000–\$59,999	9.6
\$60,000–\$69,999	15.4
\$70,000	13.5
Cancer type (%)	
Breast	48.1
Prostate	28.9
Colon	3.8
Lung	3.8
Other	15.4
Stage of cancer at diagnosis (%)	
Stage 0	1.9
Stage I	21.2
Stage II	17.3
Stage III	25.0
Stage IV	5.8
Don't Know/Missing	28.8

Table 2
Descriptive Statistics for the Study Measures

Measure	<i>M</i>	<i>SD</i>	Observed Range
Visual Analogue Scale (in centimeters)	4.94	1.94	0 – 10
MFSI General Fatigue – Average of 4 weeks	11.82	5.24	0 – 24
MFSI Emotional Fatigue – Average of 4 weeks	5.96	5.82	0 – 24
MFSI Mental Fatigue – Average of 4 weeks	6.30	4.43	0 – 23.25
MFSI Physical Fatigue – Average of 4 weeks	6.80	5.24	0 – 19.25
MFSI Vigor – Average of 4 weeks	9.86	4.81	0 – 23

Notes: *M* = mean; *SD* = standard deviation; MFSI = Multidimensional Fatigue Symptom Inventory

Table 3
Zero-Order Correlations between MFSI (Weekly Fatigue) Subscales and Average, Peak, and Most Recent Daily VAS Fatigue Ratings

Subscales	Week											
	1			2			3			4		
	Avg	Peak	Recent	Avg	Peak	Recent	Avg	Peak	Recent	Avg	Peak	Recent
General	.58**	.59**	.55**	.66**	.56**	.56**	.58**	.57**	.49**	.60**	.55**	.55**
Emotional	.52**	.47**	.48**	.54**	.38**	.41**	.51**	.48**	.41**	.62**	.53**	.52**
Mental	.54**	.38**	.41**	.51**	.46**	.40**	.52**	.45**	.43**	.50**	.46**	.40**
Physical	.46**	.38**	.34*	.44**	.29*	.37**	.35*	.31*	.40**	.42**	.32*	.39**
Vigor	-.48**	-.44**	-.39**	-.34*	-.23	-.34*	-.55**	-.57**	-.50**	-.64**	-.63**	-.65**

Notes: MFSI = Multidimensional Fatigue Symptom Inventory; VAS = visual analogue scale; Avg = average

**
p < .01

*
p < .05

Table 4
Proportion of Variance Shared Between Daily and Weekly Fatigue

MFSI Subscales	Week							
	1		2		3		4	
	<i>b</i>	<i>R</i> ²	<i>B</i>	<i>R</i> ²	<i>b</i>	<i>R</i> ²	<i>b</i>	<i>R</i> ²
General Fatigue	.19**	.36**	.23**	.44**	.22**	.33**	.24**	.38**
Emotional Fatigue	.16**	.28**	.19**	.31**	.14**	.26**	.23**	.36**
Mental Fatigue	.20**	.29**	.23**	.28**	.24**	.26**	.23**	.25**
Physical Fatigue	.17**	.24**	.17**	.20**	.14*	.11*	.17**	.17**
Vigor	-.13*	.14*	-.12*	.10*	-.24**	.26**	-.27**	.41**

Notes: MFSI = Multidimensional Fatigue Symptom Inventory; *b* = unstandardized regression coefficient; *R*² = proportion of variance extracted in mean daily fatigue by weekly Multidimensional Fatigue Symptom Inventory scores

**
p < .01

*
p < .05