Title

Predictors of the Trajectories of Self-Reported Attentional Fatigue in Women With Breast Cancer Undergoing Radiation Therapy

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Predictors of the Trajectories of Self-Reported Attentional Fatigue in Women With Breast Cancer Undergoing Radiation Therapy

by

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Abstract

Predictors of the Trajectories of Self-Reported Attentional Fatigue in Women With Breast Cancer Undergoing Radiation Therapy

John D. Merriman

This study of breast cancer patients who underwent radiation therapy (RT) examined how attentional fatigue changed from the time of simulation to four months after the completion of RT and investigated whether specific variables predicted initial levels of attentional fatigue and characteristics of the trajectories of attentional fatigue. Seventy-three women completed a number of measures (i.e., Attentional Function Index, General Sleep Disturbance Scale, Center for Epidemiologic Studies-Depression scale, Spielberger State-Trait Anxiety Inventories, Brief Pain Inventory) over six months. Descriptive statistics and hierarchical linear modeling were used for data analysis. Large amounts of inter-individual variability were found in the trajectories of attentional fatigue. At baseline, higher levels of attentional fatigue were associated with younger age, not working, a higher number of comorbidities, and higher levels of trait anxiety. The trajectory of attentional fatigue improved over time for women with a higher body mass index at baseline. This study is the first to identify predictors of inter-individual variability in attentional fatigue in women with breast cancer undergoing RT. The various predictors should be considered in the design of future correlational and interventional studies in this population.

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Attentional fatigue is a decreased capacity to direct attention (Cimprich, 1992a). This capacity is defined by three concepts: selectivity, which is the ability to highlight one stimulus while ignoring others; sustained focus, which is the maintenance of selectivity over time; and limited capacity, which is a ceiling on the number of stimuli that can be processed successfully at any one time (Cimprich, 1992a; Kaplan & Kaplan, 1982; Posner & Boies, 1971). Anatomically, attention is thought to reside in the anterior and posterior attention systems of the frontal and parietal cortices (Cimprich, 1995; Posner & Dehaene, 1994; Posner & Petersen, 1990). Attentional fatigue is not physical fatigue, so a person can experience the former with or without the latter (Cimprich, 1992b). In addition, the cognitive changes popularly referred to as "chemo brain" include, but are not limited to, attentional fatigue (Hess & Insel, 2007).

There are two types of attention, involuntary and voluntary (James, 1983; Kaplan & Kaplan, 1982). Some stimuli that originate in our thoughts or in the world around us (i.e., our internal and external environments) engage involuntary attention without effort (Cimprich, 1992a; James, 1983; Kaplan & Kaplan, 1982). These stimuli include nature, things that affect survival, and things that fascinate us (Cimprich, 1992a; James, 1983; Kaplan & Kaplan, 1982). Other stimuli must consciously be selected for processing by voluntary attention, which requires effort that reduces our capacity to direct attention further (Cimprich, 1992a; James, 1983; Kaplan & Kaplan, 1982). Voluntary attention is required to act purposefully (Lezak, 1982), to monitor one's self, and to inhibit emotional reactions (Cimprich, 1992a). As involuntary attention is drawn to a greater diversity and

intensity of sensory information, experienced as distraction, one must expend greater effort to direct voluntary attention (Cimprich, 1992a; Kaplan & Kaplan, 1982).

When diagnosed with cancer, a person's involuntary attention is drawn to the threatening information received and to the unfamiliar physical environment in which treatment occurs, both of which pertain to survival (Cimprich, 1992b). The concept of limited capacity suggests that the direction of voluntary attention during the time of diagnosis, treatment, and recovery would require increased effort, resulting in attentional fatigue and its sequelae (i.e., irritability when presented with further demands on one's attention and a decreased ability to focus on selected stimuli) (Cimprich, 1992b; Kaplan & Kaplan, 1982).

Three cross-sectional studies evaluated the correlates of self-reported attentional fatigue before treatment in women diagnosed with breast cancer (Cimprich, 1999; Cimprich, So, Ronis, & Trask, 2005; Lehto & Cimprich, 1999). Across these studies of a total of 303 women, significant correlates of higher levels of attentional fatigue included younger age, pre-menopausal status, higher symptom distress scores, a greater number of symptoms, greater mood disturbance, and high versus low-to-moderate anxiety. Two papers from the same study described self-reported attentional fatigue in women following breast cancer surgery. In these papers, higher levels of attentional fatigue were reported by women with higher levels of mood disturbance (Cimprich, 1992b) and in those assessed closer to the time of surgery (Cimprich, 1993). In a longitudinal study that evaluated self-reported attentional fatigue in women undergoing chemotherapy for breast cancer, higher levels of attentional fatigue significantly correlated with the administration of chemotherapy and higher depression scores (Jansen, Dodd, Miaskowski, Dowling, &

Kramer, 2008).

No cross-sectional or longitudinal studies were found that examine the trajectories of self-reported attentional fatigue in women with breast cancer before, during, and after radiation therapy (RT). Improvement in the understanding of trajectories of attentional fatigue in women with breast cancer may help clinicians identify patients at risk for more severe attentional fatigue and may guide the development of interventions tailored to their individual experiences. Therefore, the purposes of this study, in a sample of women who underwent RT for breast cancer, were (1) to examine how self-ratings of attentional fatigue changed from the time of simulation to four months after the completion of RT and (2) to investigate whether specific patient, disease, and symptom characteristics predicted initial levels of attentional fatigue and/or characteristics of the trajectories of attentional fatigue.

Methods

Participants and Settings

This descriptive, longitudinal study recruited 73 women with breast cancer who met the following inclusion criteria: were ≥ 18 years of age; had the ability to read, write, and understand English; had a Karnofsky Performance Status score of ≥ 60; and were scheduled to receive primary or adjuvant RT. Patients were excluded if they had metastatic disease, had more than one cancer diagnosis, or had a diagnosed sleep disorder. They were recruited from RT departments located in a comprehensive cancer center and a community-based oncology program. This study was approved by the human subjects committees of the University of California, San Francisco and the second study site.

One hundred thirty-four patients were approached and 73 consented to participate (54.5% response rate). The major reasons for refusal were being too overwhelmed with their cancer experience or too busy. No differences were found in any of the demographic or disease characteristics between patients who did and did not choose to participate.

Instruments

The study instruments included a demographic questionnaire, the Karnofsky Performance Status (KPS) scale (Karnofsky, 1977), the Attentional Function Index (AFI), the General Sleep Disturbance Scale (GSDS), the Center for Epidemiologic Studies-Depression scale (CES-D), the Spielberger State-Trait Anxiety Inventories (STAI-S and STAI-T), and a descriptive numeric rating scale (NRS) for worst pain intensity from the Brief Pain Inventory. The demographic questionnaire provided information on age, living arrangements, marital status, years of education, employment status, race, and whether children were living at home. Additional clinical characteristics were collected, including number of comorbidities, stage of disease, use of hormone replacement therapy prior to diagnosis, treatment with lymph node dissection and/or chemotherapy prior to RT, and total dose of RT. Measurements of weight and height were used to determine body mass index (BMI), which was calculated by dividing weight in kilograms by height in meters squared.

Self-reported attentional fatigue was measured using the AFI (Cimprich, 1992b). Originally developed for use with a visual analogue scale, the 16-item AFI was modified for this study to employ a 0-to-10 NRS that was anchored by phrases describing extremes, such as “not at all” and “extremely well.” A mean AFI score was calculated,

with higher scores indicating greater capacity to direct attention or lower levels of attentional fatigue (Cimprich, 1992b). Based on a previously conducted analysis of the frequency distributions of AFI scores, attentional fatigue can be grouped into categories of functional status—with those patients who score < 5.0 functioning poorly and experiencing high levels of attentional fatigue, those who score 5.0 to 7.5 functioning moderately well and experiencing moderate levels of attentional fatigue, and those who score > 7.5 functioning well and experiencing low levels of attentional fatigue (Cimprich et al., 2005). The AFI has established reliability and validity (Cimprich, 1992b; Jansen et al., 2008; Jansen, 2006; Tennessen & Cimprich, 1995). In the current study, Cronbach's alpha for the AFI was 0.95.

The GSDS consists of 21 items that evaluate various aspects of sleep disturbance (Lee & DeJoseph, 1992). Each item is rated on a NRS that ranges from 0 (never) to 7 (every day). The 21 items are summed to yield a total score that can range from 0 (no disturbance) to 147 (extreme sleep disturbance) (Lee & DeJoseph, 1992). The GSDS has well-established validity and reliability (Lee, 1992; Lee & DeJoseph, 1992; Lee, Portillo, & Miramontes, 2001). In the current study, Cronbach's alpha for the GSDS total score was 0.81.

The CES-D consists of 20 items selected to represent the major symptoms in the clinical syndrome of depression (Radloff, 1977). Scores can range from 0 to 60, with a score of ≥ 16 indicating the need for an individual to seek a clinical evaluation for depression (Radloff, 1977). The CES-D has well-established reliability and concurrent and construct validity (Carpenter et al., 1998; Radloff, 1977; Sheehan, Fifield, Reisine, & Tennen, 1995). In the current study, Cronbach's alpha for the CES-D was 0.83.

The STAI-S and STAI-T consist of 20 items each that are rated from 1 to 4 (Bieling, Antony, & Swinson, 1998). The score for each scale is summed and can range from 20 to 80, with a higher score indicating greater anxiety (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The STAI-S measures an individual's transitory emotional state during a stressful situation, while the STAI-T measures an individual's predisposition to anxiety and estimates how that person generally feels (Kennedy, Schwab, Morris, & Beldia, 2001). The STAI-S and STAI-T have well-established criterion and construct validity and internal consistency reliability coefficients (Bieling et al., 1998; Kennedy et al., 2001; Spielberger et al., 1983). In the current study, Cronbach's alphas for the STAI-S and STAI-T were 0.91 and 0.86, respectively.

Worst pain was evaluated using a descriptive NRS from the Brief Pain Inventory that ranged from 0 (no pain) to 10 (excruciating pain) (Cleeland & Ryan, 1994; Daut, Cleeland, & Flanery, 1983). A descriptive NRS is a valid and reliable measure of pain intensity (Jensen, 2003). Because 50.7% of patients in this study did not have pain, the symptom was recoded as present or absent for the longitudinal analysis.

Study Procedures

At the time of the simulation visit (i.e., approximately one week prior to the start of RT), a research nurse approached patients to discuss participation in the study. After obtaining written informed consent, patients were asked to complete baseline study questionnaires. Patients were taught to complete the AFI as part of the collection of study instruments administered at baseline, every other week during RT (four assessments) and for two months after RT, and once a month for two months. The majority of patients completed 11 assessments over six months.

Data Analysis

Descriptive statistics and frequency distributions were generated on the sample characteristics and baseline symptom severity scores (see Table 2) using SPSS™ Version 15.0. For each of the 11 assessments, a mean AFI score was calculated for use in the subsequent statistical analyses.

Hierarchical linear modeling (HLM), based on full maximum likelihood estimation, was completed using software developed by Raudenbush and colleagues (Raudenbush & Bryk, 2002; Raudenbush, Bryk, Cheong, & Congdon, 2004). Compared with other methods for analyzing change, HLM has two major advantages. First, HLM can accommodate unbalanced designs, which allows for the analysis of data when the number and spacing of assessments vary across respondents (Raudenbush, 2001; Raudenbush & Bryk, 2002). Although every patient was to be assessed on a pre-specified schedule, the actual number of assessments was not the same for all patients due to varying periods of RT and scheduling conflicts. Second, HLM has the ability to model individual change, which helps to identify more complex patterns of change that are often overlooked by other methods (Raudenbush, 2001; Raudenbush & Bryk, 2002).

With HLM, repeated measures of the outcome variable (i.e., attentional fatigue) are conceptualized as being nested within individuals, and the analysis of change in attentional fatigue scores is at two levels: within persons (level one) and between persons (level two). At level one, the outcome is conceptualized as varying within individuals and is a function of person-specific change parameters plus error. At level two, these person-specific change parameters are multivariate outcomes that vary across individuals. Level-two outcomes can be modeled as a function of demographic or clinical

characteristics that vary between individuals, plus an error associated with the individual. Combining level one with level two results in a mixed model with fixed and random effects (Li, 2005a, 2005b; Raudenbush & Bryk, 2002).

HLM analysis proceeded in two stages. First, intra-individual variability in attentional fatigue over time was examined. In this study, time in weeks refers to the length of time from the simulation visit to four months after the completion of RT. Three level-one models were compared to determine if the patients' attentional fatigue levels did not change over time (i.e., no time effect), changed at a constant rate (i.e., linear time effect), or changed at a rate that accelerated or decelerated over time (i.e., quadratic effect). At this point, the level-two model was constrained to be unconditional (i.e., no predictors), and significance tests were used to determine the best model. These analyses answered the first research question and identified the change parameters that best described individual changes in attentional fatigue over time.

The second stage of the HLM analysis, which answered the second research question, examined inter-individual differences in the trajectories of attentional fatigue by modeling individual change parameters (i.e., intercept and linear slope) as a function of proposed predictors at level two. Personal characteristics, disease and treatment characteristics, and symptom severity scores were evaluated as potential predictors of the intercept and linear slope based on a review of the literature of attentional fatigue in women with breast cancer (see Table 1). In addition, other potential predictors were identified from an analysis of morning and evening fatigue in the same sample (i.e., BMI, GSDS, and pain) (Dhruva et al., 2009). While levels of physical fatigue were evaluated in the study using the Lee Fatigue Scale (Lee, Hicks, & Nino-Murcia, 1991), physical

fatigue was not included as a potential predictor in the HLM analysis of attentional fatigue to avoid possible confounding of the two fatigue concepts.

To improve estimation efficiency and construct a model that was parsimonious, an exploratory level-two analysis was completed in which each potential predictor was assessed to see if it would result in a better model if it alone were added as a level-two predictor. Predictors with a t-value of < 2.0, which indicates a lack of significant effect, were dropped from subsequent model testing. All potentially significant predictors from the exploratory analyses were entered into the model to predict each individual change parameter, but only predictors that maintained a statistically significant contribution in conjunction with other variables (p-value of < 0.05) were retained in the final model.

Results

Patient Characteristics and Symptom Severity Scores

The demographic and clinical characteristics of the 73 patients are presented in Table 2. On average, the patients in this sample were 55 years of age and well educated, with a KPS score of 87.7 and an average of five comorbidities. Most of the patients were white (70%). Fifty-five percent were not employed and 22% were caring for children at home.

Individual and Mean Change in Attentional Fatigue

The first HLM analysis examined how levels of attentional fatigue changed from the time of the simulation visit to four months after the completion of RT. Two models were estimated in which the function of time was linear or quadratic. In the linear model, the test of the linear slope was significant ($p=0.003$). However, when a quadratic component was added to the model, neither the linear component ($p=0.731$) nor the

quadratic component (p=0.121) was significant. Consequently, the linear model was deemed the better fit.

The estimates of the linear change model are presented in Table 3 (unconditional model). Because the model had no covariates (i.e., unconditional), the intercept represents the estimated level of attentional fatigue (i.e., 6.32 on a 0-to-10 scale) at the time of the simulation visit. The estimated linear rate of change in AFI scores, for each additional week, was 0.022 (p=0.003). Figure 1 displays the predicted trajectory for attentional fatigue in the unconditional model from the time of the simulation visit to four months after the completion of RT, during which attentional fatigue was projected to improve over the course of RT (i.e., weeks one to nine) and to continue to improve after the completion of RT. It should be noted that the mean scores for the various groups depicted in all figures are estimated or predicted means based on the HLM analyses.

Although the results indicated a sample-wide improvement in attentional fatigue, this does not imply that all patients exhibited the same trajectory. The variance in individual change parameters estimated by the model (i.e., variance components, Table 3) suggested that substantial inter-individual differences existed in the trajectories of attentional fatigue, which are illustrated in Figure 2. These results suggested that further examination of inter-individual differences in the individual change parameters was warranted.

Inter-Individual Differences in the Trajectories of Attentional Fatigue

The second stage of the HLM analyses tested the hypothesis that the pattern of change over time in attentional fatigue varied based on specific person, disease, treatment, and/or symptom variables that were found to influence the level of attentional

fatigue in other studies (see Table 1). As shown in the final model in Table 3, the four variables that predicted inter-individual differences in the intercept for attentional fatigue were age, work, number of comorbidities, and baseline level of trait anxiety (i.e., baseline STAI-T score). The single variable that predicted inter-individual differences in the slope parameter for attentional fatigue was BMI.

To illustrate the effects of the five predictors on patients' initial levels and trajectories of attentional fatigue, Figures 3 and 4 display the adjusted change curves of attentional fatigue that were estimated based on differences in age (i.e., younger or older calculated based on one standard deviation (SD) below and above the mean age of the patients), employment status (i.e., working or not working), number of comorbidities (i.e., lower or higher number of comorbidities calculated based on one SD below and above the mean number of comorbidities), baseline level of trait anxiety (i.e., lower or higher STAI-T calculated based on one SD below and above the mean baseline STAI-T score), and BMI (i.e., lower or higher BMI calculated based on one SD below and above the mean BMI).

Discussion

To our knowledge, this longitudinal study is the first to evaluate the trajectories of self-reported attentional fatigue in women with breast cancer undergoing RT. In this study the mean AFI score before treatment was 6.6 (range 2.1 to 9.9), which was similar to baseline means in previous studies (Cimprich, 1992b, 1999; Cimprich et al., 2005; Jansen et al., 2008; Lehto & Cimprich, 1999). Approximately 41.1% of the women reported moderate levels of attentional fatigue (i.e., an AFI score of 5.0 to 7.5) and 21.9% reported high levels of attentional fatigue (i.e., an AFI score of < 5.0) at baseline. The

model predicted improvement in attentional fatigue scores from the beginning (5.9) to the end (6.4) of the study. However, at the end of the study the majority of the women were still experiencing moderate levels of attentional fatigue.

In this sample, younger age was associated with higher levels of attentional fatigue at the time of the simulation visit. This finding is supported by the hypothesis put forward by Cimprich et al. (2005) that younger women may be more distressed by changes in attentional function than older women, who may have become more accustomed to a diminished capacity to direct attention. As a result, younger women would rate their attentional fatigue at higher levels than older women.

Not working predicted higher levels of attentional fatigue at baseline. While Cimprich (1999) did not find a correlation between employment status and attentional fatigue in women newly diagnosed with breast cancer, our findings are consistent with a previous report in patients with depression (Williams et al., 2000). In that report, the authors hypothesized that the mechanisms involved in directing attention may be conditioned in a work environment to function more efficiently. Based on this hypothesis, a person who is not working could lack this routine conditioning, which may contribute to the perception of higher levels of attentional fatigue when that person is confronted with a demanding life situation, like RT for breast cancer.

The finding of higher levels of trait anxiety being associated with higher levels of attentional fatigue prior to treatment is consistent with previous reports (Cimprich, 1999; Cimprich et al., 2005; Lehto & Cimprich, 1999). Lehto and Cimprich (1999) proposed that unrelenting anxiety may worsen attentional fatigue by reducing the ability to maintain sustained focus. A consistent finding of the association of anxiety with

attentional fatigue across four studies suggests that clinicians should routinely assess patients undergoing cancer treatment for anxiety and provide appropriate interventions.

Although not a predictor of inter-individual variability in attentional fatigue in this study, depression has correlated with self-reported attentional fatigue in a previous study of patients undergoing chemotherapy (Jansen et al., 2008). In addition, previous studies have found correlations between mood states, which include depression, and attentional fatigue (Cimprich, 1992b, 1999; Cimprich et al., 2005). In the present study, 61.6% of the patients scored above the cut point of 31.8 (Spielberger et al., 1983) for significant trait anxiety. In contrast, 32.9% scored at or above the cut point of 16.0 for significant depression. Perhaps in the setting of RT, anxiety overrides depression.

Finally, while a previous study of women newly diagnosed with breast cancer found no association between comorbidities and attentional fatigue (Cimprich et al., 2005), in this study a higher number of comorbidities was associated with higher levels of attentional fatigue at baseline. These inconsistent findings may be related to the methods used to evaluate comorbidities. In the study by Cimprich et al. (2005), comorbidities were coded as present or absent, so the total number of comorbidities experienced by the women is not known. While it is interesting that the presence or absence of pain, as separately assessed, did not predict inter-individual differences in attentional fatigue in the current study, the three most frequently reported comorbidities included allergies (58.6%), back problems (54.8%), and headaches (44.4%). It is possible that engagement of the attentional processes needed to manage multiple comorbidities, in light of the concept of limited capacity, fatigues the neurological mechanisms involved in directing attention. In addition, it is possible that patients took

allergy medications and analgesics for these comorbidities that contributed to attentional fatigue (Banerji, Long, & Camargo, 2007; Palos, 2008). Additional research is warranted to evaluate these relationships in more detail.

Relative to the mean BMI for the sample (27.4 ± 7.3), estimates that used BMI scores of one SD above the mean suggest that a higher BMI at baseline predicted improvement in AFI scores, or lessening of attentional fatigue, over the six months of the study. The mean baseline BMI for the women in this study is categorized as overweight, as determined by the National Heart, Lung, and Blood Institute (NHLBI) (NHLBI, 2009). The estimate for higher BMI at baseline (i.e., one SD above the mean) would be categorized as obese, while the estimate for lower BMI (i.e., one SD below the mean) would be categorized as normal weight. Physiological mechanisms that might explain this finding warrant investigation in future studies.

While previous studies found correlations between treatment characteristics and self-reported attentional fatigue (Cimprich, 1993; Jansen et al., 2008), treatment characteristics and stage of disease did not predict inter-individual differences in attentional fatigue in the present study. Cimprich's (1993) sample included 32 patients, Jansen et al.'s (2008) sample included 30 patients, and the current study included 73 patients. A larger sample size in future studies could provide more information about the influence of treatment and disease characteristics on attentional fatigue.

Results of this study are limited in their generalizability by the characteristics of the sample, especially that most of the women were white, middle-aged, and highly educated. Given that many of the women who declined to participate in the current study stated that their reason was being too overwhelmed with the experience of cancer, it is

possible that the current study underestimates baseline attentional fatigue in patients with breast cancer prior to RT. This study did not collect data on menopausal status, which has been shown to influence self-reported attentional fatigue (Cimprich et al., 2005). Although previous studies collected data on attentional fatigue using both objective measures and the AFI (Cimprich, 1992b, 1993, 1999; Cimprich et al., 2005; Jansen et al., 2008; Lehto & Cimprich, 1999), the current study employed only the AFI. The sample size for the current study was sufficient for the number of predictors tested, although a larger sample would have the potential to identify more predictors and stronger relationships among the variables. The collection of longitudinal data, the avoidance of practice effects by employing a subjective measure of attentional fatigue, and the use of HLM strengthened the results of this study.

The identification of predictors associated with the trajectories of attentional fatigue in women with breast cancer undergoing RT could provide direction for future correlational studies designed to improve the understanding of this symptom, including studies aimed at uncovering genetic factors that might correlate with higher versus lower levels of attentional fatigue. These findings could also inform the modification of the current natural restorative environment intervention to improve attentional fatigue in women with breast cancer undergoing surgery (Cimprich & Ronis, 2003) so that it could be tested in patients undergoing RT.

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Table 1

Potential Predictors of the Intercept (I) and Linear Coefficient (LC) for Attentional Fatigue

Potential Predictors Using Baseline Characteristics	I	LC
Demographic Characteristics		
Age	■	
Children at home	■	
Employment status	■	
Racial group (white/other)		
Lives alone		
Marital status		
Years of education		
Clinical Characteristics		
Body mass index		■
Chemotherapy prior to radiation therapy		
Hormone replacement therapy prior to diagnosis		
Karnofsky Performance Status score		
Lymph node dissection prior to radiation therapy		
Number of comorbidities	■	
Stage of disease		
Total dose of radiation		
Symptoms		
Center for Epidemiologic Studies-Depression scale score	■	■
General Sleep Disturbance Scale score	■	■
Presence of pain		
Spielberger State Anxiety score	■	■
Spielberger Trait Anxiety score	■	■

■ = From the exploratory analysis, this potential predictor had a t-value of ≥ 2.0.

Table 2

Demographic, Clinical, and Symptom Characteristics of the Patients (n=73) at Baseline

	Mean (SD)
Demographic Characteristics	
Age (years)	55.1 (11.0)
Education (years)	16.2 (2.7)
Children at home	22.0%
Employed	45.0%
Racial group	
White	70.0%
Other	30.0%
Lives alone	41.0%
Marital status	
Married/partnered	28.8%
Divorced/separated	30.1%
Other	41.1%
Clinical Characteristics	
Body mass index	27.4 (7.3)
Karnofsky Performance Status score	87.7 (12.4)
Number of comorbidities	5.3 (2.6)
Total dose of radiation therapy (cGys)	5829.0 (438.3)
Chemotherapy prior to radiation therapy	55.0%
Hormone replacement therapy prior to diagnosis	44.0%
Lymph node dissection prior to radiation therapy	49.0%
Stage of disease	
Localized	56.2%
Locally advanced	43.8%
Symptoms	
Attentional Function Index score	6.6 (1.9)
Center for Epidemiologic Studies-Depression scale score	12.0 (9.2)
General Sleep Disturbance Scale score	44.7 (21.7)
Spielberger State Anxiety score	33.7 (12.9)
Spielberger Trait Anxiety score	36.2 (11.3)
Presence of pain	49.3%

Table 3

Hierarchical Linear Model of Attentional Fatigue

	Coefficient (SE)	
Variable	Unconditional Model	Final Model
Fixed effects		
Intercept	6.324 (0.213)**	5.895 (0.193)**
Time[a] (linear rate of change)	0.022 (0.007)*	0.02 (0.006)*
Time invariant covariates		
Intercept: Age		0.036 (0.014)+
Work		0.961 (0.29)*
Number of comorbidities		-0.165 (0.058)*
Spielberger Trait Anxiety score		-0.088 (0.013)**
Linear: Body mass index x time		0.004 (0.001)**
Variance components		
In intercept	3.028**	1.185**
In linear rate	0.002**	0.001**
Goodness-of-fit deviance (parameters estimated)	2229.568 (6)	2157.193 (11)
Model comparison (χ^2 [*df*])		72.375 (5)**

**p < 0.0001, *p < 0.01, +p = 0.014

[a]Time was coded 0 at the time of the simulation visit.

Figure 1

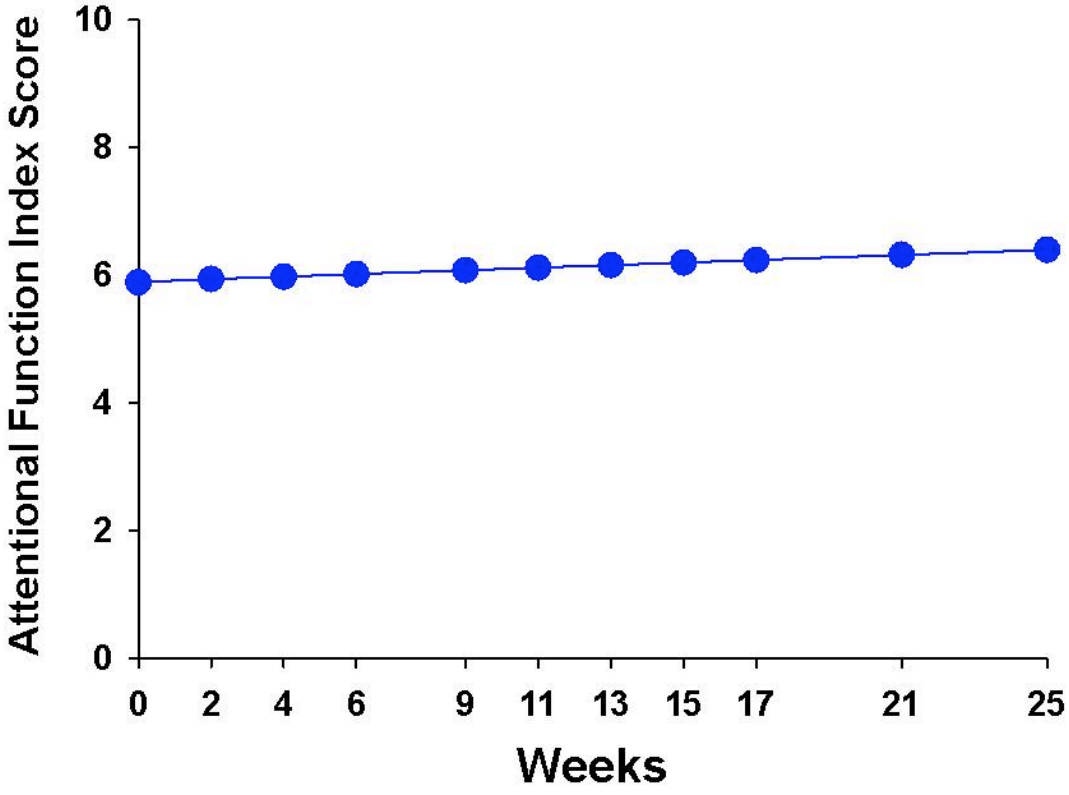

Attentional Function Index Score
10
8
6
4
2
0
0
2
4
6
9
11
13
15
17
21
25
Weeks

Figure 2

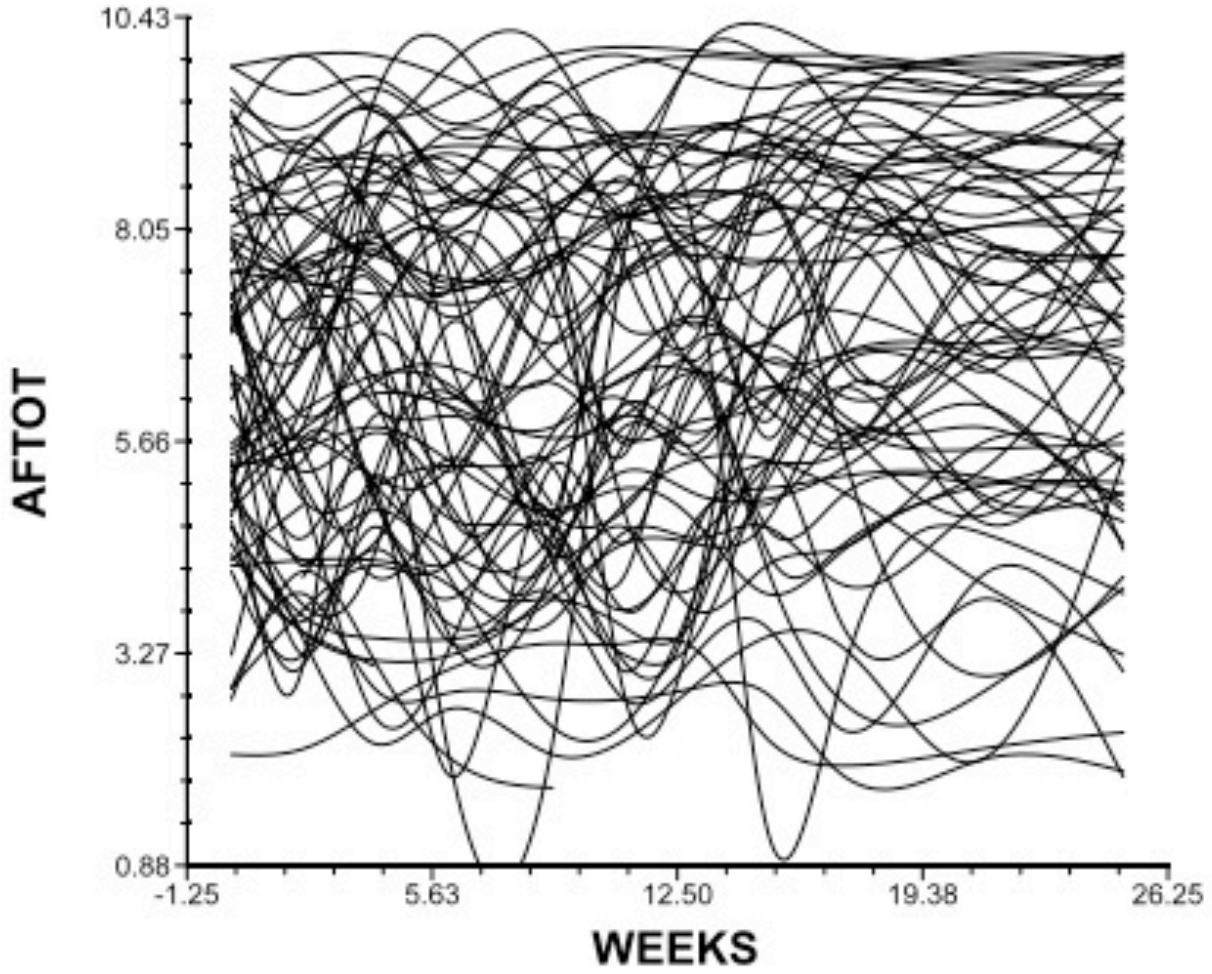


Figure 3

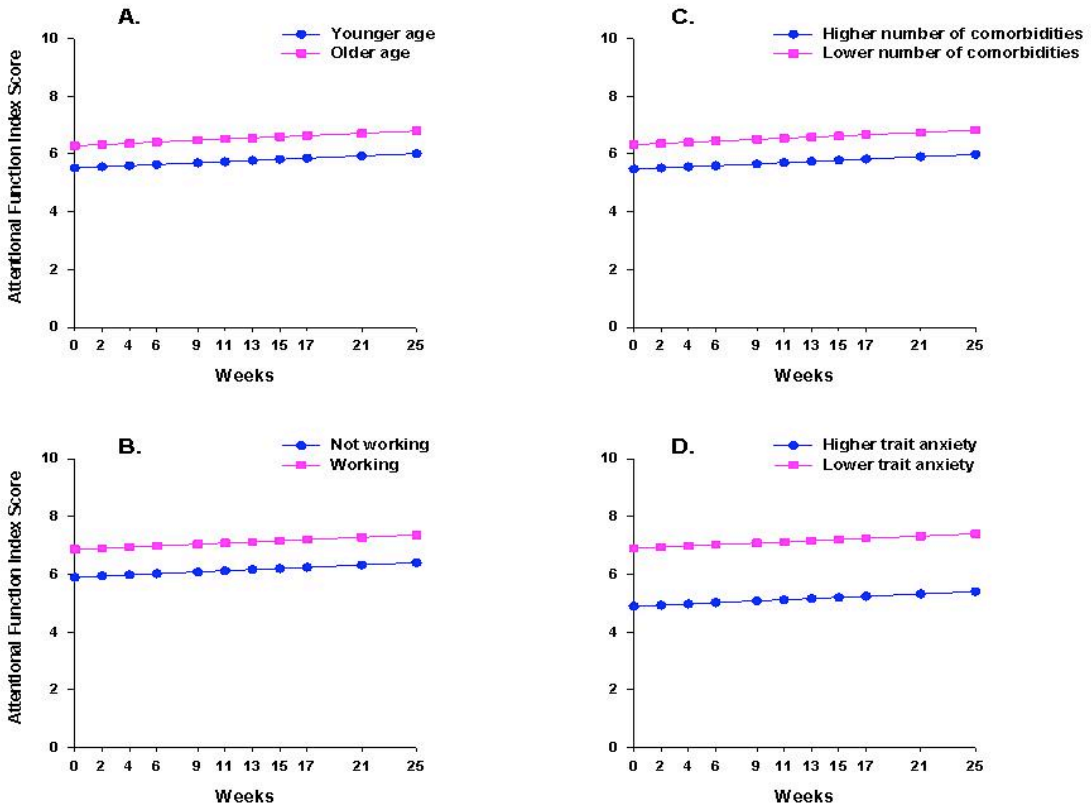
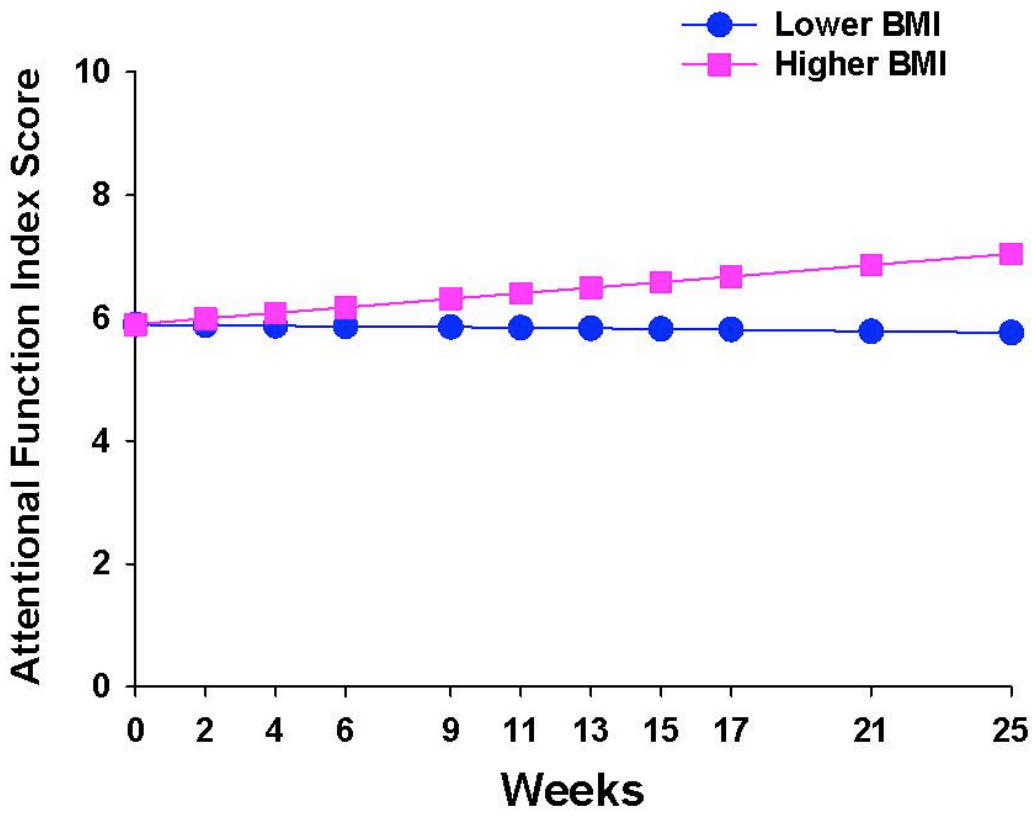

A.
Younger age
Older age
Attentional Function Index Score
Weeks
B.
Not working
Working
Attentional Function Index Score
Weeks
C.
Higher number of comorbidities
Lower number of comorbidities
Weeks
D.
Higher trait anxiety
Lower trait anxiety
Weeks

Figure 4


Lower BMI
Higher BMI
Attentional Function Index Score
10
8
6
4
2
0
0
2
4
6
9
11
13
15
17
21
25
Weeks

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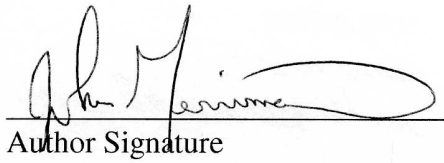

Author Signature

April 9, 2009

Date