

The Impact of Fatigue on Role Functioning During Radiation Therapy

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Fatigue is one of the most common and distressing side effects of cancer and cancer treatment, particularly radiation therapy (Dhruva et al., 2010; Lundberg & Rattanasuwan, 2007; Poirier, 2006; Williams et al., 2006). Fatigue impacts many aspects of patients' quality of life, including the ability to carry out usual activities (Ahlberg, Ekman, & Gaston-Johansson, 2005; Barsevick, Dudley, & Beck, 2006; Browall et al., 2008; Dodd, Cho, Cooper, & Miaskowski, 2010; Hoffman et al., 2009; Knobf & Sun, 2005; Miaskowski et al., 2006; Poirier, 2007; Pud et al., 2008; Seifert, 2010; Suwisith et al., 2008; Thanaslip & Kongsaktrakul, 2005). Performance of usual activities is one representation of functional status (Tulman & Fawcett, 1990). The role function mode of the Roy Adaptation Model (RAM) provides a novel way to view functional status by describing the performance of behaviors associated with various roles taken on by an individual with cancer (Roy & Andrews, 1999). Those primary, secondary, and tertiary roles may take on differing levels of importance to individuals undergoing cancer treatment and, therefore, may be affected in varying degrees by fatigue and other treatment-related side effects.

Background

The American Cancer Society (2010) estimated that 1,529,560 new cases of cancer were diagnosed in the United States in 2010, not including in situ cancers and nonmelanoma skin cancers. Five-year relative survival rates have increased, from 50% in 1975 to 65% in 2007 (Howlader et al., 2011), possibly from a combination of early detection and improved treatment. Multimodality treatment involving some combination of surgery, chemotherapy, radiation therapy, and biotherapy currently is the mainstay of treatment for most cancers (National Comprehensive Cancer Network, 2010). About 60% of all patients diagnosed with cancer will receive radiation therapy at some point in their treatment (Gosselin, 2010), either alone or in combination with chemotherapy.

Although multimodality treatments for cancer have resulted in improved survival rates, they also have increased the number of adverse effects. Haylock and

Purpose/Objectives: To identify the impact of fatigue, site-specific side effects, and individual characteristics on role activities during radiation therapy.

Design: Secondary data analysis.

Setting: A community radiation therapy department in the northeastern region of the United States.

Sample: 77 patients receiving radiation therapy for adjuvant or curative intent.

Methods: Items from the Piper Fatigue Scale and the Brief Fatigue Inventory were grouped into primary (i.e., basic activities of daily living), secondary (i.e., work and school activities), and tertiary (i.e., socialization with family and friends) roles according to the Roy Adaptation Model. Paired t tests and multiple regression were used to analyze performance of roles.

Main Research Variables: Primary, secondary, and tertiary roles.

Findings: Functioning in all three roles declined during treatment, with greater disruption in secondary roles than primary or tertiary roles. Patients maintained their primary and tertiary roles. Patients had greater difficulty maintaining secondary roles such as work and school activities. Treatment to the lung, pelvis, or head and neck; living alone; and an increase in total side-effect scores were associated with increased disruption in role functioning.

Conclusions: Radiation therapy-related fatigue can affect role functioning at the primary, secondary, and tertiary levels.

Implications for Nursing: Oncology nurses are in an ideal position to design interventions to help patients maintain activities at greatest risk for disruption. Future research where performance of specific activities is the primary outcome of interest is indicated.

Hart (1979) were among the first to describe fatigue as a result of radiation therapy for cancer. Since that time, much attention has been given to the subject of cancer treatment-related fatigue. Fatigue, which has been reported in 65%–100% of patients receiving radiation therapy for cancer, consistently has been one of the most common and distressing side effects (Browall et al., 2008; Ekfors & Petersson, 2004; Kim, Jahan, et al., 2009; Stone, Richards, A'Hern, & Hardy, 2001). Fatigue related to radiation therapy follows a fairly consistent pattern, usually beginning in the second week of treatment, gradually increasing during the course of

treatment, and peaking near the end of treatment (Ahlberg et al., 2005; Dhruva et al., 2010; Donovan et al., 2004; Knobf & Sun, 2005; Lai et al., 2007; Lavdaniti et al., 2006; Miaskowski et al., 2008; Poirier, 2006). Other side effects of treatment are specific to the part of the body being treated (e.g., diarrhea during pelvic radiation, esophageal irritation during chest radiation) and generally begin after doses of 1,500–3,000 cGy or after the second or third week of treatment (Haas, 2010; Poirier, 2006). Concurrent chemotherapy and radiation therapy may exacerbate fatigue and site-specific side effects of treatment (Gosselin, 2010; Hickey, Francis, & Lehman, 2006; Rowell & O'Rourke, 2004; Schwartz et al., 2000; Williams et al., 2010).

Fatigue and other treatment-related side effects often lead to changes in patients' ability to carry out usual activities (Ahlberg et al., 2005; Curt et al., 2000; Kärki, Simonen, Mälkiä, & Selfe, 2005; Kim, Dodd, Aouizerat, Jahan, & Miaskowski, 2009; Knobf & Sun, 2005; Poirier, 2007; Serin et al., 2004). Individual characteristics such as coexisting medical conditions, age, gender, level of education, employment status, and living situation also may be associated with functional status during cancer treatment (Garman & Cohen, 2002; Garman, Pieper, Seo, & Cohen, 2003; Hoffman et al., 2009; Lundh, Seiger, & Furst, 2005; Pandey et al., 2005; Poirier, 2007; Schmidt et al., 2005; Sultan et al., 2004; Uzun, Aslan, Selimen, & Koç, 2004). Disease and treatment characteristics such as treatment site, extent of disease, multimodality treatment, and symptom severity also may affect functional status during cancer treatment. Patients with more extensive disease, receiving multimodality treatment, experiencing more severe symptoms (e.g., pain, sleep disturbances, fatigue), or receiving radiation treatment to the chest or head and neck regions experience greater disruption in functional status and, therefore, in their ability to carry out their usual activities (Ahlberg et al., 2005; Bansal et al., 2004; Doorenbos, Given, Given, & Verbitsky, 2006; Given, Given, Azzouz, & Stommel, 2001; Hoffman et al., 2009; Poirier, 2007; Seifert, 2010; Tanaka, Akechi, Okuyama, Nishiwaki, & Uchitomi, 2002; Tchen et al., 2003).

Many factors may contribute to patients' abilities to carry out their usual activities during a course of radiation therapy, and they may impact those activities to varying degrees. The role function mode of the RAM provides a unique way to view functional status as measured by performance of usual activities (Tulman & Fawcett, 1990, 2007). In the RAM, individuals are viewed as holistic adaptive systems with coping processes that serve to maintain adaptation in four inter-related modes: role function, self-concept, interdependence, and physiologic (Roy & Zhan, 2006).

Patients undergoing treatment for cancer need to use coping processes to adapt to changes in physical and psychosocial functioning that occur as a result of their disease or treatment. Functional status is viewed as the

performance of behaviors that are associated with roles taken on by an individual (Roy & Andrews, 1999). The role function mode classifies role sets into primary, secondary, and tertiary roles. Primary roles are related to developmental stage and include age, gender, and basic activities of daily living, such as bathing, dressing, and walking (DiMattio & Tulman, 2003; Roy & Andrews, 1999). Secondary roles are assumed by an individual to accomplish tasks associated with primary roles and include household chores, paid employment, and care of family members (DiMattio & Tulman, 2003; Roy & Andrews, 1999). Tertiary roles are chosen freely, are temporary in nature, and are associated frequently with the accomplishment of some task in a person's current developmental stage. Tertiary roles include volunteer activities, socialization with friends and family, and hobbies (DiMattio & Tulman, 2003; Roy & Andrews, 1999). Those roles may be impacted differently by disease or treatment effects. In a sample of 61 women who had undergone coronary artery bypass graft, DiMattio and Tulman (2003) found that participants experienced minimal disruption in primary roles but moderate disruption in secondary and tertiary roles. Ahlberg et al. (2005) reported a decline in the social dimension of functional status from baseline to the end of treatment in women who had received radiation therapy for uterine cancer (N = 60).

Few studies were found in the cancer literature that examined disruption of activities during radiation treatment in the context of RAM's primary, secondary, and tertiary roles. Poirier (2007) incorporated all three roles into the variable "usual activities," which included basic activities of daily living as well as more advanced activities associated with secondary and tertiary roles. That study examined factors affecting patients' abilities to carry out usual activities during radiation therapy. Participants were asked to rate the extent to which they were continuing to perform their usual activities on a single-item scale of 0 (not at all) to 10 (all the time). Increased fatigue, increased severity of other treatment-related side effects, presence of coexisting medical conditions, living alone, and receiving radiation treatment to chest or head and neck regions were associated with a decrease in performance of usual activities over the course of radiation therapy (Poirier, 2007). The major limitation of the study was using a single-item instrument that asked only about usual activities; it did not differentiate what types of activities were impacted. Although participants were asked to consider a broad range of activities (e.g., walking, eating, working, caring for family members, volunteering), the study did not obtain specifics on actual activities performed or not performed. Thus, the study was unable to determine the activities that were less likely to be continued as fatigue and side effects increased over the course of treatment (Poirier, 2007).

Although Poirier (2007) did not examine specific activities impacted by radiation therapy, two instruments that are used to measure fatigue, the Piper Fatigue Scale (PFS) and the Brief Fatigue Inventory (BFI), include specific questions related to activities of daily living. In Poirier's (2007) study, only the composite scores of the instruments were used to measure fatigue and its impact on usual activities. The current study, however, was undertaken using individual items from the PFS and BFI, rather than the composite scores. The purpose of the current study was to identify the impact of fatigue, site-specific side effects of treatment, and selected individual characteristics on the performance of primary, secondary, or tertiary roles during radiation therapy, using selected items from the PFS and BFI.

The following specific research questions were explored.

- What is the impact of fatigue on patients' abilities to carry out their usual activities (grouped into primary, secondary, and tertiary roles) during a course of radiation therapy?
- What is the impact of side effects of treatment, other than fatigue, on patients' abilities to carry out their usual activities during a course of radiation therapy?
- What factors, other than fatigue and side effects of treatment, impact the ability of patients to carry out their usual activities during a course of radiation therapy?

Methods

Design and Sample

A secondary analysis was conducted on data collected for a previous study that examined the relationship between fatigue and employment patterns in a convenience sample of 77 participants receiving radiation therapy at a community hospital (Poirier, 2006). Inclusion criteria for the original study were receiving a minimum of four weeks of radiation therapy for curative or adjuvant intent, having a Karnofsky Performance Status Scale score of greater than 70, and working at the time of the cancer diagnosis. Exclusion criteria were receiving radiation therapy to the brain or for palliative intent and having coexisting unstable medical or psychiatric diagnoses. The study initially intended to enroll 150 participants based on Cohen's (1988) formulas for a medium effect size and power of 0.8 or greater. An interim power analysis conducted after 77 participants had been enrolled revealed a large effect size with powers of 0.97–0.99, so recruitment was stopped (Poirier, 2006).

Procedures

The original study was approved by the institutional review boards of the community hospital and the University of Massachusetts–Boston. Participants signed a

written informed consent and authorization for use of protected health information. Demographic data, information on sick leave benefits, employment status, and fatigue were measured at the initial teaching and weekly nursing on-treatment visits to reduce participant burden.

Instruments

Individual items from the revised PFS and the BFI related to activities of daily living were grouped into primary, secondary, and tertiary roles based on the RAM (see Figure 1). A previous study found the PFS and BFI to be highly correlated, ranging from 0.92–0.95 (Poirier, 2006). Fatigue had been measured at baseline, weekly during treatment, and at the one-month follow-up visit.

Piper Fatigue Scale: The revised PFS is a 22-item scale that measures the effect of fatigue on four dimensions: behavior/severity, affective/meaning, sensory, and cognitive/mood (Piper et al., 1998). Each item is scaled from 0 (no fatigue) to 10 (severe fatigue). The entire scale and the subscales have demonstrated good validity and reliability in previous studies (Piper et al., 1998; Poirier, 2006). Four items from the PFS were chosen for inclusion in the current study: To what degree is the fatigue you are feeling now interfering with your ability to (a) complete your work or school activities (secondary role), (b) visit or socialize with your friends (tertiary role), (c) engage in sexual activity (tertiary role), and (d) engage in the kind of activities you enjoy doing (tertiary role). Interference with sexual functioning ultimately was eliminated from data analyses because of many missing values.

Brief Fatigue Inventory: The BFI consists of nine items rated on a scale of 0–10 and measures the impact of fatigue on usual functioning (Schwartz, 2002; Wu & McSweeney, 2001). Internal consistency reliabilities for the BFI have ranged from 0.89–0.98 in previous studies (Mendoza et al., 1999; Okuyama et al., 2003; Poirier, 2006; Radbruch et al., 2003). Three items from the BFI were chosen for the current study: Circle the one number that describes how, during the past 24 hours, fatigue has interfered with your (a) general activity (primary role), (b) walking ability (primary role), and (c) normal work (includes both work outside the home and daily chores) (secondary role).

Primary roles: related to developmental stage

- Activities of daily living (e.g., walking)

Secondary roles: associated with primary roles

- Work or school activities, daily chores

Tertiary roles: related to secondary roles

- Leisure activities (e.g., socializing with friends)

Figure 1. Role Function Mode Based on Roy Adaptation Model

Note. Based on information from Piper et al., 1998; Roy & Andrews, 1999; Schwartz, 2002; Wu & McSweeney, 2001.

Table 1. Participant Characteristics

Characteristic	\bar{X}	SD	Range
Age (years)	53.69	8.44	29–67
Education (years)	14	2.21	8–18

Characteristic	n	%
Gender		
Female	45	58
Male	32	42
Living situation		
With others	59	77
Alone	18	23
Comorbidities^a		
None	21	27
1–2	39	51
More than 2	17	22
Chemotherapy		
Prior only	19	25
Concurrent	20	26
None	38	49
Treatment site		
Breast	34	44
Chest	13	17
Prostate	11	14
Head and neck	10	13
Abdomen or pelvis	9	12

N = 77

^a Primarily hypertension, hypercholesterolemia, and osteoarthritis

Demographic data: Demographic data previously collected and incorporated into the current study included age, gender, education, living situation, treatment site, comorbidities, site-specific treatment-related side effects, and previous or concurrent chemotherapy (Poirier, 2006). Patients were given a weekly total side-effect score using the radiation therapy department's nursing documentation tool, which was based on the Common Terminology Criteria for Adverse Events tool developed by the National Cancer Institute (2006).

Data Analysis

SPSS®, version 12.0, was used to analyze the data. Based on combined scores from the PFS and BFI, participants were assigned a score for each role, ranging from 0 (no impact on functioning) to 10 (maximum impact on functioning). Participants' ratings of performance of each role for the entire sample and for groups categorized by treatment site were graphed for each measurement point. Paired *t* tests were used to test for significant differences in each of the roles at each measurement point. Bivariate correlations were used to evaluate the relations between each of the roles and the other variables measured in the current study.

A series of linear regression models were used to test for relations between the independent

variables in the study and the performance of each of the roles at baseline and at the end of treatment. Confirmatory regression analysis was conducted using the simultaneous regression procedure, entering all independent variables into the regression model at the same time (Burns & Grove, 2005; Poirier, 2005, 2006). Variables then were retained or eliminated based on results of regression diagnostic tests, the strength of the supporting literature, and statistical significance (Poirier 2005, 2006).

Results

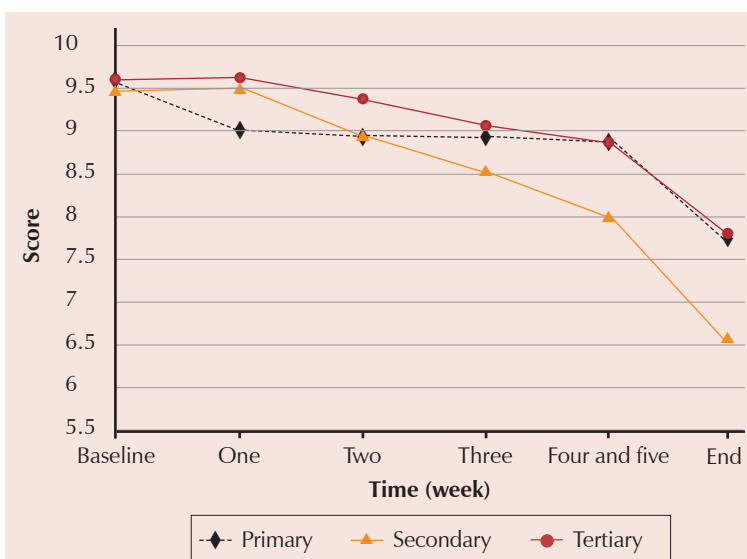
Participants ranged in age from 29–67 years, with a mean age of 54 years. Forty-four percent of the participants were receiving radiation therapy to the breast, with the rest fairly evenly divided among radiation therapy to the chest, abdomen or pelvis, head and neck, or prostate (see Table 1).

Impact of Fatigue on Activities

Fatigue was associated with decreased functioning in all three roles during the course of treatment. A statistically significant difference in functioning existed in all roles between baseline and the end of treatment (primary *t* = 6.786, *p* = 0.000; secondary *t* = 7.289, *p* = 0.000; tertiary *t* = 6.409, *p* = 0.000) (see Figure 2). Secondary roles were impacted to a greater degree than primary or tertiary roles.

Impact of Other Side Effects on Activities

In bivariate correlations, the total side-effect score was the variable most strongly correlated with performance of all of the roles at the end of treatment (see



Note. Scores ranged from 0–10, with lower scores indicating greater impact on functioning.

Figure 2. Changes in Role Functioning Over Time

Table 2). Living situation, treatment site, and chemotherapy had moderate correlations with performance of each of the roles at the end of treatment. None of the individual characteristics measured was correlated statistically with performance of any of the roles at baseline. Performance of each of the roles at baseline was correlated with performance of each of the roles at the end of treatment.

Participants who received treatment to the lung, pelvis, or head and neck area experienced greater disruption in functioning than participants who received radiation to the breast or prostate (see Figure 3).

In a series of multiple regression analyses, increases in side-effect scores and living alone were associated with significant disruption in functioning in all roles. Calculation of adjusted R^2 revealed that performance of primary roles at baseline, treatment-related side effects, and living situation explained 37% of the variance in performance of primary roles at the end of treatment. Treatment-related side effects, chemotherapy, living situation, and age explained 44% of the variance in performance of secondary roles at the end of treatment. Performance of tertiary roles at baseline, treatment-related side effects, living situation, and age explained 42% of the variance in performance of tertiary roles at the end of treatment. The younger the patients, the greater disruption they tended to experience in secondary and tertiary roles. Those receiving chemotherapy concurrent with their radiation had greater disruption in secondary roles than those who received radiation therapy alone. No differences were found in performance of any of the roles according to gender or educational level.

Discussion

The study supported previous findings from the literature that found that functional status declined over a course of radiation therapy. Specific factors such as fatigue, severity of side effects, treatment site (particularly radiation therapy to the lung or head and neck), living alone, multimodality treatment, and age all were related to a decrease in the ability of patients to carry out their usual activities. The study findings revealed differences in the performance of each role during a course of radiation therapy. Patients maintained their primary and tertiary roles, but had greater difficulty

Table 2. Correlation Matrix for Participant Characteristics

Variable	At End of Treatment					
	Primary Roles		Secondary Roles		Tertiary Roles	
	Pearson	p	Pearson	p	Pearson	p
Primary roles at baseline	0.317*	0.005	0.242**	0.034	0.227**	0.047
Secondary roles at baseline	0.292*	0.01	0.281**	0.013	0.271**	0.017
Tertiary roles at baseline	0.321*	0.004	0.3*	0.008	0.312*	0.006
Age	0.091	0.43	0.069	0.554	0.151	0.189
Education	-0.112	0.334	-0.146	0.204	-0.112	0.334
Gender	-0.119	0.305	-0.122	0.291	-0.136	0.237
Living situation	0.311*	0.006	0.372*	0.001	0.301*	0.008
Comorbidities	0.054	0.64	0.016	0.887	0.116	0.317
Side effects	-0.549*	0.000	-0.601*	0.000	-0.564	0.000
Concurrent chemotherapy	-0.341*	0.002	-0.39*	0.000	-0.345*	0.000
Treatment site	0.25**	0.028	0.377*	0.004	0.306*	0.007

* Correlation is significant at the 0.01 level (two-tailed).

** Correlation is significant at the 0.05 level (two-tailed).

maintaining work (both in and out of the home) and school activities. The findings contrast with those of Di-Mattio and Tulman (2003) and Ahlberg et al. (2005), who found greater disruption in tertiary roles. The current study was unable to explain why patients maintained or reduced certain activities. Patients may have reduced work and school activities but continued to engage in social activities that were less tiring and less structured, which allowed them to participate whenever they felt well enough.

The concept of socialization has changed with the growth of Internet support groups and social networking sites. Those options of maintaining social contact may be less tiring than traditional activities, such as going out to a show or dinner. Roy and Andrews (1999) described tertiary roles as requiring less emotional and physical involvement than secondary roles. Patients may be better able to maintain their tertiary activities despite increasing fatigue and other effects of treatment.

Tertiary roles often are temporary in nature and related to specific secondary roles. Some secondary roles are more likely to be disrupted than others. For example, the secondary role of teacher or student may be given up by patients because of fatigue or side effects of treatment.

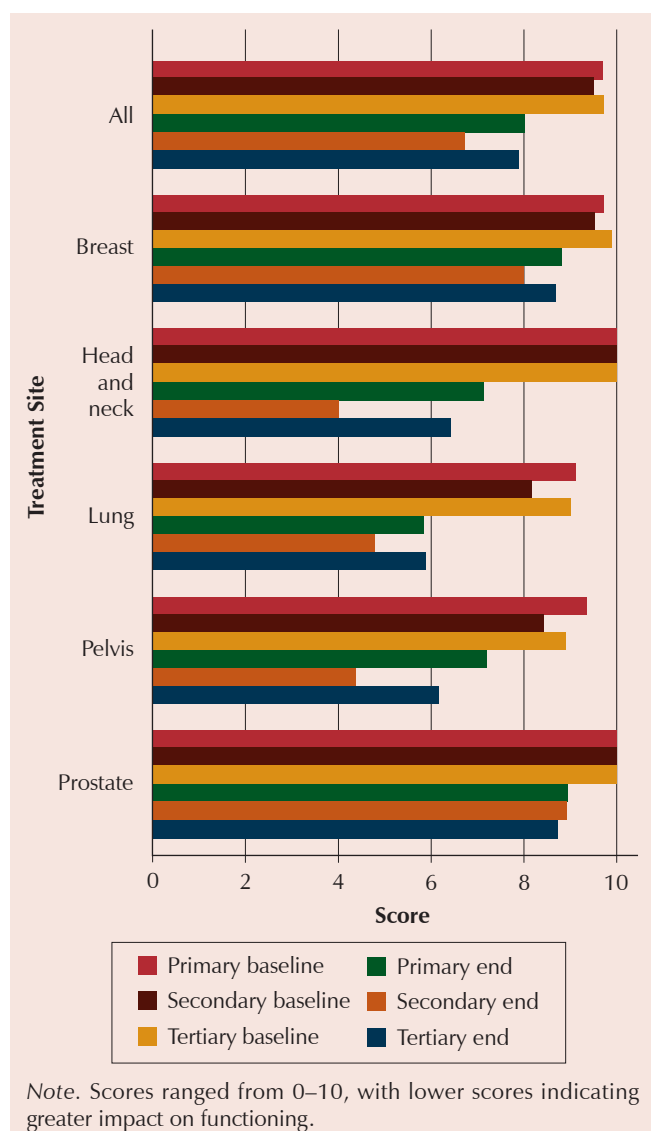


Figure 3. Changes in Role Functioning by Treatment Site

Secondary roles such as spouse, parent, or friend are less amenable to change. Tertiary roles associated with those secondary roles, such as attending a cheerleading rally or sending a text message to a friend, also might be maintained. The relationship of the RAM's secondary and tertiary roles to each other is an area for future investigation as society's concepts of roles change. Much more information is needed on the activities that are important for patients to continue during their cancer treatment.

Implications for Nursing Practice

Oncology nurses are in an ideal position to identify the activities that have the highest priority for patients. Health care has focused recently on true patient-centered care as an indicator of quality. Patient-centered care is defined as respectful of and responsive to individual patient preferences, needs, and values, which should

guide all clinical decisions (Institute of Medicine, 2001). Nursing interventions that focus on fatigue and symptom management and time management may help patients maintain activities that are most important to them.

Oncology nurses can design interventions geared toward helping patients maintain those activities at greatest risk for disruption during a course of cancer treatment. Interventions to support secondary roles might include homemaker services, Meals on Wheels, or use of employee assistance programs.

Policy Implications

Patients in the study experienced disruption in work activities during their radiation treatment, and younger patients experienced greater disruption in secondary roles than older patients. That may have significant social and financial implications for patients. Younger patients may have fewer accrued job benefits and, therefore, may take a greater financial loss if unable to work during a course of radiation treatment. In a study by Poirier (2005), participants changed their employment status during a course of radiation therapy not only because of fatigue and other side effects of treatment but also because of employer concerns about potential absenteeism and loss of productivity. Sick leave benefits were available to some but not all of the participants in the study; only 37% of participants were eligible for the Family and Medical Leave Act (Poirier, 2005). Although 58% of the participants had paid sick leave benefits at the time of their cancer diagnoses, only 49% had benefits remaining at the start of their radiation therapy, meaning many of the participants received no income or significantly reduced income during their treatment (Poirier, 2005, 2006). Nurses need to engage in informed discussions with policymakers to ensure equitable decisions are made regarding employment and sick leave for cancer treatment.

Limitations

Fatigue, not functional status, was the primary end point measured by the study instruments, which represents a major limitation. The items chosen from the PFS and BFI reflect only a few of the many activities that represent primary, secondary, or tertiary roles and, therefore, may not be sufficiently sensitive to changes in patient activities during radiation treatment. Replication of the study using valid and reliable instruments that directly measure functional status would provide more detailed information on how radiation therapy might impact usual activities.

Another limitation was the study's examination of the effect of side effects on activities. The study assigned an overall side-effect score to participants during their weekly visits using the department's patient care record. Increasing side-effect scores were associated with a decrease in activities in all three roles. However,

the study did not identify which side effects had the greatest impact. Future studies of the impact of individual side effects or symptom clusters on activities would provide nurses with more information to assist patients in managing activities while experiencing side effects.

The study also was limited by the small sample size, the small number of participants receiving treatment to cancer sites other than breast, and the homogeneous racial and ethnic make-up of the sample.

Suggestions for Future Research

A priority topic of the Oncology Nursing Society ([ONS], 2009), as identified in the 2009–2013 research agenda, is to develop an in-depth understanding of cancer-related symptoms and side effects. Changes in functional status or the ability to maintain performance of usual activities because of cancer or its treatment require additional study. Functional status needs to be measured across disease sites, treatment modalities, age groups, gender, and diverse racial and ethnic groups, using valid and reliable instruments such as the Comprehensive Inventory of Functional Status–Cancer (Tulman & Fawcett, 2007) or the Functional Assessment of Cancer Therapy. Appropriate outcome studies then can be designed using these instruments to measure the effect of nursing interventions on primary, secondary, or tertiary roles.

The impact of other aspects of fatigue, such as cognitive or attentional fatigue on functional status is another area for future research. Patients experiencing cognitive fatigue may have difficulty engaging in activi-

ties requiring significant mental effort, such as work and school, but may be able to participate in tertiary roles requiring less effort.

Conclusions

The findings from the current study address ONS' 2009–2013 Research Agenda by adding to the body of knowledge of one cancer treatment-related symptom, changes in functional status (ONS, 2009). The role function mode of the RAM provided a unique way to look at functional status as measured by performance of usual activities. Radiation therapy-related fatigue and site-specific side effects impacted functioning in all three roles, with the greatest disruption occurring in the secondary roles of work and school activities. Future studies should be conducted using valid and reliable instruments to measure the effect of nursing interventions on patients' actual and desired role activities. Information on patient preferences and values will allow nurses to design interventions that support those activities important to patients during cancer treatment. Doing so will help oncology nurses in all settings as they develop evidence-based models of nursing care that are truly patient centered.

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