Running head: TESTING A THEORETICAL MODEL

Title:

Testing a Theoretical Model of Perceived Self-Efficacy for Cancer-Related Fatigue Self-Management and Optimal Physical Functional Status

Date:

December 3, 2007

Corresponding Author Information

Amy J. Hoffman, PhD, RN
Recent Research Fellow, National Institute of Nursing Research, National Institutes of Health
Doctoral Graduate, College of Nursing, Michigan State University, East Lansing, Michigan
Home Address: 489 Lehigh Drive SE, Ada, Michigan 49301
Telephone Number: 616-682-0289
Email Address: ahoffman32@aol.com

Contributing Author Information

Alexander von Eye, PhD
Professor, Psychology Department
Michigan State University, East Lansing, Michigan

Audrey G. Gift, PhD, RN, FAAN
Professor Emeritus, College of Nursing
Michigan State University, East Lansing, Michigan

Barbara A. Given, PhD, RN, FAAN
University Distinguished Professor, College of Nursing
Michigan State University, East Lansing, Michigan

Charles W. Given, PhD
Professor, Department of Family Practice, College of Human Medicine
Michigan State University, East Lansing, Michigan

Marilyn Rothert, PhD, RN, FAAN
Professor Emeritus, College of Nursing
Michigan State University, East Lansing, Michigan

Acknowledgements

Personal Funding Source: Supported by 1) National Institutes of Health, National Institute of Nursing Research, Individual Ruth L. Kirschstein National Research Service Award, Grant Number 1F31 NR009621-01A1. Project Title: Fatigue, Self-Efficacy, and Functional Status in Persons with Lung Cancer, Principal Investigator Amy Hoffman; 2) Mary Margaret Walther Cancer Research Fellowship. Behavioral Cooperative Oncology Group. Walther Cancer Institute, Indianapolis, Indiana; 3) Blue Cross Blue Shield of Michigan Foundation, Grant Number 1044.SAP. Project Title: Fatigue, Self-Efficacy, and Functional Status in Persons with Lung Cancer, Principal Investigator Amy Hoffman; 4) Sigma Theta Tau International Honor Society of Nursing, Kappa Epsilon Chapter-At-Large, MI. 5) John F. Dunkel Scholarship Award, College of Nursing, Michigan State University, 2003 & 2004.

Data Source: The authors gratefully acknowledge the data source: The Family Home Care for Cancer: A Community-based Model for Symptom Management" (FHCC) project (R01 CA-079280) sponsored by Barbara A. Given, Ph.D., R.N., FAAN, Principal Investigator, and "The Automated Telephone Monitoring for Symptom Management" (ATSM) project (R01 CA-30724) sponsored by Charles W. Given, Ph.D., Principal Investigator.

Abstract

Background: Critical gaps exist in the understanding of cancer symptoms, particularly for cancer-related fatigue (CRF). Existing theories and models do not examine the key role perceived self-efficacy (PSE) plays in a person's ability to manage symptoms.

Objectives: Guided by a synthesis theory derived from the Theory of Unpleasant Symptoms and Bandura's Self-Efficacy Theory, the purpose of this study was to test the hypothesis that physical functional status (PFS) is predicted through patient characteristics, CRF, other symptoms, and PSE for fatigue self-management in persons with cancer.

Methods: This study is a secondary data analysis from the baseline observation of two randomized control trials. The combined data set includes 298 subjects who were undergoing a course of chemotherapy. Key variables included physiological and situational patient characteristics, the severity from CRF and other symptoms, PSE, and PFS. Path analysis examined the relationships among the variables in the proposed theoretical model.

Results: Persons with cancer reported CRF as the most prevalent symptom among a mean of 7.4 other concurrent symptoms. The severity from CRF had a direct and indirect effect on PFS, with CRF having a direct adverse impact on PFS (t = -7.02) and an indirect adverse effect as part of the severity from the other symptoms (t = 9.69) which also adversely impacted PFS (t = -2.71). Consistent with the proposed theoretical model, PSE had a positive effect on the PFS (t = 2.87) of persons with cancer while serving as a mediator between CRF severity and PFS.

Discussion: Findings indicate that CRF is prevalent and related to the presence of other symptoms, and PSE for fatigue self-management is an important factor influencing CRF and PFS. This study provides the foundation for future intervention studies to increase PSE to achieve optimal PFS in persons with cancer.

Key Words: Self-Efficacy; Fatigue; Symptom Self-Management; Cancer; Symptoms; Oncology

In 2007, nearly 1.5 million Americans will learn they have cancer and 600,000 will die from the disease (American Cancer Society, 2007). Consequently, many Americans in 2007 will be living longer with the effects of the disease and its treatment. Regrettably, one of the major effects of cancer and its treatment is the occurrence of multiple symptoms that place persons with cancer at risk for poor outcomes (Miaskowski et al., 2006). Among the multiple concurrent symptoms, fatigue is a highly prevalent and distressing symptom (Gupta, Lis, & Grutsch, 2007). Cancer-related fatigue (CRF) is accompanied by many other severe symptoms that are poorly managed by patients and professionals (Gift, Stommel, Jablonski, & Given, 2003).

Symptoms such as CRF are one of the major determinants of physical functional status (PFS) (Doorenbos, Given, Given, & Verbitsky, 2006; B Given, Given, Sikorskii, & Hadar, 2007). Physical functional status is the physical activity that people accomplish in the normal course of their lives to meet basic needs, fulfill usual roles, and maintain their health and well-being (Leidy, 1994). Research indicates that symptoms such as CRF have an adverse impact on PFS making symptom self-management an important component to maximize PFS (Dodd, Miaskowski, & Paul, 2001; Gift, Jablonski, Stommel, & Given, 2004; B Given, Given, Azzouz, & Stommel, 2001). Symptom management occurs through self-directed action, with perceived self-efficacy (PSE) (perception of ability) being a key factor. In some populations, a positive relationship between a person's PSE and his or her ability to manage symptoms has been shown (Lorig, Ritter, & Plant, 2005). Currently, most CRF management is carried out by patients via self-care strategies (Stone et al., 2003). These strategies are often impacted by the person's level of fatigue and PSE. In order to manage fatigue, it is critical to know what a person thinks of his or her ability to manage fatigue and how it impacts their self-directed action. Perceived self-efficacy forms the basis of any decision to act, the course of action selected, the degree of effort

exerted, and the perseverance to continue in the face of adversity (Bandura, 1997). Thus, the ability to exercise control over self-directed action is fundamental to symptom self-management and other actions characteristic of living with a life threatening chronic illness such as cancer.

Experts agree there are critical gaps in knowledge of CRF management and CRF research should focus on CRF interventions to understand the mediating mechanisms of CRF (Ahlberg, Ekman, Gaston-Johansson, & Mock, 2003; Mock, 2004). Existing models and theories provide insight into factors necessary for the successful management of symptoms but do not address the important role PSE plays in a person's ability to self-manage symptoms (Dodd, Janson et al., 2001; Lenz, Pugh, Milligan, Gift, & Suppe, 1997). Using mesh terms, keywords and thesaurus terms via PubMed, MEDLINE, CINAHL, and PsycINFO (i.e., fatigue, symptoms, self-efficacy, and cancer), no studies have been conducted on the role PSE plays in the self-management of fatigue and other associated symptoms to achieve optimal PFS for the cancer population. The purpose of this study is to examine the relationships between CRF, PSE for fatigue management, and PFS for persons with cancer to extend the science by providing data that currently is not available. Consequently, this study will provide the foundation for future intervention studies to increase PSE to achieve optimal CRF self-management and PFS in persons with cancer.

Theoretical Framework

This study was guided by a synthesis of the Theory of Unpleasant Symptoms (TOUS) and Bandura's Self-Efficacy Theory. The theoretical framework provides insight into how a person's belief (PSE) in their ability to manage their symptoms influences their performance of those behaviors. In order to understand what influences symptom self-management one must understand the factors that affect symptoms. The TOUS sheds light on this by exposing the

multidimensional nature and impact of symptoms (Lenz et al., 1997). Patient and symptom characteristics and symptom interactions all have an affect on a patient's PFS. Bandura's Self-Efficacy Theory posits that PSE serves as a mediator between symptoms and PFS (1997). According to Bandura, PSE is a person's perception of ability to implement behaviors to manage his or her symptoms such as CRF. Perceived self-efficacy is specific to each behavior or situation and this study focuses on PSE to manage CRF. Once multiple facets of symptoms such as CRF and the role PSE plays in symptom self-management are understood, symptom self-management strategies can be derived and tailored to enhance PSE and ultimately PFS.

Research Hypotheses Related to the Theoretical Model

Figure 1 depicts the hypothesized theoretical model for this study. Current literature provides limited evidence of the etiology of CRF in the cancer population (National Comprehensive Cancer Network, 2007). While patient characteristics likely influence other symptoms from cancer and its treatment, this study is focused on identifying patient characteristics that affect CRF. Physiological and contextual characteristics are hypothesized to influence CRF (Hypothesis 1). During the course of their illness and treatment trajectory, persons with cancer present with CRF and other concurrent symptoms. The concurrence of symptoms are likely to catalyze each other worsening the level of symptom severity (Lenz et al., 1997). Consequently, a reciprocal relationship is hypothesized to occur between CRF severity and average symptom severity (Hypothesis 2). A contributing factor to the achievement of CRF self-management to attain maximum PFS may be a person's PSE. Investigations substantiate that PSE plays a central role in producing positive outcomes in symptom self-management and functional ability in persons living with chronic conditions (Lorig et al., 2005; Motl, Snook, McAuley, & Gliottoni, 2006). Few studies have been conducted relative to PSE and symptom

management in the cancer population, and those that have indicate that increased PSE has a positive impact on the lives of persons with cancer (Eller et al., 2006; Lev et al., 2001; Weber et al., 2004). Moreover, although limited research exists describing the relationship between fatigue and PFS in persons with cancer, studies have documented that increased CRF contributes to decreased PFS (B. Given et al., 2001; C Given, Given, Stommel, & Kozachik, 2000). Therefore, PSE for fatigue self-management is hypothesized to mediate the relationship between CRF and PFS with PSE having a positive effect on PFS (Hypothesis 3).

Methods

Design and Sample

Secondary analysis was conducted using data from two National Cancer Institute sponsored randomized control trials (RCTs) of persons with cancer (B. Given, 1998-2007; C. Given, 2003-2007). This secondary analysis employed a descriptive design using data from the two RCTs' baseline measures collected prior to any intervention. The sample ($N = 298$) included persons with breast ($n = 105$), lung ($n = 63$), colon ($n = 44$), and other sites of cancer diagnoses ($n = 86$). Study participants were at least 21 years old and undergoing a course of chemotherapy with at least two cycles remaining at time of enrollment for a new or recurrent diagnosis of breast, colorectal, or lung cancer, and other solid tumors and non-Hodgkin's lymphoma, and may have been receiving concurrent radiation therapy. Persons had to be cognitively intact, English speaking, able to conduct telephone interviews, and not receiving hospice care. Specific inclusion criteria for the Family Home Care for Cancer: A Community-based Model for Symptom Management included reaching a symptom severity threshold of 2 out of 10 (10 most severe) for both pain and fatigue or 3 out of 10 on either pain or fatigue. Specific inclusion criteria for the Automated Telephone Monitoring for Symptom Management required a symptom

severity threshold of 2 out of 10 for at least 1 of 16 possible symptoms related to cancer and its treatment. This secondary analysis was approved by the Michigan State University Institutional Review Board for the protection of human subjects.

Measures

Measures for key variables are presented and organized according to the hypothesized theoretical model and include: physiological and contextual patient characteristics; symptoms; PSE for fatigue self-management; and PFS (see Figure 1).

Physiological and Contextual Patient Characteristics

Most patient characteristics were collected in the original study through a demographic questionnaire and medical records. Twenty-five patient characteristics were included in the hypothesized theoretical model.

Physiological patient characteristics included type and stage of cancer, treatment information, co-morbid conditions, sex, and age. For the purpose of this analysis, type of cancer was coded into two groups, lung cancer and other cancer diagnoses. Stage of cancer was classified according to the tumor-node-metastasis staging system of the American Joint Committee on Cancer. For small cell lung cancer, a two-staged system was used: limited or extensive. The study's researchers combined and coded stages 0-II and limited stage into the early stage, and stages III-IV and extensive stage as late stage. Treatment information included radiation therapy and two surgery variables: surgery prior and surgery during. Radiation therapy was coded into two groups (receiving and not receiving). Surgery prior means surgery occurred anytime prior to chemotherapy and may or may not be related to this episode of cancer and was coded into four groups (yes had surgery; don't know if had surgery; this response choice was not selected; no surgery). Surgery during means that surgery occurred during chemotherapy between the time of

consent and the last interview and was coded into three groups (yes had surgery; this response choice was not selected; no surgery). Co-morbid conditions were assessed using a modified version of the Comorbidity Questionnaire (Katz, Chang, Sangha, Fossel, & Bates, 1996), which inquires about the presence of 15 chronic health conditions. For the purposes of this analysis, co-morbid conditions scores were divided into two groups: fewer than two co-morbid conditions, and two or more co-morbid conditions. The Comorbidity Questionnaire has established content validity and test-retest reliability.

Contextual patient characteristics included race, marital status, level of education, income, employment and health insurance information. For the purpose of this analysis, race was coded into two groups (majority and minority); marital status coded into married and not married; employment data included whether a person was retired, receiving disability, was on a temporary leave; and whether they had to quit employment; health insurance held was coded in three groups (private, Medicare, or Medicaid); and health insurance policy holder status was coded in three groups (patient, spouse, or no policy).

Symptoms

Cancer-related fatigue. The Brief Fatigue Inventory (BFI) is a 9-item measure that focuses on the assessment of CRF severity. Substantial evidence supports the psychometrics of the BFI in the cancer population (Mendoza et al., 1999). For this study, two items (patient's current and worst severity of CRF within the past seven days) from the BFI were used to calculate a CRF severity score (0-10, 10 most severe). Current and worst fatigue severity were used since these observations were identically distributed and this condition ensures that all the data are similar and addressing the same effects (Wickens, 1989). The CRF severity score was calculated by summing each subject's response for both CRF severity items and dividing by two to standardize

the score on an 11-point scale. Internal consistency for the two items for the CRF severity score in this study was Cronbach's α 0.85.

Other symptoms. The Symptom Experience Inventory is a self-report measure of 16 symptoms related to cancer and its treatment (B Given et al., 2002). On an 11-point scale (0-10, 10 most severe), patients were asked to rate the current severity of each of the symptoms. For this study, evaluation of internal consistency reliability resulted in a Cronbach's α of 0.72. The average symptom severity was calculated by summing each subject's severity scores for each symptom reported and dividing by the number of symptoms reported to standardize the score on an 11-point scale. The average symptom severity score did not include the symptom of fatigue.

Perceived Self-efficacy for Fatigue Self-Management

Review of the literature found no existing tool to measure PSE for fatigue self-management in persons with cancer. A 6-item subscale adapted from the Lorig Arthritis Self-Efficacy Scale (ASE) was developed to measure PSE for fatigue self-management. Lorig created the ASE to measure persons' PSE to cope with the symptoms of arthritis. The ASE has a 3-factor solution accounting for 61% of the variance in PSE. Internal coefficient alphas for each of the subscales (n = 143) have been reported as 0.76 for pain management, 0.89 for physical functioning, and 0.87 for coping with other symptoms (Lorig, Chastain, Ung, Shoor, & Holman, 1989).

The Coping with Other Symptoms Lorig subscale was chosen and modified to focus on fatigue by replacing other identified symptoms with fatigue to create the PSE for Fatigue Self-Management Scale (PSEFSMS). The PSEFSMS is a self-report measure containing 6-items related to PSE for fatigue self-management. On an 11-point scale (0-10, 10 very certain) respondents rated their certainty in performing fatigue managing behaviors. Content validity for

the PSEFSMS was evaluated by nurse experts experienced in CRF management. For this study, evaluation of the internal consistency reliability resulted in a Cronbach's α of 0.92.

Physical Functional Status

The outcome, PFS, was measured using the 10-item physical functioning subscale of the Medical Outcomes Study 36-Item Short Form Health Survey (Ware, Snow, Kosinski, & Gandek, 1993). The items capture the extent of PFS using a 3-point Likert-type scale, summed, and then transformed to a 0-100 scale, with higher scores indicating greater PFS. This measure has been used extensively in populations with chronic illness and has provided evidence of psychometric soundness. In this study, the internal consistency reliability value is a Cronbach's α of 0.91.

Data Analysis

An estimation algorithm employing the maximum likelihood factor of covariance was used for missing value analysis (von Eye & Schuster, 1998). A cut-off point determined at 50% or less missing cases per variable was used to estimate incomplete data yielding 100% complete cases on data analyzed. For this study, 2.9% of the data incurred missing values requiring estimation and imputation. Descriptive statistics and Cronbach's α of the main study variables are presented in Table 1. Correlations among the main study variables are presented in Table 2. The hypothesized theoretical model was examined using an exogenous-endogenous non-recursive path model to test the hypothesis that PFS for persons with cancer is predicted through patient characteristics, CRF severity, other symptoms, and PSE for fatigue self-management. This approach was selected because it simultaneously examines multiple hypothesized paths of influence and can provide global indices of the fit between the data and the hypothesized theoretical model (Raykov & Marcoulides, 2006). This incorporated a sequence of predictions tested through a path model via LISREL Version 8.72 statistical software package.

All analyses were conducted using the Satorra-Bentler Robust Maximum Likelihood Method of parameter estimation to adjust model chi-square for non-normally distributed variables. Since multiple models were tested and decisions about the parameters were made based on earlier statistical results, the chi-square statistic may not approximate the chi-square distribution properly and the standard errors estimated for the confidence intervals can be underestimated. Therefore, the weight placed on the chi-square statistic was small, and several other model fitting measures were used to attain a parsimonious final solution (Raykov & Marcoulides, 2006). The Satorra-Bentler Scaled chi-square reflects the degree of discrepancy between the observed covariance matrix derived from the data and that predicted by the model. A well fitting model is one where the resulting chi-square value is small and not significant. The Root-Mean Square Error of Approximation (RMSEA) provides an estimate of the average absolute discrepancy between the model covariance estimates and the observed covariances. RMSEA values ≤ 0.05 indicate close fit with a value of zero indicating the exact fit. The 90% confidence intervals (CI) for population parameters estimated by the RMSEA reflects the degree of uncertainty associated with RMSEA as a point estimate at the 90% level of statistical confidence. If the lower bound of a 90% CI is ≤ 0.05, the model has close fit in the population. The Comparative Fit Index (CFI) was used indicating the amount of covariation in the data that can be reproduced by a given model. A CFI value above 0.90 indicates good model fit. The Goodness-of-Fit Index (GFI) is the percent of observed covariances explained by the covariances implied by the model. A GFI = 1.0 indicates perfect model fit with a GFI > 0.90 indicating a good fit. Last, the Akaike Information Criteria (AIC) is a parsimony adjusted index used to select among competing models favoring simpler models where the lower AIC reflects the better fitting model. In the final parsimonious model, the chi-square difference statistic was used to evaluate the mediating role of PSE for

fatigue self-management and the average severity of the other symptoms in the relationship between CRF severity and PFS (Raykov & Marcoulides, 2006). The chi-square difference statistic can be used to determine whether two nested models differ in their model fit. Following the suggestions of Baron and Kenny (1986), the model that included both the direct and indirect paths from CRF severity to PFS was compared with the model where the direct path from CRF severity to PFS was constrained to zero.

Results

Patient Characteristics

The analysis was completed on 298 persons with cancer. Table 3 depicts physiological and contextual patient characteristics. Participants ranged in age from 25 to 90 years with a mean of 57 years; 70% were men; 87% were Caucasian; and 69% were married. The majority of participants had completed some college education and had an annual combined income of $50,000 to $74,999. The median number of co-morbid conditions per participant was two, with hypertension (45%), emotional problems (28%), and other major health problems (21%) accounting for the majority of co-morbid conditions. Most were diagnosed with late-stage cancer (74%), and had a surgery anytime prior to receiving chemotherapy (62%).

Symptoms

Data indicate a high number of concurrent symptoms in persons with cancer with a mean of 7.4 symptoms (*SD* = 2.60). Fatigue was the most prevalent symptom occurring 100% of the time over the past seven days prior to the baseline interview followed by insomnia (77%), lack of appetite (63%), weakness (60%), dry mouth (60%), pain (55%), and nausea (53%). Out of 16 symptoms, alopecia was the most severe (*M* = 5.77; *SD* = 3.24) followed by insomnia (*M* = 5.40; *SD* = 2.63), vomiting (*M* = 5.29; *SD* = 2.97), constipation (*M* = 5.26; *SD* = 2.81), and fatigue (*M*

= 5.23; *SD* = 2.33) (see Table 4). Considering the top five most prevalent symptoms for all persons with cancer, fatigue was the most severe. The average symptom severity score for persons with cancer was 4.64 (*SD* = 1.58) which positively correlated with CRF severity (*r* = .51; *p* = .000).

Testing the Fit of the Hypothesized Theoretical Model

Patient characteristics included in the hypothesized theoretical model were refined by combining bivariate and multiple regression analyses (inclusion criterion set a $p < .20$) with an evaluation of each characteristic's merit based on past research and theory. These criteria were chosen to retain as many patient characteristics as possible since they could be significant in the final analyses of theory testing. As a result, 16 patient characteristics to the prediction of CRF severity were retained. Next, the exogenous-endogenous model was tested to examine the overall fit. While the solution converged, the fit of the model was not acceptable (X^2 = 185.5; *p* = 0.00; *df* = 50; RMSEA = .098; the lower bound 90% CI = 0.074; CFI = 0.92; GFI = 0.95; and AIC = 482). The model was improved by removing non-significant paths one at a time and by including paths that had not been taken into account in the first solution. Both removing and including paths were based on evaluation of parameter estimates, modification indexes, goodness-of-fit tests, past research, and theoretical considerations.

Figure 2 depicts the direct and indirect paths in the final parsimonious theoretical model with the fitting measures indicating a good fit, improved over the original model (X^2 = 17.76; *p* = .22; *df* = 14; RMSEA = .03; the lower bound 90% CI = 0.00; CFI = .99; GFI = 0.99; and AIC = 79). The direct paths demonstrate the following for persons with cancer: younger age (*t* = -2.18), greater number of co-morbid conditions (*t* = 3.36), and being female (*t* = 2.11) predicts greater CRF severity. Having surgery anytime prior to chemotherapy (*t* = -2.85) predicts greater average

severity of the other symptoms. Greater CRF severity predicts both greater average severity of the other symptoms (t = 9.69) and lower PSE for fatigue self-management (t = -7.02). Greater PSE for fatigue self-management predicts greater PFS (t = 2.87). Last, more co-morbid conditions (t = -7.47), greater CRF severity (t = -5.30) and greater average severity of the other symptoms (t = -2.71) predicted lower PFS. Moreover, two indirect paths from CRF severity to PFS were identified (t = -3.61), including PSE for fatigue self-management as originally hypothesized in the model, and the average severity of the other symptoms which was not hypothesized a priori. The significance of the mediating variables was evaluated using the chi-square difference test. The difference between the constrained model and the model of partial mediation was significant ($\Delta\chi^2 = 27.81$; 2 *df;* $p < 0.001$). Therefore, the model of partial mediation was retained. Last, two nonsignificant paths were retained, the effects of stage of cancer (t = 1.95) and having surgery anytime prior to chemotherapy (t = 1.60) on CRF severity because the model was significantly worse without these two paths.

Discussion

This study extends the literature by examining the patient characteristics related to CRF severity to optimize PFS, and whether PSE for fatigue self-management mediates the relationship between CRF and PFS. This is one of the first studies of the cancer population to demonstrate the beneficial effect that PSE has on symptom self-management and PFS providing a clearer picture of the CRF experience.

Hypothesis 1. Patient Characteristics Influence CRF

Path analysis revealed that specific patient characteristics related directly to CRF severity. Greater CRF severity was predicted by younger age, greater number of co-morbid conditions, and being a woman. This study's findings are similar to Degner and Sloan (1995) who found that

younger age related to higher symptom distress in newly diagnosed persons with cancer which researchers of this study and Degner and Sloan noted was counterintuitive. Further study is needed to explore what contributes to greater fatigue in younger persons with cancer. This study also found that persons with two or more co-morbid conditions were nearly twice as likely to have a higher level of CRF severity. This parallels prior research where the number of co-morbid conditions influenced CRF (C Given, Given, Azzouz, Kozachik, & Stommel, 2001; Reyes-Gibby, Aday, Anderson, Mendoza, & Cleeland, 2006). Further study is needed to determine if specific co-morbid conditions contribute to fatigue or if the presence of additional symptoms from co-morbid conditions catalyzes the effects of symptoms from cancer and cancer treatment. Understanding the effects of co-morbid conditions on a patient's ability to achieve symptom management is essential to optimize PFS. This study found that sex predicted greater CRF severity as women were twice as likely to experience CRF severity at levels of 7 to 10 (1-10 scale, 10 most severe). Further sex-based symptom research is required.

Path analysis also demonstrated that patient characteristics affected two endogenous variables not accounted for in the hypothesized model, average severity of the other symptoms and PFS. First, having surgery anytime prior to chemotherapy predicted greater average severity of the other symptoms. Both Cooley et al. (2002) and C. Given et al. (2000) have reported that in persons with cancer, patterns of symptom distress varied among cancer treatment, including surgery. Moreover, C. Given and colleagues (2000) found that symptoms did not simply mediate between treatments and patient functioning but produced a significant effect that was independent of treatment with each additional symptom associated with a decline in PFS. The results from the current path analysis provides direction for future research since average symptom severity was heightened from the direct influence of the severity of CRF and from

undergoing surgery anytime prior to chemotherapy. Second, greater co-morbid conditions predicted lower PFS which is consistent with studies that showed within varied cancer populations that patients with greater co-morbid conditions scored lower in PFS (B. Given et al., 2001; C Given et al., 2000). Note that co-morbid conditions have a direct effect on PFS and an indirect effect on PFS through its influence on the severity of CRF.

Hypothesis 2. CRF and the Other Unpleasant Symptoms are Reciprocally Related

The final model revealed that the relationship between CRF and the other unpleasant symptoms was not reciprocal with only CRF affecting the other unpleasant symptoms. Parallel to the TOUS, symptoms interact and create a catalyzing effect having a resultant effect on critical patient outcomes. Gaps in multi-symptom relationships or symptom clusters exist. Not all symptoms are equal in importance and there is a need to identify priority symptoms that may dominate and trigger the experience of multi-symptom relationships to optimize symptom management (Barsevick, 2007; Gift, 2007). Researchers found that cancer patients who experienced fatigue reported an average of 4.4 other symptoms (C. Given et al., 2001). This study identifies CRF as a priority symptom associated with greater levels of average symptom severity of the other unpleasant symptoms leading to lower PFS.

Hypothesis 3. PSE for Fatigue Self-Management Mediates Between CRF Severity and PFS

The severity from CRF indirectly and directly impacts PFS in persons with cancer. The indirect path is a unique finding showing that PSE for fatigue self-management mediates CRF severity and PFS in persons with cancer as greater CRF severity predicted lower PSE for fatigue self-management, and greater PSE for fatigue self-management predicted greater PFS. Cancer-related fatigue severity was also found to directly lower PFS and indirectly lower PFS via its direct effect on average severity of the other symptoms lowering PFS for persons with cancer.

Limitations

This secondary analysis was obtained data from two RCTs, one required the presence of either high pain or fatigue while the other required the presence of one symptom. The exact date of onset of chemotherapy as well as the exact date of a surgical procedure was not included in this current requested dataset as a part of a de-identification protocol. The variables "surgery prior" and "surgery during" chemotherapy refer to a wide variety of procedures that may or may not be related to cancer treatment. The study used a cross-sectional design and the measurement within this design was bounded by all persons diagnosed with cancer undergoing chemotherapy with at least two cycles remaining at the time of enrollment.

Implications for Practice and Research

This study extends the science by providing new data showing a relationship between CRF, PSE for fatigue self-management, and PFS in persons with cancer. The findings indicate that CRF severity impacts average symptom severity which adversely impacts PFS; CRF severity directly worsens PFS; and PSE is an important factor in optimizing CRF self-management and PFS. Thus, the findings reveal that in order to optimize PFS for persons with cancer, CRF self-management and PSE for fatigue self-management should be included in the treatment plan.

Empowering persons with cancer to increase PSE is important to optimize self-management of symptoms and achieve optimal PFS. The nurse in partnership with the patient can implement any one or a combination of PSE for fatigue self-management interventions which include direct mastery experiences, vicarious experiences, use of social and verbal persuasion, and interpreting inferences from physiological and psychological states indicative of personal strengths and vulnerabilities to reach goals (Bandura, 1997). Through the use of PSE enhancing fatigue self-management interventions, nurses can equip the patient to manage CRF and optimizing PFS.

This study also identified patient characteristics that may be labeled as risk factors to CRF and other symptoms leading to decreased PFS. Knowledge of which patient characteristics predict CRF and other symptoms provides a risk profile to pre-empt the development of higher levels of CRF and other symptoms that decrease PFS.

One important finding of this study was that CRF severity was found to directly influence PFS and indirectly influence PFS through its effect on PSE for fatigue self-management. As a result, the findings from this analysis provides a platform for further research to develop efficacy enhancing interventions to optimize symptom control and PFS by addressing CRF severity and PSE for fatigue self-management. In addition, path analysis revealed that CRF severity impacts PFS indirectly as an influencer of the average severity of the other symptoms. Further research examining multi-symptom relationships stemming from CRF would provide a comprehensive approach to symptom self-management and optimization of PFS in persons with cancer.

Conclusion

The theoretical framework presented was developed with the goal of elucidating the mediating mechanism of CRF in order to provide insight into how a person's PSE to manage CRF influences ability to manage CRF. This was accomplished by identifying age, co-morbid conditions, sex, and having surgery anytime prior to chemotherapy as important risk factors in the CRF experience. Additionally, CRF severity was found to directly and adversely impact the average symptom severity of other symptoms as well as PFS. Moreover, PSE for fatigue self-management was found to positively influence the impact of CRF on PFS. Knowledge generated from this study provides the foundation for partnerships in practice and research to increase PSE to achieve optimal symptom self-management and PFS in persons with cancer.

References

Ahlberg, K., Ekman, T., Gaston-Johansson, F., & Mock, V. (2003). Assessment and management of cancer-related fatigue in adults. The Lancet, 362, 640-640.

American Cancer Society. (2007). Facts and figures 2007. Retrieved January 22, 2007, from http://www.cancer.org/docroot/home/index.asp

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: Freeman.

Baron, R., & Kenny, D. (1986). The moderator-mediator variable distinction in social-psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology, 51, 1173-1182.

Barsevick, A. (2007). The concept of symptom cluster. Seminars in Oncology Nursing, 23, 89-98.

Cooley, M., Short, T. H., & Moriarty, H. (2002). Patterns of symptom distress in adults receiving treatment for lung cancer. Journal of Palliative Care, 18, 150-159.

Degner, L. F., & Sloan, J. A. (1995). Symptom distress in newly diagnosed ambulatory cancer patients and as a predictor of survival in lung cancer. Journal of Pain and Symptom Management, 10, 423-431.

Dodd, M., Janson, S., Facione, N., Faucett, J., Froelicher, E., Humphreys, J., et al. (2001). Advancing the science of symptom management. Journal of advanced nursing, 33, 668-676.

Dodd, M., Miaskowski, C., & Paul, S. (2001). Symptom clusters and their effect on the functional status of patients with cancer. Oncology Nursing Forum, 28, 465-470.

Doorenbos, A., Given, B., Given, C., & Verbitsky, N. (2006). Physical functioning: Effect of behavioral intervention for symptoms among individuals with cancer. Nursing Research, 55, 161-171.

Eller, L., Lev, E., Gejerman, G., Colella, J., Esposito, M., Lanteri, V., et al. (2006). Prospective study of quality of life of patients receiving treatment for prostate cancer. Nursing Research, 55(2S), S28-S36.

Gift, A. (2007). Symptom clusters related to specific cancers. Seminars In Oncology Nursing, 23, 136-141.

Gift, A., Jablonski, A., Stommel, M., & Given, C. (2004). Symptom clusters in elderly patients with lung cancer. Oncology Nursing Forum, 31, 203-212.

Gift, A., Stommel, M., Jablonski, A., & Given, C. (2003). A cluster of symptoms over time in patients with lung cancer. Nursing Research, 52, 393-400.

Given, B. (1998-2007). The Family Home Care for Cancer: A Community-based Model for Symptom Management (R01 CA-079280).

Given, B., Given, C., Azzouz, F., & Stommel, M. (2001). Physical functioning of elderly cancer patients prior to diagnosis and following initial treatment. Nursing Research, 50, 222-232.

Given, B., Given, C., McCorkle, R., Kozachik, S., Cimprich, B., Rahbar, M., et al. (2002). Pain and fatigue management: Results of a nursing randomized clinical trial. Oncology Nursing Forum, 29, 949-956.

Given, B., Given, C., Sikorskii, A., & Hadar, N. (2007). Symptom clusters and physical function for patients receiving chemotherapy. Seminars In Oncology Nursing, 23, 121-126.

Given, C. (2003-2007). The Automated Telephone Information and Monitoring of Symptoms (R01 CA-30724).

Given, C., Given, B., Azzouz, F., Kozachik, S., & Stommel, M. (2001). Predictors of pain and fatigue in the year following diagnosis among elderly cancer patients. Journal of Pain and Symptom Management, 21, 456-466.

Given, C., Given, B., Stommel, M., & Kozachik, S. (2000). Comparison of changes in physical functioning of elderly patients with new diagnoses of cancer. Medical Care, 38, 482-493.

Gupta, D., Lis, C., & Grutsch, J. (2007). The relationship between cancer-related fatigue and patient satisfaction with quality of life in cancer. Journal of Pain and Symptom Management, 34(1), 40-47.

Katz, J., Chang, L., Sangha, O., Fossel, A., & Bates, D. (1996). Can co-morbidity be measured by questionnaire rather than medical record review? Medical Care, 34, 73-84.

Leidy, N. (1994). Functional status and the forward progress of merry-go-rounds: Toward a coherent analytical framework. Nursing Research, 43(4).

Lenz, E., Pugh, L., Milligan, R., Gift, A., & Suppe, F. (1997). The middle-range theory of unpleasant symptoms: An update. Advances in Nursing Science, 19, 14-27.

Lev, E., Daley, K., Conner, N., Reith, M., Fernandez, C., & Owen, S. (2001). An intervention to increase quality of life and self-care self-efficacy and decrease symptoms in breast cancer patients. Scholarly Inquiry for Nursing Practice: An International Journal, 15, 277-294.

Lorig, K., Chastain, R. L., Ung, E., Shoor, S., & Holman, H. (1989). Development and evaluation of a scale to measure perceived self-efficacy In people with arthritis. Arthritis and Rheumatism, 32(1), 37-44.

Lorig, K., Ritter, P., & Plant, K. (2005). A disease-specific self-help program compared with a generalized chronic disease self-help program for arthritis patients. Arthritis and Rheumatism, 53, 950-957.

Mendoza, T., Wang, S., Cleeland, C., Morrissey, M., Johnson, B., Wendt, J., et al. (1999). The rapid assessment of fatigue severity in cancer patients: Use of the brief fatigue inventory. Cancer, 85, 1186-1196.

Miaskowski, C., Cooper, B., Paul, S., Dodd, M., Lee, K., Aouizerat, B., et al. (2006). Subgroups of patients with cancer with different symptom experiences and quality-of-life outcomes: A cluster analysis. Oncology Nursing Forum, 33, E79-89.

Mock, V. (2004). Evidence-based treatment for cancer-realted fatigue. Journal of the National Cancer Institute Monographs, 32, 112-118.

Motl, R., Snook, E., McAuley, E., & Gliottoni, R. (2006). Symptoms, self-efficacy, and physical activity among individuals with multiple sclerosis. Research in Nursing and Health, 29, 597-606.

National Comprehensive Cancer Network. (2007). NCCN clinical practice guidelines in oncology: Cancer-related fatigue version 2.2007. Retrieved July 30, 2007, from http://www.nccn.org/professionals/physician_gls/PDF/fatigue.pdf

Raykov, T., & Marcoulides, G. (2006). A first couse in structural equation modeling (2nd ed.). Mahwah: Lawrence Erlbaum Associates, Inc.

Reyes-Gibby, C., Aday, L., Anderson, K., Mendoza, T., & Cleeland, C. (2006). Pain, depression, and fatigue in community-dwelling adults with and without a history of cancer. Journal of Pain and Symptom Management, 32, 118-128.

Stone, P., Ream, E., Richardson, A., Thomas, H., Andrews, P., Campbell, P., et al. (2003). Cancer-related fatigue--a difference of opinion? Results of a multicentre survey of healthcare professionals, patients and caregivers. European Journal of Cancer Care, 12, 20-27.

von Eye, A., & Schuster, C. (1998). Regression analysis for social sciences. San Diego, CA: Academic Press.

Ware, J. E., Snow, K. K., Kosinski, M., & Gandek, B. (1993). SF-36 Health Survey: Manual and interpretation guide. Boston, MA: Nimrod Press.

Weber, B., Roberts, B., Resnick, M., Deimling, G., Zauszniewski, J., Musil, C., et al. (2004). The effect of dyadic intervention on self-efficacy, social support, and depression for men with prostate cancer. Psycho-Oncology, 13, 47-60.

Wickens, T. (1989). Multiway contingency tables analysis for social sciences. Hillsdale: Lawrence Erlbaum Associates.

Table 1

Descriptive Statistics for the Main Study Variables ($N = 298$)

Measure	*n*	*M (SD)*	Potential Range	Internal Consistency Cronbach's alpha
Age	298	57.10 (11.88)	≥ 21	---
Co-morbid Conditions	298	2.02 (1.59)	0-15	---
Cancer-Related Fatigue Severity	298	5.84 (2.23)	0-10	.85
Total Symptom Severity	296	4.64 (1.58)	0-10	.72
Perceived Self-Efficacy for Fatigue Self-Management	298	6.43 (2.25)	0-10	.92
Physical Functional Status	298	58.10 (27.10)	0-100	.91

Table 2

Bivariate Correlations of the Main Study Variables

Variables	1	2	3	4	5	6	7	8	9
1. Age	1.00								
2. Co-morbid Conditions	.41**	1.00							
3. Sex	-.12*	-.06	1.00						
4. Cancer Stage	-.10	.01	.22**	1.00					
5. Surgery anytime prior to chemotherapy	.01	-.08	.10	.16*	1.00				
6. CRF Severity	-.08	.14*	.15**	.15*	.04	1.00			
7. Total Symptom Severity	-.03	.09	.00	.02	-.12*	.51**	1.00		
8. PSE for Fatigue Self-Management	.06	-.06	-.13*	-.09	.07	-.39**	-.14*	1.00	
9. Physical Functional Status	-.16**	-.38**	-.11	-.02	-.02	-.50**	-.36**	.32**	1.00

*p < .05 (2-tailed). **p < .01 (2-tailed). Note CRF = Cancer-Related Fatigue; PSE = Perceived Self-Efficacy.

Table 3

Physiological and Contextual Patient Characteristics ($N = 298$)

Characteristics	*n*	%
Gender		
Men	89	30
Women	209	70
Race		
Caucasian	259	87
Other	39	13
Marital Status		
Married	205	69
Not married	93	31
Education Completed		
Less than high school	30	10
High school	73	24
Some college/Technical training	86	30
College	60	20
Graduate/Professional	49	16
Annual Household Income		
< $24,999	43	15
$25,000-$49,999	77	26
$50,000-$74,999	84	28
$75,000-$99,999	34	11

Table 3 (Continued).

Characteristics	n	%
> $100,000	60	20
Co-morbid Conditions		
Hypertension	134	45
Emotional problems	82	28
Other major health problems	61	21
Other cancer	58	20
Heart problem	52	17
Loss of urine beyond control	48	16
Diabetes	41	14
Cataract surgery	30	10
Arthritis	29	10
Emphysema	28	9
Wear a hearing aid	15	5
Surgical replacement of joint	11	4
Stroke	6	2
Angina	7	2
Fractured hip	1	--
Stage of cancer		
Early	78	26
Late	220	74

Table 4

Most Frequent and Most Severe Symptoms ($N = 298$)

Symptom	Frequency		Severity	
	Rank	*n* (%)	Rank	*M* (*SD*)
Fatigue	1	298 (100)	5	5.24 (2.33)
Insomnia	2	229 (77)	2	5.54 (2.63)
Lack of Appetite	3	187 (63)	7	5.04 (2.48)
Weakness	4	180 (60)	8	4.84 (2.42)
Dry Mouth	5	178 (60)	9	4.80 (2.60)
Pain	6	164 (55)	10	4.62 (2.27)
Nausea	7	159 (53)	12	4.54 (2.64)
Difficulty Remembering	8	133 (45)	16	3.71 (2.44)
Numbness/Tingling	9	124 (41)	13	4.44 (2.55)
Constipation	10	118 (40)	4	5.26 (2.81)
Dyspnea	11	115 (39)	11	4.59 (2.14)
Cough	12	105 (35)	15	3.89 (2.36)
Alopecia	13	100 (34)	1	5.77 (3.24)
Diarrhea	14	93 (31)	6	5.10 (2.56)
Vomiting	15	45 (15)	3	5.29 (2.97)
Fever	16	30 (10)	14	4.07 (2.32)

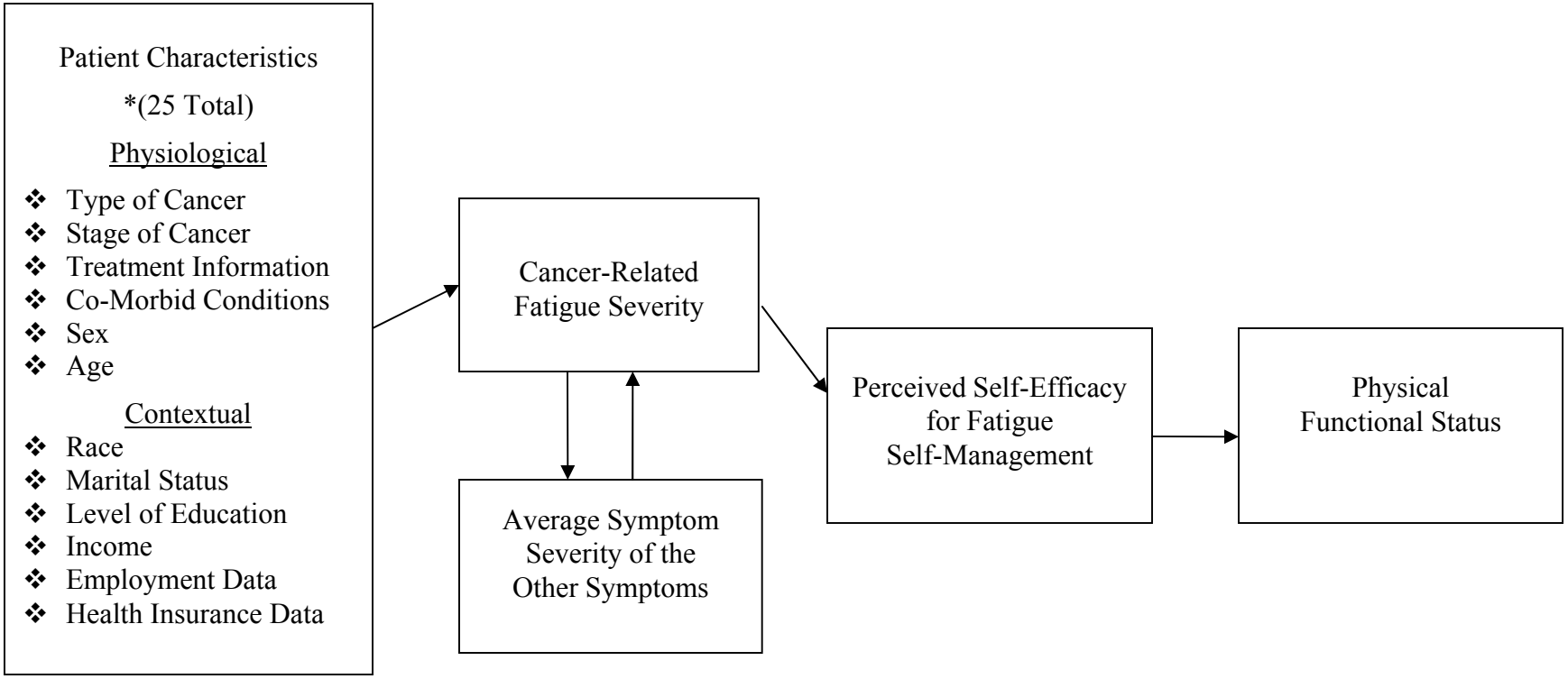

Figure 1. Hypothesized Theoretical Model

*Note: There are more than one characteristic in certain patient characteristic categories. See details of each patient characteristic in the Measures Section of the manuscript.

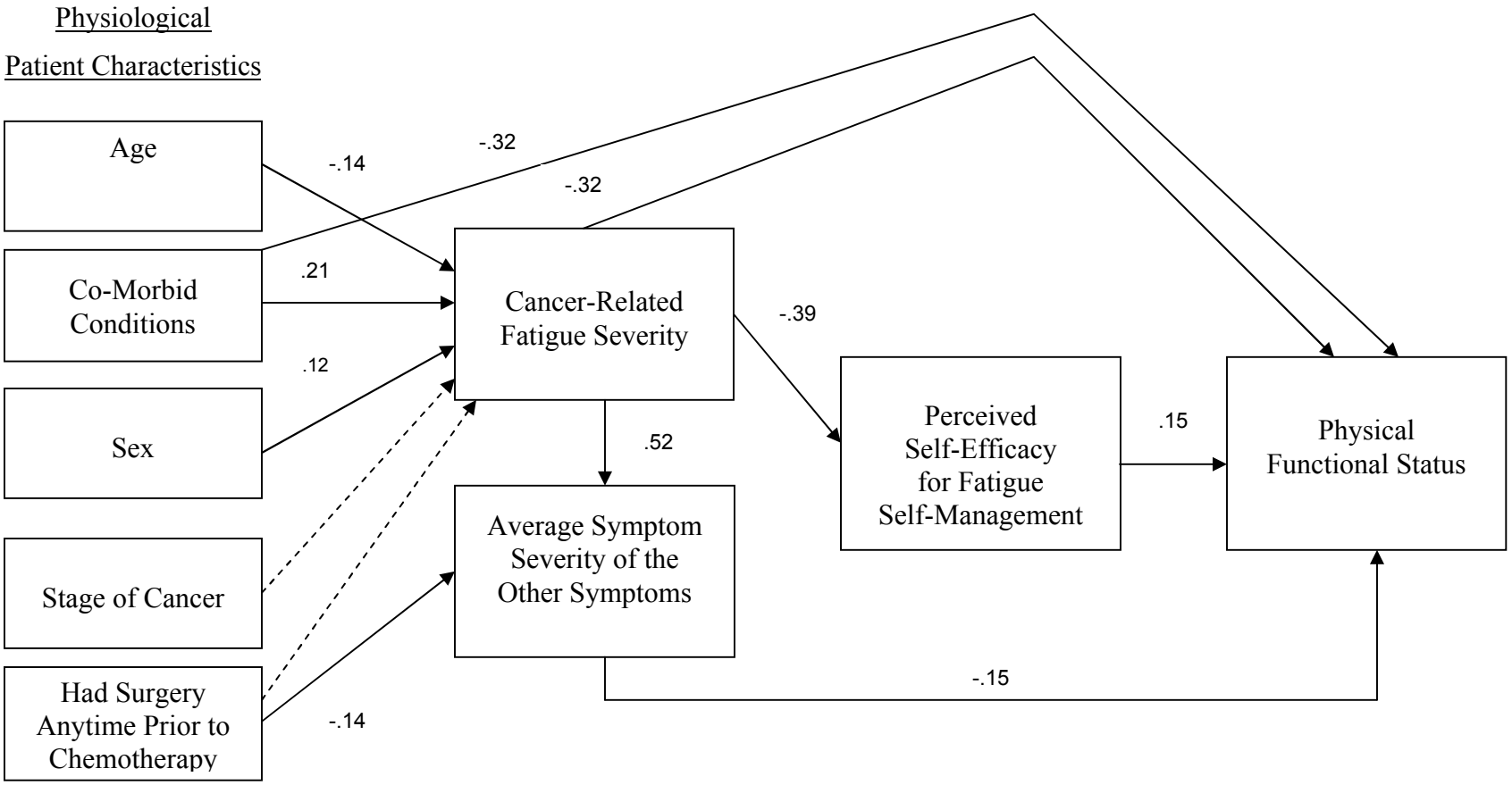

Figure 2. Final Parsimonious Theoretical Model: Satorra-Bentler Scaled Chi-Square 17.76; p = .22; df = 14; RMSEA = .03; RMSEA lower bound 90% CI = 0.00; CFI = .99; GFI = 0.99; and AIC 79.

Legend

- Solid line means a significant direct path (t > -/+ 2.0).
- Dashed line means a nonsignificant direct path (t < 2.0).
- The numerical values represent standardized path coefficients.
- Not depicted in the Figure 2, standardized significant indirect path coefficient from CRF severity to PFS of -0.14.