Energy conservation and chemotherapy-related fatigue in adult women with breast cancer

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Abstract

Purpose: The three purposes of this study were to assess the use of energy conservation techniques (ECT) in women with breast cancer (WWBC) receiving chemotherapy; to assess the correlation between non-use of applicable ECT and fatigue; and to compare ECT use between WWBC and a comparison group (CG) of age-matched women with no major impairments.

Participants: Data collection was completed with twelve WWBC from an urban cancer clinic and fourteen CG women.

Procedure: After informed consent, participants completed a phone interview consisting of the Demographic Questionnaire, the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F), the Energy Conservation Checklist, and the Closing Questionnaire. The FACIT-F and the Energy Conservation Checklist were counterbalanced for order. Test-retest stability was confirmed by a follow-up call with twelve randomly selected participants from the two groups.

Results: WWBC experienced a much higher level of fatigue than the CG, t (24) = 6.4, p <.0001. Of 116 energy conservation techniques, a mean of 61.9 (SD = 13.1) were not used by WWBC while the CG reported not utilizing an average of 69.9 (SD = 7.5) ECT; the difference between groups approached statistical significance, with t (24) = -1.95, p = .06. For the 12 WWBC, the Pearson correlation between fatigue and non-use of energy conservation techniques was -.37, p = .23.

Conclusion: Despite very high levels of fatigue, women with breast cancer frequently do not use applicable energy conservation techniques. This small-sample study suggests a possible need for education-oriented occupational therapy.

Cancer is a general term used to describe the abnormal growth of cells in any part of the body (Longpre, & Newman, 2011). Cancer is a major public health problem in the United States and many other parts of the world. As of 2010, 1 in 4 deaths in the United States was due to cancer. The American Cancer Society projected a total of 1,529,560 new cancer cases and 569,490 deaths from cancer occurred in the United States in 2010 (Ahmedin, Siegel, Jiaquan, & Ward, 2010). There are more than 100 types of cancer, which may affect specific tissues, organs, blood, or lymphatic systems (Longpre & Newman, 2011). Of all types of cancer, breast cancer is estimated to account for the highest number of new cases diagnosed in women. Breast cancer accounts for 28% of new cancer diagnoses in women, estimated at 207,090 new cases in 2010. In women, breast cancer has been cited as the second leading cause of death from cancer accounting for 39,840 (15%) of deaths, following lung and bronchus cancer (Ahmedin, Siegel, Jiaquan, & Ward, 2010).

The average 5-year survival rate continues to improve due to earlier detection and treatment strategies. Therefore there is an increasing need to coordinate rehabilitation services and prepare a comprehensive plan for treatment and follow-up (DeLisa, 2001). Cancer itself and its treatment (chemotherapy) commonly result in side effects that cause distress, the most frequent and most debilitating of which is fatigue, according to Hofman, Ryan, Figueroa-Moseley, Jean-Pierre, and Morrow (2007). Treatment can disrupt occupational functioning of the individual and his/her support system. People experience progressive functional loss when they experience side effects due to the treatment, such as cancer-related fatigue (Berger, Abernethy, Atkinson, Barsevick, & Breitbart, 2010).

The National Comprehensive Center Network (NCCN) defines cancer-related fatigue (CRF) as “a distressing, persistent, subjective sense of physical, emotional and/or cognitive

tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning" (Berger, Abernethy, Atkinson, Barsevick, & Breitbart, 2010). Proposed criteria for CRF adopted for inclusion in the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (World Health Organization, 2007) include:

1. Significant fatigue, diminished energy, or increased need to rest, disproportionate to any recent change in activity level, plus five or more of the following:
    a) Complaints of generalized weakness, limb heaviness.
    b) Diminished concentration or attention.
    c) Decreased motivation or interest to engage in usual occupations.
    d) Insomnia or hypersomnia.
    e) Experience of sleep as unrefreshing or nonrestorative.
    f) Perceived need to struggle to overcome inactivity.
    g) Marked emotional reactivity (e.g., sadness, frustration, or irritability) to feeling fatigued.
    h) Difficulty completing daily tasks attributed to feeling fatigued.
    i) Perceived problems with short-term memory.
    j) Post-exertional fatigue lasting several hours.
2. The symptoms cause clinically significant distress or impairment in social, occupational, or other areas of functioning.
3. There is evidence from the history, physical examination, or laboratory findings that the symptoms are a consequence of cancer or cancer therapy.

4. The symptoms are not primarily a consequence of co-morbid psychiatric disorders such as major depression, somatization disorder, somatoform disorder, or delirium.

These symptoms must be present every day or nearly every day during the same 2-week period in the past month in order to qualify for the term cancer-related fatigue (World Health Organization, 2007).

Up to 80% of individuals with cancer treated with chemotherapy experience this fatigue, according to Hofman, Ryan, Figueroa-Moseley, Jean-Pierre, & Morrow (2007). A cross-sectional study surveyed 174 patients with cancer, 19% of whom had breast cancer, who had all undergone treatment for cancer in the past six months. The results reported that clinically significant fatigue was present in 52% of patients (Shafqat, Einhorn, Hanna, Sledge, & Hanna, 2005).

Not only is CRF the symptom most frequently anticipated and reported by cancer patients, it is also widely rated as one of the most distressing, both during and after treatment. Indeed, CRF has been rated as more troublesome with a greater negative impact on patients' daily activities and quality of life than other cancer-related symptoms, including pain, depression, and nausea. The impact of CRF on a patient's quality of life, particularly in relation to physical functioning and the ability to perform occupations of daily living, is both profound and pervasive (Hofman, Ryan, Figueroa-Moseley, Jean-Pierre, & Morrow, 2007). In a study by Curt et al. (2000), 379 patients with cancer who reported fatigue at least a few times per month were asked to describe their fatigue and its impact on quality of life. Throughout chemotherapy, 76% of participants experienced fatigue at least a few days each month and 30% experienced fatigue on a daily basis. Ninety-one percent of those who experienced fatigue reported that it prevented a "normal" life, and 88% indicated that fatigue caused an alteration in daily routine. Fatigue made it more difficult to participate in social activities, and perform typical cognitive tasks. Seventy-

five percent of participants reported changing employment status as a result of fatigue, and 65% indicated that their fatigue resulted in their caregivers taking at least one day off work in a typical month (Curt, Breitbart, Cella, Groopman, & Horning, 2000).

In a study specifically oriented to women with breast cancer receiving chemotherapy (Rotonda, Guillemin, Bonnetain, & Conroy, 2011), between 58% and 94% experienced CRF. CRF continues for months and even years following completion of treatment in approximately one-third of patients with cancer (Hofman, Ryan, Figueroa-Moseley, Jean-Pierre, & Morrow, 2007).

Reinertsen, Cvancarova, Loge, Edvardsen, and Wist, (2010) conducted a study to examined chronic fatigue cross-sectionally and longitudinally in relapse-free women up to 10 years after receiving treatment for breast cancer. Questionnaire data were collected twice from all 249 breast cancer survivors: 2.5 -- 7 years after being diagnosed with breast cancer (T1) and 2.5 -- 3 years thereafter (T2). Chronic fatigue was diagnosed in 33% of the women at T1 and in 39% of women at T2. This finding is in basic agreement with previous studies that indicated that approximately 30% of breast cancer post-treatment survivors have reported moderate to severe levels of fatigue (Bower, J. E., Ganz, P. A., Desmond, K. A., Rowlan, J. H., Meyerowitz, B. E., & Belin, T. R., 2000).

A total of 284 patients receiving chemotherapy for breast cancer were surveyed in a cross-sectional study regarding quality of life. One-fifth of the participants indicated that quality of life was unsatisfactory. The results also identified that many of the participants experienced problems with physical functions (24.3%), role functions (22.5%), and social functions (26.1%). The primary reported cause of functional problems and overall decrease in quality of life was fatigue, severely affecting more participants (46.8%) than insomnia, pain, nausea/vomiting, diarrhea, constipation, and loss of appetite (Ivanauskiene, Kreqzdyte, & Padaiga, 2010).

An article in the National Comprehensive Cancer Network (NCCN) written by Berger and colleagues (2010, pp. 909) stated, "All patients should be screened for fatigue at their initial visit, at regular intervals during and following cancer treatment, and as clinically indicated" (Berger, Abernethy, Atkinson, Barsevick, & Breitbart, 2010). The NCCN has identified that there is more need for assessing, screening and managing fatigue in patients undergoing treatment for cancer. Much of the management of chronic fatigue in people with cancer involves promoting adaptation and adjustment to the condition. It is imperative that the individuals with cancer are educated about fatigue before it occurs and are taught about self-care strategies necessary to manage fatigue (National Cancer Institute, 2010). The National Cancer Institute (NCI) has listed specific techniques for the management of fatigue including the following:

1. Assessment for presence of correctable correlates or causes of fatigue.
2. Evaluation of patterns of rest and activity during the day as well as over time.
3. Determination of the level of attentional fatigue and encouragement of the planned use of attention-restoring activities.
4. Encouragement of activity/planned exercise programs within individual limitations; making goals realistic by keeping in mind the state of disease and treatment regimens.
5. Education of individuals and families about fatigue related to cancer and its treatment.
6. Helping people with cancer and their families identify fatigue-promoting activities and develop specific strategies to modify these activities.
7. Suggesting individualized environmental or activity changes that may offset fatigue.
8. Scheduling important daily activities during times of least fatigue and eliminating nonessential stress-producing activities.

9. Addressing the negative impact of psychologic and social stressors and how to avoid or modify them.
10. Evaluating the efficacy of fatigue interventions on a regular and systematic basis.

These techniques include some common principles of energy conservation. Energy conservation consists of breaking up physically active periods with rest periods, resulting in increased amount of physical activity (Yasuda, 2008). Grace Young, a post-polio survivor and occupational therapy practitioner with over 25 years of experience, defines energy conservation as "any technique, device or practical strategy that you can implement that will keep you from spending more energy on daily activities that take away the joy of life" (Mathew, 2008). The fundamental principles of energy conservation are prioritizing, planning, eliminating, delegating, modifying, and pacing. To control the effect of fatigue on everyday functioning, a patient can be taught to analyze daily occupations to determine occupations that increase pain and fatigue. This self-analysis of one's routine daily schedule can assist individuals identify when activities should be stopped to provide rest (Yasuda, 2008). According to Donovan (1998), the most common energy leaks include pain, poor body mechanics, poor posture, altered gait, altered breathing patterns, and poor ergonomics during tasks including those performed in the workplace. Through patient education on beneficial energy conservation from a health care professional, many of these energy leaks can be avoided and worked around. Young adds that it is important for the patient to get into the actual details of each situation and to study the energy expenditures in their daily roles. Paying attention to these daily details offers the hope of reaching the formula of maximal functioning for each person (Mathew, 2008).

The first randomized clinical trial that researched the efficacy of energy conservation for fatigue reduction and maintenance of functional performance in adults who are undergoing

treatment for cancer was conducted by Barsevick, Dudley, Beck, Sweeney, & Whitmer (2004). This study compared an energy conservation and activity management (ECAM) intervention with a control intervention focused on nutrition in 396 participants with cancer, 282 of whom (71%) had breast cancer. The ECAM group experienced a greater decrease in fatigue over time compared with the control group ($p = .01$) (Barsevick, Dudley, Beck, Sweeney, & Whitmer, 2004).

With the high frequency of CRF and the severe debilitating effect it has on so many patients and their families, the high demand for rehabilitation that focuses treatment on improving this condition is obvious. According to DeLisa (2001), cancer rehabilitation is a concept that is defined by the patient and involves assisting a person with cancer to obtain maximum physical, social, psychological, and vocational functioning within the limits imposed by the disease and its treatment. Rehabilitation for patients with cancer should be parallel to rehabilitation for those with other diagnostic conditions. However, factors such as reduced life expectancy, pain, and excessive co-morbidity make cancer rehabilitation unique and challenging.

In a fact sheet published by The American Occupational Therapy Association, Longpre & Newman (2011) stated that the occupational therapist has an important role in oncology by encouraging the highest level of daily performance through a holistic approach regardless of prognosis. Given the high levels of fatigue experienced by persons in chemotherapy, Guidera (2010) argued that there should be funded programs whereby occupational therapists teach energy conservation techniques to all chemotherapy patients. Through a survey, Helen Vockins (2004) determined that within a specialist cancer center occupational therapists spent significant amounts of time facilitating educational programs, teaching relaxation techniques, and exploring strategies for managing breathlessness and fatigue.

Ellen Romsaas and Susan Rosa (1985) studied the role of occupational therapy in the care of cancer patients who were being actively treated for metastatic disease. They reviewed the records of 54 adult inpatients (57% consisting of women with breast cancer) who received occupational therapy services during hospital admission and found that occupational therapy assessments focused on independent living skills, sensorimotor components, and therapeutic adaptations. The results also indicated that treatment focused on these areas but placed heavy emphasis on physical daily living skills, range of motion, assistive/adaptive equipment, and energy conservation.

A study conducted by Carmen Guidera (2010) aimed to determine the level of use of energy conservation techniques in adult cancer patients receiving chemotherapy and the degree of correlation between the level of fatigue and use of energy conservation techniques. Guidera's study consisted of 23 adult cancer patients, 18 of which were women with breast cancer. Participants in this study were between 38 and 74 years of age ($M = 52.3$) and were currently receiving chemotherapy at the Cancer Center at the University of Toledo Medical Center. Guidera administered the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F) and the Energy Conservation Measure. Participants' results revealed that, of the 116 energy conservation techniques, an average of 45 were used 58.6 were not used (less than 10% of the items on average were labeled as not applicable). Also, given the recommended cutoff point of 36 on the FACIT-F, 19 participants in the study ($N = 23$) scored in the range of chronic fatigue. The Pearson correlation between fatigue and overall energy conservation was .61, $p = .002$. Results of this study indicate that there is a significant but imperfect correlation between energy conservation techniques and cancer-related fatigue. Guidera concluded that although cancer-

related fatigue is a debilitating symptom of cancer and its treatments, energy conservation techniques appear to be under-utilized.

This study was intended to replicate and extend Carmen Guidera's research (2010) on fatigue and the use of energy conservation techniques in women with breast cancer. Extending beyond Guidera, this study included a healthy control group, matched on age in order to see if women receiving chemotherapy for breast cancer are utilizing especially higher rates of energy conservation techniques. The purpose of this cross-sectional comparison was to see how women with breast cancer receiving chemotherapy compared to the norm in terms of the use of energy conservation techniques. This study also contained a follow-up phone call with randomly selected subjects from each group of participants to test the stability of the Energy Conservation Measure.

There were three major research questions in this study, two of which were hypotheses that were statistically testable. One research question was descriptive: how many of what types of energy conservation techniques (ECT) are not being utilized by women receiving chemotherapy for breast cancer? Secondly, we tested the correlation between level of fatigue and use of ECT in women receiving chemotherapy for breast cancer. Lastly, the ECT data provided by the women with breast cancer were compared to data gathered from a group of health adult female participants of the same age. Secondary analyses were also conducted. The severity of fatigue in women with breast cancer was compared to the level of fatigue in healthy women. The correlation between level of fatigue and basic occupations of daily living (BODL) and the correlation between fatigue and advanced occupations of daily living (AODL) were both tested. Additional, a test-retest analysis was configured regarding the use of ECT and fatigue in

participants from each group of subjects. Lastly, secondary analyses tested the correlations between the use of ECT and demographics in women with breast cancer.

Method

Methods mirrored Guidera (2010) in many respects, so that data collection in this study could be presented in parallel fashion to Guidera's data collected on 18 women with breast cancer.

Participants

All procedures were accomplished in accordance with directives of the University Biomedical Institutional Review Board. There were two groups of participants in this study, Women with Breast Cancer (WWBC) and Comparison Group (CG). For inclusion in WWBC Group, participants had to be female, between the ages of 35 to 85, with breast cancer undergoing chemotherapy at the Cancer Center at the University of Toledo Medical Center (UTMC). Excluded in WWBC Group were persons with neurological cancers, chronic obstructive pulmonary disease, or major cognitive or sensorimotor disability. The student researcher and/or medical staff at UTMC approached the subjects in the Cancer Center waiting room on their scheduled days for chemotherapy to explain the research project and obtain informed consent.

Within WWBC, informed consent was obtained from 17 patients. Of those 17, 12 completed all data collect requirements. Of the five patients who did not complete data collection, one changed her mind, one did not receive the expected chemotherapy treatment, one was unavailable to answer the phone, one became very ill, and one passed away. Of the 12 participants in WWBC, all were females with breast cancer undergoing chemotherapy treatment at UTMC. For 9 of the 12 participants this was the first round of chemotherapy. Two other participants were on the second round, and one participant was on her third round of chemotherapy. The age

range for these participants was 38 to 72 years, with an average age of 51.2 (*SD* = 10.1) years. The average weight of these participants was 197.4 (*SD* = 54.8) pounds, with a range from 126 to 316 pounds. The education level of WWBC varied from an obtained graduate degree to completed some high school or less, with the median educational level of some college or a college degree. The household income for the 12 WWBC ranged from $25,000 to $125,000 per year, with the median annual income in the $50,000 to $75,000 range. Two of the 12 participants stated that they had previously received instructions relevant to energy conservation techniques from a health care professional in the past. None of the WWBC had ever worked in a health care setting that advocated for energy conservation techniques for their patients.

For inclusion in the CG, participants were female, between the ages of 35 to 85, with self-reports of current good health. Excluded from the CG were persons with any major diseases that are life threatening or that disrupt daily life, or persons who had ever underwent any treatment for a cancer-related illness, including chemotherapy or radiation. A convenience sample was used for recruitment by the student researcher to assure that WWBC approximately matched the CG on age (mean and standard deviation). This involved selective recruitment on age in the latter stages of recruitment for the CG. The student researcher made announcements in classrooms at the University of Toledo and sent out emails to students at the University of Toledo to ask if they knew of anyone who was willing to participate.

Within the CG, informed consent was received from a total of 16 healthy adult women. Data collection was not completed with two of the 16 women due to an inadequate match on age. The age range for the 14 participants in the CG was 35 to 88 years, with an average age of 50.1 (*SD* = 13.8) years. The weight of these participants varied from 112 to 260 pounds, with and average weight of 163.9 (*SD* = 38.9) pounds. The education level of the participants in the CG var-

ied from a graduate degree to a high school diploma, with the median educational level in the range of obtained college degree to completed some graduate level studies. The household income for the 14 participants in the CG ranged from $25,000 to $200,000 per year, with the median income falling between $75,000 and $100,000 per year. Two of the 14 participants in the CG reported receiving instructions from a health care professional relevant to energy conservation techniques in the past. Meanwhile, 6 of the 14 participants stated they had worked in health care settings that advocated energy conservation techniques for their patients.

Measurements

Demographics Questionnaire. The initial questionnaire the participants completed addressed demographic information. Two separate questionnaires were created to match the needed criteria of the two groups of participants. The demographic questionnaire for WWBC collected information including the participant's age, weight, education, cancer diagnosis, and details regarding sequence in the chemotherapy process. The demographic questionnaire designed for the CG collected information including the participant's age, weight, education, and health status.

FACIT-F. The Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F), also known as the Functional Assessment of Cancer Therapy-Fatigue subscale (FACT-F) was an assessment that used 5-point Likert-type self-report scales containing 13 items that are used to identify the intensity of fatigue (Alexander, Minton, & Stone, 2009). The total score varies from 0 (best condition) to 52 (worst condition), with each item ranging from 0 (not at all) to 4 (very much so). The score was determined after re-parameterization of items 7 (I have energy) and 8 (I am able to do my usual activities). These items had an inverse relationship to the other 11 subscale items. The FACIT-F had an internal alpha consistency of .94 (Van Belle, Paridaens, Evers,

et al. 2005). The optimal cutoff for the FACIT-F had been found to be 36 of the possible 52 (Alexander, Minton, & Stone, 2009).

Energy Conservation Measure. The suggestions for energy conservation compiled by Eileen Donovan (1998) and presented in *Fatigue in Cancer: A Multidimensional Approach* was utilized in order to determine how many techniques participants were actually using in everyday life. The list was divided into two categories: basic activities of daily living, and advanced activities of daily living. Each category was further broken down into subcategories. Basic activities of daily living included: bathing (use of a hand-held shower while sitting), grooming/hygiene (use of an elevated commode seat), dressing (wear slip-on shoes), and mobility (ride the elevator). Advanced activities of daily living were broken down into: housekeeping (delegate heavy work), shopping (make a list first), meal preparation (use of lightweight utensils), laundry (sit to iron), child care (Instead of going to the zoo, go to places like the beach or a park to sit or lie down), workplace (request modified duty if necessary), and leisure (use of assistive equipment). There were a total of 116 tips for energy conservation. Those tips were formatted into yes/no/non-applicable items and were answered by the participants of the study.

To calculate the primary variable in this study, the number of no's were added because the number of yes's were confounded by items that were non-applicable. The sum of the "no" scores indicate that there are applicable techniques that are not being used, whereas the sum of the "yes" scores does not necessarily indicate thoroughness of use. For example, one person might have 2 yes scores, 6 NA scores, and 2 no scores, whereas another person might have 5 yes scores, no NA scores, and 5 no scores. If yes scores were used in the correlations, the latter person would appear to have much less need of occupational therapy than the former, whereas the latter actually has more need for occupational therapy services because of the 5 no scores. The

term “occupation” was used in the energy conservation measure as opposed to “activity”. The term “occupation” is defined as anything done throughout the day that has meaning and purpose.

Closing Questionnaire. The closing questionnaire that the participants completed addressed prior training on energy conservation techniques, past work experiences in a health care setting, and average annual family income. These questions were not asked by Guidera (2010) and were completed at the end of the interview so that they did not interfere with the participants responses to the previous questionnaires.

Procedure

After obtaining informed consent, the participants finalized a contact sheet which asked them their first name, primary and secondary phone numbers, and availability to conduct the over-the-phone interview. After completion of the aforementioned forms, participants received a copy of the informed consent if desired. Each participant completed the four measurement instruments in an initial over the phone interview conducted by the student researcher. The Demographic Questionnaire was completed first by all participants. Then, the FACIT-F scale and Energy Conservation Measure were counterbalanced for order. The Closing Questionnaire was completed last. Since the term “occupation” was used in the energy conservation measure as opposed to “activity,” the student researcher defined the term “occupation” for the participants as anything you do throughout the day that has meaning and purpose to you. The student researcher conducted a follow-up phone call with 5 WWBC and 7 participants from the CG within 12 to 18 days after their initial interview. Each sample of participants was randomly selected for follow-up using two blocks of eight for each group, with randomization sequence constructed by student adviser blind to all testing. During this follow-up phone interview the participant again complet-

ed the Energy Conservation Measure and the FACIT-F scale. All personal contact information was deleted after the follow-up phone call was completed.

Results

A check for skewness was completed as planned. The main variables, fatigue and use of energy conservation techniques, for both groups of women were not significantly skewed; therefore, *t*-tests and Pearson correlations were used for statistical analysis of these variables, with an alpha level of .05. Concerning the demographics data, however, both age and weight were positively skewed due to outliers (1.24 and 1.14 respective skewness levels). Therefore, non-parametric statistics (the Mann Whitney U-test and the Spearman correlation) were used when analyzing demographics.

The two groups of participants were appropriately matched on age as planned (see Table 1). There were no statistically significant differences in demographic variables between WWBC and the CG. However, the difference in weight between the two groups approached statistical significance ($p = .09$). Women in the CG had more exposure to ECT education in the past compared to WWBC. It was reported that two participants from both WWBC group and the CG received instructions in the past from a health care professional regarding energy conservation techniques. A total of 6 participants in the CG ($n = 14$) had previously worked in a health care setting that advocated ECT for their patients while none of the WWBC ($n = 12$) reported this previous work experience.

When measuring the level of fatigue using the FACIT-Fatigue scale, a higher number indicates relatively high fatigue. WWBC ($n = 12$) reported a mean fatigue score of 25.8 ($SD = 8.1$), ranging from 13 to 39. Women in the CG ($n = 14$) had a mean fatigue score of 7.6 ($SD = 6.4$),

with scores ranging from 1 to 23. Comparing the level of fatigue between groups, t (24) = 6.4, p <.0001 implying a very large effect. See Table 1 for results.

The first main research question aimed to assess the number of ECT not being utilized by WWBC. Of 116 energy conservation techniques, a mean of 61.9 (*SD* = 13.1) applicable ECT were not used by WWBC. In other words, more than half of the techniques available to assist in saving energy were not being used by WWBC who experienced high levels of fatigue. The 14 participants in the CG did not use a mean of 69.9 (*SD* = 7.5) ECT. Addressing the second main research question of comparing the use of energy conservation techniques between WWBC and women in the CG, 2-tailed t (24) = -1.95, p = .06. Although there was not a statistically significant difference between groups, the effect size d was .75, which is a moderate-to-large effect size. See Figure 1 which depicts energy conservation techniques not utilized by WWBC across categories.

Testing the third research questions, the Pearson correlation between fatigue and overall use of energy conservation techniques in WWBC was r = -.37, p = .23. This implies there might be an inverse relationship between non-use of energy conservation techniques and level of fatigue experienced for WWBC, but it is not statistically significant. Secondary analysis testing the correlation between fatigue and use of energy conservation techniques within basic occupations of daily living for WWBC resulted in r = -.63, p = .03; the correlation between fatigue and use of energy conservation techniques within advanced occupations of daily living for WWBC was r = -.27, p = .39.

Many energy conservation techniques for basic and advanced occupations of daily living were not being used by WWBC. During bathing all 12 of 12 participants answered “no” to the technique “I use a terry robe instead of drying off” while 11 women replied “no” to “I use a

shower bench or lawn chair to sit while showering." Nine WWBC reported not using the technique of sitting down while they complete their grooming/hygiene. While dressing 5 women stated they do not lay out their clothes before starting to dress to avoid extra steps, while 12 of 12 answered "no" to the ECT of "I use Velcro fasteners instead of buttons or shoelaces."

Items rated non-applicable mainly applied to advanced occupations of daily living, particularly in the childcare, workplace, and leisure categories. However, most WWBC answered "no" to several potentially useful ECT. During housekeeping 10 women answered "no" to the technique of using a wheeled cart or carpenter's apron to carry supplies. Of the 12 WWBC, 8 stated during shopping they do not organize their grocery list by store aisle to save time and 6 reported "no" to shopping at less busy times. In the category for meal preparation 7 women answered "no" to the ECT that states "I prepare double portions and freeze half for later"; 9 reported not storing frequently used items at chest level to avoid reaching and bending; and 6 stated they do not use cookware they can serve from. During laundry 8 of the 12 WWBC stated they do not wash undergarments and socks in a bag to avoid tangling. Within the workplace, the ECT of arranging the workspace ergonomically was not used by 3 WWBC. In the last category of leisure, 11 of 14 women answered "no" to using adaptive equipment during leisure occupations.

To assess test-retest reliability of the fatigue scale and the energy conservation score, 12 subjects were randomly selected according to the plan of randomized blocks. The intraclass correlation coefficient analyzed was the fixed effects model to be used when assessing degree of agreement in the tested sample with no intention of generalizing to future samples (Shrout & Fleiss, 1979). The ICC was .96 for fatigue and .92 for energy conservation, confirming very strong test-retest reliability in both measures.

Regarding only WWBC there was no statistically significant correlation between use of energy conservation techniques and age (r = -.20, p = .53), weight (r = -.06, p = .84), and income (r = -.32, p = .31). However, there was a statistically significant but unplanned correlation between level of education and ECT use (r = -.63, p = .03). There was no correlation between use of ECT and demographic information (age, weight, income, or education) for participants in the CG.

Discussion

A majority of the energy conservation techniques available were not being utilized by adult women with breast cancer. On average, participants reported not using over half (61.9 ECT) of the applicable ECT. For basic occupations of daily living, WWBC responded "no" to an average of 6 energy conservation techniques available within each category. On average, women with breast cancer reported not using 8.3 ECT for bathing, 3.8 for grooming, 6.5 for dressing, and 5.4 under the category for mobility. Within the advanced occupations of daily living for each category an average of 5.4 ECT were not being used by WWBC. Participants answered "no" to 3.7 ECT in the housekeeping category, 4.8 for shopping, 16.5 during meal preparation, 5.8 for laundry, 0.7 for childcare, 2.3 in the workplace, and 4.1 for within the leisure category.

There were an increased number of non-applicable responses in particular categories, including childcare, workplace, leisure, and housekeeping, largely due to the nature of the chosen participants. The majority of the WWBC did not have children or grandchildren whom they were caring for at home. In addition, many of the participants were not working while undergoing chemotherapy treatment, either due to taking a medical leave, being retired, or being a housewife. Many WWBC reported delegating a majority of the housekeeping duties to others, such as

a spouse or children, therefore a large portion of the housekeeping energy conservation techniques were considered non-applicable.

According to Alexander, Milton, and Stone (2009), although the FACIT-F cannot be utilized as a diagnostic instrument for cancer-related fatigue, it can be utilized to identify patients with cancer who are at high risk of clinically significant chronic post treatment fatigue. The participants with breast cancer, who were currently undergoing chemotherapy, reported a mean fatigue score of 25.8 (SD = 8.1) implying that they are experiencing an extremely high level of fatigue in their daily lives. We can infer that these participants are potentially at risk of experiencing chronic fatigue. This statistic agrees with previous studies that indicated approximately 30% of breast cancer survivors reported moderate to severe levels of fatigue (Bower et al., 2000). As expected, WWBC experienced a significantly higher amount of fatigue than participants in the CG whom were reported as healthy ($p < .0001$).

Although the results of this study demonstrated a possible inverse correlation between level of fatigue and ECT not used by participants with breast cancer, the outcome was not statistically significant. It is questionable, however, as to whether these findings reflect a lack of a relationship between variables or a Type II error due to small sample size.

For participants with breast cancer, the correlation between fatigue and non-use of basic occupations of daily living ECT was statistically significant (r = -.63, p = .03). Basic occupations of daily living, including bathing, grooming, dressing, and mobility, are aspects of each participant's everyday lives that are nearly unavoidable. The more fatigue these participants experienced the more energy conservation techniques they utilized during their basic occupations of daily living to assist them in maintaining enough energy to last an entire day. For the same women, the correlation with fatigue and advanced occupations of daily living ECT was not statistical-

ly significant (r = -.27, p = .39). Each day may not have consisted of every advanced occupation of daily living (housekeeping, shopping, meal preparation, laundry, childcare, workplace, leisure). The ECT utilized during these advanced occupations of daily living may not have been as prevalent because new habit formation depends on repeated performance.

There was no statistically significant correlation between the demographic data of age, weight, and income and the non-use of ECT in women with breast cancer. There was, however, a correlation between education and overall use of energy conservation techniques (r = -.63, p = .03). The higher the level of education the participants with breast cancer had received, the fewer "no" responses they provided. This may imply that relatively well-educated women might have been able to figure out useful ECT on their own, whereas other individuals may need more assistance, such as that from an occupational therapist.

Both groups of participants reported not using many applicable energy conservation techniques. With a mean of 61.9 (SD = 13.1) applicable ECT not being utilized by WWBC, and a mean of 69.9 (SD = 7.5) for the CG, the comparison of unused ECT between each group of participants was not statistically significant (t (24) = -1.95, p = .06). However, the moderate to large effect size suggests the need for a larger sample. With 116 recommended energy conservation techniques it is evident that many valuable techniques to conserve energy throughout their daily lives were underutilized. WWBC who were experiencing a high level of fatigue in their daily lives were using not-so-different amounts of ECT as women who were healthy and experiencing minimal fatigue. It is possible that WWBC are underexposed to education regarding potentially helpful ECT.

The results of this study can be compared to Guidera's research completed in 2010. Guidera collected data on 18 women with breast cancer in attempt to determine the degree of

correlation between the level of fatigue and use of energy conservation techniques. The participants in Guidera's study and the women with breast cancer in this study were similar in terms of demographics of age and weight (education and income were not measured in Guidera's study). Guidera implemented the same measurement tools (FACIT-F and Energy Conservation Checklist) as were implemented in this report and data were collected for both studies at the same cancer center in Toledo. Participants in Guidera's study reported an even higher level of fatigue than in the present study (a mean of 36 on the FACIT-F scale versus a mean of 25.8 here). Guidera reported that on average 58.6 ECT were not being utilized by participants compared to a mean of 61.9 (13.1) ECT not utilized by WWBC in this study. In other words, participants in Guidera's study did not use 50.5% of the recommended ECT while WWBC in this study did not utilize 53.4% of the 116 ECT, which is a very comparable amount. Guidera found a statistically significant correlation between fatigue and overall use of energy conservation techniques ($r = .61$, $p = .002$). Although the correlation between fatigue and ECT use for WWBC was not statistically significant for this study ($r = -.37$, $p = .23$), the results of the two studies are parallel in the inverse direction. Both studies found statistically significant correlations between ECT in basic self-care and fatigue. As in the current study, Guidera concluded that although cancer-related fatigue is a debilitating symptom of cancer and its treatments, energy conservation techniques appear to be under-utilized.

There are several implications for occupational therapy practice that can be drawn from this study. This study identified many potential energy conserving techniques that are not being utilized by women who may benefit from them. Of course, the participants may reject any given techniques; however, they should be provided with the necessary information to make an informed decision. Occupational therapists should work with individual patients to create an indi-

vidualized, comprehensive energy conservation program for women with breast cancer undergoing treatment. Given the high level of fatigue experienced by females enduring chemotherapy, there should be funded programs where occupational therapists teach ECT to these individuals. This type of program should especially focus on bathing, dressing, and meal preparation (as indicated in Figure 1), because so many of those techniques were utilized very little by participants in this study. The program should go beyond the basic energy conservation techniques of pacing, planning, and delegating by exploring the individual's unique patterns of daily occupations, especially those that result in the most energy expenditure. According to Donovan (1998), the most common energy leaks include pain, poor body mechanics, poor posture, altered gait patterns, altered breathing patterns, and poor ergonomics during tasks including those performed in the workplace. Occupational therapist could also attend support groups for women with breast cancer to discuss energy conservation techniques, provided educational handouts, and demonstrate proper body mechanics. Such programs would be cost-efficient, considering that cancer causes roughly $18.8 billion for indirect morbidity costs alone, including the cost of lost productivity due to illness, according to the ACS (2009). By conserving energy in certain occupations, especially those of occupations of daily living, a person can enhance their opportunity for improving their quality of life and participating in meaningful social, family, leisure, and work tasks.

A limitation is that data collection for the WWBC group was conducted at one single cancer center. The sample size of participants was also very small for a descriptive study. Furthermore, WWBC who were currently undergoing chemotherapy were within their first to third rounds of treatment. Therefore, the results are not generalizable to all females with breast cancer, to other individuals with cancer, to people in varying stages of their cancer treatment, or across a variety of locations. Future studies should be implemented to include individuals with other

types of cancer, both male and female, in multiple stages of cancer treatment, and in a variation of regions.

Another limitation to this study is that the comparison group had a slightly higher level of education and had more exposure to energy conservation techniques in the past compared to WWBC. This difference in exposure may have affected individual use of ECT due to a higher awareness of what techniques are available to help save energy throughout their daily lives.

Lastly, the measure of energy conservation techniques used in this study is not a standardized measure. It has face validity in that it is directly drawn from clinical recommendations and has very strong test re-test reliability in this study (.92). More research is required to address additional reliability and validity of this measure.

Cancer-related fatigue is a debilitating symptom of cancer and its treatment. Women with breast cancer experience a high level of fatigue, especially when compared to healthy women; however, they are not utilizing all of the energy conservation techniques that are available. Individuals undergoing chemotherapy might well benefit from occupational therapy services including education in techniques that assist with conserving their energy throughout their daily lives. By conserving more energy in required daily tasks these women could dedicate more of their limited energy to enjoyable and meaningful occupations, therefore increasing overall quality of life. There is still very limited research available on this topic, especially in the field of occupational therapy. Further research, including longitudinal studies, is necessary to elaborate on these findings.

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Table 1. Demographics and outcomes for women with breast cancer (WWBC) and healthy comparison group.

	WWBC (n = 12)		Comparison (n = 14)				
	M	*SD*	*M*	*SD*	*t*	*Z*	*p*
Age (yrs.)	51.2	10.1	50.1	13.8		0.57	.57
Weight (lb.)	197.4	54.8	163.9	38.9		1.70	.09
Education*	3.8	1.7	4.4	1.5		0.89	.37
Income**	3.2	1.0	4.1	1.7		1.55	.12
Fatigue	25.8	8.1	7.6	6.4	6.40		<.0001
ECT not used	61.9	13.1	69.9	7.5	-1.95		.06

*Education: 1- Some high school or less; 2- Graduated high school; 3- Some college; 4- College Degree; 5- Some graduate level education; 6- Graduated degree.

**Income (in thousands): 1- Less than $25; 2- $25-50; 3- $50-75; 4- $75-100; 5- $100-125; 6- $125-150; 7- $150-175; 8- $175-200; 9- More than $200.

Figure 1. Results of the Energy Conservation Checklist across categories for women with breast cancer (n = 12).