The Effects of a Comprehensive Exercise Program on Physical Function, Fatigue, and Mood in Patients With Various Types of Cancer

Lindsey Renee Hanna, MS, Patricia Frist Avila, RN, MSN, OCN®, John D. Meteer, MA, Donald R. Nicholas, PhD, and Leonard A. Kaminsky, PhD

Purpose/Objectives: To evaluate the effectiveness of a comprehensive exercise program consisting of low-to-moderate intensity aerobic and resistance exercise twice a week for 16 sessions with patients in active treatment and cancer survivors beyond treatment related to improvements in physical function, fatigue, and mood.

Design: Retrospective analysis of archived data.

Setting: Cancer center in a 350-bed teaching hospital in east central Indiana.

Sample: 39 patients with cancer and cancer survivors who voluntarily completed a 16-session comprehensive exercise program.

Methods: Physical function, fatigue, and mood were evaluated using the six-minute-walk test, Profile of Mood States questionnaire, and Piper Fatigue Scale questionnaire pre- and postprogram. The program consisted of low-to-moderate aerobic and resistance exercise, education, and support twice weekly.

Main Research Variables: Physical function, fatigue, and mood.

Findings: Pre- and postprogram outcome measures had significant differences ($p < 0.05$). Participants had significant improvements in physical function, fatigue, and mood.

Conclusions: A comprehensive exercise program consisting of low-to-moderate intensity aerobic and resistance exercise, education, and support twice a week for eight weeks results in significant improvements in physical function, fatigue, and mood in patients in active treatment and cancer survivors beyond treatment.

Implications for Nursing: The comprehensive exercise program is feasible for many institutions using current resources and collaborating among departments to mitigate the short- and long-term effects of fatigue and improve quality of life for cancer survivors with a variety of diagnoses and stages.

Key Points . . .

- ➤ Patients with cancer experience many negative side effects, such as fatigue, depression, loss of physical function, weakness, and a decreased quality of life that may last long after treatment has ended.
- ➤ Evidence supports the use of exercise to help alleviate side effects of cancer and its treatments.
- ➤ Use of a comprehensive exercise program that includes exercise, education, and support may be a useful way to improve physical function, fatigue, and mood in patients with various types of cancer, regardless of stage and treatment status.

An estimated 1.4 million new cancer cases will be diagnosed in the United States in 2008 (American Cancer Society, 2008). Cancer treatment varies from a single surgery to months or even years of radiation, chemotherapy, immunotherapy, or other targeted cancer therapies. All cancer treatments potentially have serious side effects, which can include fatigue, muscle loss, hair loss, nausea, pain, weakness, loss of appetite, depression, anxiety, sleep disruptions, and loss of ability to perform activities of daily living (Courneya & Friedenreich, 1999; Morrow, Andrews, Hickok, Roscoe, & Matteson, 2002; Pedro, 2001). Fatigue is the most common and distressing side effect reported by patients with cancer and is more severe and prevalent in patients receiving treatment (Sood & Moynihan, 2005; Winningham, 2001). With earlier diagnosis and as treatments become more specialized, patients are living longer, resulting in a shift in patient care from survival to quality of life (QOL). In the mid-1980s, studies emerged reporting exercise as an effective means of side effect management, particularly fatigue (Winningham & MacVicar, 1988; Winningham, MacVicar, Bondoc, Anderson, & Minton, 1989).

The purpose of this study was to evaluate the effectiveness of a comprehensive exercise program using low-to-moderate intensity aerobic and resistance exercise for patients with various types of cancer on physical function, fatigue, and mood.

Literature Review

Background

Exercise for patients with cancer is becoming widely accepted as therapy for alleviation of side effects and enhanced QOL.

Lindsey Renee Hanna, MS, is a cancer exercise program specialist and Patricia Frist Avila, RN, MSN, OCN®, is a clinical nurse specialist, both in the Cancer Center at Ball Memorial Hospital in Muncie, IN. John D. Meteer, MA, is a doctoral student and Donald R. Nicholas, PhD, is a professor, both in the Department of Counseling Psychology and Guidance Services; and Leonard A. Kaminsky, PhD, is a professor in the School of Physical Education, Sport, and Exercise Science and the coordinator of the Clinical Exercise Physiology program, all at Ball State University in Muncie. In addition, Nicholas is the coordinator of Cancer Counseling Services at the Cancer Center at Ball Memorial Hospital. *(Submitted February 2007. Accepted for publication October 18, 2007.)*

Digital Object Identifier: 10.1188/08.ONF.461-469

Benefits of exercise illustrated in this population are almost universal. Because of the variations in cancer type, stage, and treatment regimen, researchers still are working to develop optimal and standardized exercise guidelines. To date, suggested guidelines have been published by Mock, Cameron, Tompkins, Lin, and Stewart (1997); Schneider, Dennehy, Roozeboom, and Carter (2002); Schwartz (2004); Winningham, MacVicar, and Burke (1986); and Winningham (1991). Winningham was the first researcher to address the need for and benefits of exercise in the cancer population, a topic that, at the time, was considered by many to be unnecessary and even unsafe. During a period when the most commonly prescribed lifestyle change was increased rest, Winningham et al. (1986) published an article addressing the need for exercise as therapy in the cancer population. Through her own expertise and research with patients with breast cancer, she proposed basic guidelines for exercise in the cancer population. Winningham's (1986) guidelines complement guidelines endorsed by the Rocky Mountain Cancer Rehabilitation Institute (Schneider, Dennehy, and Carter, 2003), Schwartz (2004), and Mock, Cameron, et al. (1997) that stress an initial clinical assessment, low-to-moderate exercise intensities, and special attention to treatment side effects. Emphasis also is placed on starting slowly and cautiously while adjusting exercise to symptom levels. These guidelines provide a scientific and valid source of information for the general cancer population, but much about the science of cancer and exercise still is unknown.

Current Research

Loss of physical function and weakness are common issues among the cancer population, and exercise's effect on physical function is a primary outcome often analyzed in studies (Conn, Hafdahl, Porock, McDaniel, & Nielsen, 2006; Courneya, 2001; Courneya & Friedenreich, 1999; Courneya, Mackey, et al., 2003; Friedenreich & Courneya, 1996; Galvao & Newton, 2005; MacVicar, Winningham, & Nickel, 1989; Segal et al., 2001).

Cancer-related fatigue (CRF) also is an important topic when discussing side effects of cancer and cancer treatment. CRF is very complex and multidimensional, and researchers continue to attempt to understand it and find an optimal treatment (Berger, 2003; Hwang, Chang, Rue, & Kasimis, 2003). Although few studies have focused on CRF as the main or singular outcome (Labourey, 2007), most exercise programs have been successful in reducing CRF (Holley & Borger, 2001; Mock, Dow, et al., 1997; Mock et al., 2001, 2005; Schwartz, 1998, 1999, 2000, 2007; Schwartz, Mori, Gao, Nail, & King, 2001; Stricker, Drake, Hoyer, & Mock, 2004; van Weert et al., 2006; Watson & Mock, 2004). Some researchers have concluded that exercise currently offers the most promising nonpharmacologic treatment for CRF (Mock, 2004; Mock & Olsen, 2003). Still, many unanswered questions remain, such as the ideal timing, intensity, and duration of exercise, particularly in patients actively receiving chemotherapy.

Research studies also have focused on psychological distress (Dimeo, Bauer, Varahram, Proest, & Halter, 2001; Dimeo, Stieglitz, Novelli-Fischer, Fetscher, & Keul, 1999) or anxiety and depression (Midtgaard et al., 2005; Segar et al., 1998). One study found a significant decrease in acute anxiety following a single exercise session (Blanchard, Courneya, & Laing, 2001).

QOL is a commonly used term with respect to the cancer population and has been interpreted in many ways. In general, QOL may be defined as a composition of dimensions of well-being, including physical, functional, cognitive, emotional, social, and spiritual (Courneya, 2001). QOL is the primary outcome in many studies (Cheema & Gaul, 2006; Smith, 1996; Young-McCaughan & Sexton, 1991). However, many other studies listed numerous variables related to QOL, used different tools for QOL measurement, and were not prospective in nature, making comparing and interpreting results difficult (Oldervoll, Kaasa, Hjermstad, Lund, & Loge, 2004).

Most research on exercise relates to patients with breast cancer (Courneya, 2001; Courneya & Friedenreich, 1999; Friedenreich & Courneya, 1996; Kirshbaum, 2007; McNeely et al., 2006; Monninkhof et al., 2007). This trend most likely is because of the higher number of breast cancer survivors as compared with other cancers. Several studies, however, have involved patients with a variety of different types of cancer (Adamsen et al., 2003; Andersen et al., 2006; Burnham & Wilcox, 2002; Dimeo, Fetscher, Lange, Mertelsmann, & Keul, 1997; Durak & Lilly, 1998; Holley & Borger, 2001; Midtgaard et al., 2005; Mustian et al., 2006; van Weert et al., 2004, 2005, 2006; Wilson, Taliaferro, & Jacobsen, 2006; Young-McCaughan et al., 2003). Although multiple diagnoses are more representative of the population, drawing conclusions across such a varied population is more difficult. Some studies have used patients with a single cancer type other than breast cancer, such as lung (Spruit, Janssen, Willemsen, Hochstenbag, & Wouters, 2006) and colon (Courneya, Friedenreich, Quinney, et al., 2003; Meyerhardt et al., 2006), to attempt to eliminate this complication, but those studies are few and many more are needed before conclusions can be drawn.

Furthermore, the research community generally accepts that cancer treatment has a tremendous effect on how patients will tolerate exercise and, presumably, has an effect on the study's specific outcomes. Variance exists among studies in patients' treatment status. Most studies involved patients on active cancer treatments and fewer studies analyze patients who had completed cancer treatment prior to the exercise intervention (Courneya & Friedenreich, 2001; Kirshbaum, 2007).

Many types of exercise and physical activity are beneficial. The variation in exercise interventions has contributed to the difficulty in determining specific exercise guidelines (Courneya, 2001, 2003; Fairey, Courneya, Field, & Mackey, 2002; Galvao & Newton, 2005; Knols, Aaronson, Uebelhart, Fransen, & Aufdemkampe, 2005; Oldervoll et al., 2004). To add more complexity, some studies are multidimensional, including education or support groups (Andersen et al., 2006; Holley & Borger, 2001; Midtgaard et al., 2005; Mock et al., 1994; van Weert et al., 2004, 2005, 2006; Wilson et al., 2006; Young-McCaughan et al., 2003).

Research clearly has illustrated the usefulness of exercise in alleviation of the multiple symptoms of cancer and cancer treatment. None of the reported studies involved a comprehensive cancer exercise program achieving a significant improvement in physical function, fatigue, and mood in a mixed group of cancer diagnoses, staging, and treatment type.

Conceptual Framework

Levine's (1969) Conservation Model was chosen to guide the present study. The model contains three overarching concepts (wholeness, adaptation, and conservation) and explains how the holistic human being adapts to change through conservation. Conservation is "the way in which complex systems are able to continue to function, even when severely challenged" (Levine, 1990, p. 192), while balancing energy supply and demand. In Levine's Conservation Model, conservation is a process and an outcome of adaptation. An outcome of the model is to promote the health of patients, which simply is the adaptation of patients to the demands of the environment (Marriner-Tomey & Alligood, 2006). Adaptation is reflected in patients' integrity and oneness in the face of change.

Levine proposed that the whole person can be understood by exploring the parts. Therefore, Levine's Conservation Model consists of a variety of subconcepts, or parts of the whole. For example, Levine proposed three levels of environments, four levels of responses to environmental demands, and four principles of conservation. The subconcepts of specific interest in the present study were the four principles of conservation, specifically conservation of energy, structural integrity, personal integrity, and social integrity.

Conservation of energy is defined as the extent to which a person's energy supply meets his or her demand for energy. Disease and healing processes and aging require energy. When expended, energy must be renewed to sustain life. Nursing interventions can reduce energy demands and support energy renewal (Marriner-Tomey & Alligood, 2006). Examples include rest, reassurance, oxygen administration, internal and external temperature control, pain management, and stress management.

Conservation of structural integrity pertains to holistic preservation or restoration a person's physical functioning. Early recognition of threats to functionality is an example of a nursing action to conserve structural integrity (Marriner-Tomey & Alligood, 2006). Other examples include interventions to prevent pressure ulcers and falls, dressing changes to promote wound healing, and management of vomiting to limit electrolyte imbalances.

Conservation of personal integrity maintains quality of life, self-worth, and self-identity (Marriner-Tomey & Alligood, 2006). Personal integrity may be reflected in expressions of emotional well-being. Emotional distress may indicate a less successful adaptation on this dimension. In conserving personal integrity, nurses coordinate patients' whole illness experience with dignity and focuses on valuing and respecting them. Nurses design interventions to address negative emotions.

Conservation of social integrity requires social relationships for adaptation. The adequacy of social functioning may indicate the degree to which social integrity is sustained. To enhance social integrity and functioning, nurses may optimize existing relationships or promote new ones. Functional relationships assist in interpreting experiences and fostering a sense of social well-being within roles.

Levine's Conservation Model has guided knowledge development about fatigue. Levine (1990) stated that fatigue is a manifestation of the body's attempt to heal itself. Fatigue often occurs when the body's supply of energy is not able to meet the demand for energy. In cancer survivorship, practitioners may see fatigue early on as a manifestation of the cancer itself, during treatment, as a side-effect of treatment, and beyond as the body continues to heal. Fatigue is not only a physical indicator, but has psychological ramifications as well. Therefore, in the present study, the physical and emotional health of patients was evaluated. Fatigue was conceived as a symptom of ongoing adaptation and measured as an outcome through multiple instruments to operationalize the four dimensions of conservation.

Methods

Design

After obtaining institutional review board approval, archived patient data comparing various preprogram to postprogram measures of physical function, fatigue, and mood were analyzed retrospectively in the population. All patients voluntarily began the Cancer Exercise Program (CEP) after receiving information about it while visiting the Cancer Center at Ball Memorial Hospital, a 350 bed teaching hospital located in east central Indiana. Data for this analysis were obtained from patient records documented between October 2003 and August 2006.

Sample and Setting

The only qualification for entry into the CEP was a diagnosis of cancer; type and age of diagnosis were not factors. Patients received CEP information from their oncologist, nurse, other oncology staff, or the CEP specialist, a master's-prepared exercise physiologist who coordinates the program. Exclusion criteria included inability to travel, cognitive dysfunction, younger than age 18, and inpatient status. All patients participated voluntarily after receiving information about the program and potential benefits of exercise. Of the 63 patients who initially began the program, 39 (62%) completed the program. Of the 24 patients who discontinued the program, 11 (46%) did so because of a cancer-related illness, 5 (21%) left to exercise at a more convenient setting, 4 (17%) were unable to continue for personal reasons, 2 (8%) quit because of scheduling complications, 1 reported being too busy to maintain attendance, and 1 discontinued the program because of a noncancer-related illness.

Instruments

As demonstrated in Table 1, conservation of energy was evaluated using the revised **Piper Fatigue Scale (PFS)** and determining the patients' activity level. Conservation of structural integrity was evaluated by heart rate, blood pressure, and the six-minute walk (6MW) test. Personal and social integrity were evaluated using the subscales of the **Profile of Mood States (POMS)**. Health history, cancer diagnosis and staging, and cancer treatment information was obtained from patients and confirmed by medical records. All preprogram data were obtained by the CEP specialist from patients before they began structured exercise sessions and postprogram data were obtained after the completion of 16 structured exercise sessions.

Physical function was measured by the 6MW, which measures the distance walked in six minutes. Historically, the 6MW test has been used to test the functional capacity of patients with congestive heart failure (Lipkin, Scriven, Crake, & Poole-Wilson, 1986). The 6MW test has been described as an objective assessment of exercise capacity in patients with moderate-to-severe physical disabilities. It is inexpensive, easy to administer, and does not require a maximal level of exertion from patients; therefore, the 6MW test is better tolerated than treadmill testing, which may require a maximal level of exertion, on patients with a decreased physical capacity.

Table 1. Example of Variables and Indicators According to Levine's Conservation Principles

Concepts From Levine's Framework	Study Variables	Empirical Indicators
Conservation of energy	Subjective fatigue	Piper Fatigue Scale; activity level
Conservation of structural integrity	Physical functioning	Heart rate; blood pressure; six-minute walk test
Conservation of personal integrity	Quality of life	Total mood disturbance score
Conservation of social integrity	Social functioning	Total mood disturbance score

Fatigue was measured by the revised PFS (Piper et al., 1998), a written questionnaire composed of 22 numerically scaled items. Patients rate their fatigue in different situations on a scale from 0 (none) to 10 (a great deal). Scores are averaged to obtain a total fatigue score (0 = none, 1–3 = mild, 4–6 = moderate, and 7–10 = severe).

Mood was measured by the POMS. The POMS is a 65-item self-report, adjective checklist with subscale scores on moods of tension, anger, fatigue, depression, confusion, and vigor, which calculates the total mood disturbance (TMD) score through a mathematical equation (McNair, Lorr, & Droppleman, 1971). In the development of the POMS, McNair et al. reported good reliability and validity data. Internal consistency coefficients across the five moods ranged from 0.84–0.95 in two different validation studies, and test-retest reliability coefficients ranged from 0.65–0.74 for the five moods.

Intervention

The CEP is a comprehensive program based on three key elements: exercise, education, and support. The three components were an important and unique aspect of the CEP that distinguished it from other programs such as physical therapy–based programs, gyms that also service healthy populations, or exercise programs that lack education and support.

Patients in the CEP attended twice a week as able until they completed 16 exercise sessions. If patients missed a session, they resumed with the next session when they returned. On average, patients completed the 16 sessions in 10.92 weeks, with a range of 8–19 weeks. At the start of each exercise session, the CEP specialist obtained resting blood pressure, oxygen saturation, and heart rate for each patient. Patients also were asked how they felt that day, if they were having any unpleasant or unusual symptoms, and if they had any change in their medication or treatment regimen. If patients currently were receiving chemotherapy or complaining of feeling ill, their oral temperatures would be taken at rest. In the case of an oral temperature more than 100° F, patients were referred to a nurse and restricted from exercise participation that day.

Patients would perform aerobic exercise on a seated exercise machine (Nu-Step®) or walking (treadmill or hallway). Exercise mode was determined based on patients' current fitness level (assessed by 6MW and activity history), goals, or limitations. Each patient would warm up for five minutes before beginning steady state exercise. Intensity of exercise was determined according to current fitness level and exercise tolerance. Each patient was given an individualized target heart rate range for exercise. Patients in this program who were predominantly sedentary, had significant deconditioning, and had a low fitness level were given a goal target heart rate range of 30%–45% heart rate reserve (HRR) (light-to-moderate exercise intensity) using the Karvonen formula (American College of Sports Medicine [ACSM], 2005; Schneider et al., 2003). Those who were active, had no significant deconditioning, and had a moderate fitness level were given a goal target heart rate range of 45%–60% HRR (moderate exercise intensity). A target range for Ratings of Perceived Exertion was set at 11–13 for all patients, corresponding with "fairly light" to "somewhat hard" on the Borg (1970) scale. The Borg (1970) scale rates overall whole body feeling of exertion and measures exertion levels from 6 (sitting and doing nothing) to 20 (the hardest physical exertion you could do). If patients reached 14 or higher at any point during exercise, their intensity level was decreased. Patients began at a duration of exercise that was appropriate for them based on current fitness level, which varied from 10–40 minutes.

The CEP was designed to be individually progressive as tolerated. Progression was obtained first through increased exercise **duration** by adding small increments of 3–5 minutes per session as tolerated until patients reached 40 continuous minutes. All patients were able to progress successfully to 40 minutes of aerobic exercise before the end of 16 sessions. Exercise **intensity** was increased by small increments as tolerated (0.2 miles per hour on the treadmill or one level of increased resistance on the Nu-Step). All patients were able to increase their intensity to some degree within the program. Decisions regarding exercise progression were made by the CEP specialist.

The education portion of the CEP was an important component that enhanced the program along with physical exercise. The purpose of education was to further enhance patients' sense of control and, therefore, improve mood and coping skills. Education included a wide variety of topics focused on symptom management, coping, and wellness, including support groups, survivorship, resources, spirituality, stress management, chemotherapy and radiation, nutrition, energy conservation, relaxation and imagery, drugs and herbs, fatigue and pain, humor therapy, exercise safety and benefits, diagnostic testing, communication issues, financial issues, complementary therapy, and infection control. Classes were taught by professionals employed in the cancer center, such as the CEP specialist, dietitian, patient and nurse educators, the clinical nurse specialist, counselors, social workers, pharmacists, and the chaplain, as well as professionals in the hospital, such as occupational therapists and epidemiologists. Patients were encouraged to bring family members and caregivers with them to education sessions. Classes were informal and questions and interaction within the group were encouraged. Education classes were held twice a week with a different topic offered each session. Classes were offered in the morning and the afternoon, thereby making them available to patients in different exercise classes and making the most of educators' time. From January 2004 to August 2006, the average attendance per month was 12. The most frequently attended classes were nutrition, energy conservation, fatigue and pain, and stress management. Education was an optional, yet encouraged, component of the CEP. Variation in attendance of education classes was a result of different levels of patient interest in each topic offered, patient treatment status, patients' schedules, and seasonal variation.

The support offered as part of the CEP came in many forms and was an essential program component. The first type of support offered was peer support in the exercise classes. Classes were small (maximum of four people per class), with patients exercising in a group (even though the CEP specialist instructed each patient with his or her own personal exercise mode, time, and intensity). The exercise environment encouraged and was conducive to discussion within the group, allowing patients to share their cancer experience with each other. At times, patients who had finished a specific type of treatment were able to share with other patients who were preparing to go through that treatment. This facilitated a relationship of sharing and encouragement. According to Midtgaard, Rorth, Stelter, and Adamsen (2006), this sense of camaraderie also encourages and improves compliance in a program.

The other form of support that was offered in the program was from the CEP specialist. During each exercise session, the specialist assessed whether patients were healthy enough for exercise and also inquired about how patients were coping with their disease, side effects, and treatments. The specialist encouraged patients and praised them for taking the initiative to exercise for improvement of their health. As needed, patients were referred to counseling or education services, dietitians, support groups, or physical or occupational therapy.

Procedure

Patients receiving care in the cancer center were given information on the CEP as a complementary therapy to their standard cancer treatment. Oncologists signed a release for each patient and an initial evaluation was performed by the CEP specialist that included the 6MW. The POMS and PFS were taken home, completed, and returned at the first exercise session. Patients completed 16 exercise sessions, attended education classes, and received support and guidance from staff and fellow patients. Patients completed the 6MW, POMS, and PFS again after the conclusion of all exercise sessions.

Data Analysis

The effectiveness of the CEP was tested by comparison within the group from the preprogram measures (baseline) to the postprogram measures using paired t tests. Significance was established at the $p = 0.05$ level using conservative two-tailed tests. The data was coded, entered, and analyzed using SPSS® version 11.5.

Results

Sample

Patient demographics are listed in Table 2; 39 patients completed the program in its entirety. The age range of the group was 42–87 years ($\bar{X} = 63$; SD = 10.61). When asked about previous exercise habits, 45% (n =15) of the group indicated that exercise was "extremely" new to them, 24% (n = 8) stated that exercise was "somewhat" new to them, and 30% (n =10) indicated that exercise was "not at all" new to them. The group consisted of patients diagnosed with 13 different types of cancer with the majority being breast (39%), lung (15%), and prostate (7%). Other cancers included ovary, plasmacytoma, leukemia, lymphoma, skin or melanoma, non-Hodgkin lymphoma, multiple myeloma, rectal, endometrial, and peritoneal. The most common diagnosed stage was III (26%), followed closely by stage I (23%), and stage II (21%). Fourteen percent of the population was diagnosed with stage IV cancer, and one patient was stage 0 (ductal carcinoma in situ of the breast).

Table 3 describes patient treatment status on entry in the CEP. Most patients had finished cancer treatment within six months of the time they began the program (36%). Other patients were being treated (33%), had finished treatment within the last 6–12 months (10%), or had finished treatment more than one year earlier (21%).

Change in Fatigue

On average, patients reported significantly less fatigue on the PFS after the CEP ($\bar{X} = 3.56$) compared to before the CEP ($\bar{X} = 4.81$, $t[38] = 3.78$, $p < .05$). Seventy-five percent of the sample improved; 25% stayed the same or decreased over time.

Change in Physical Function

The distance walked in feet on the 6MW test was significantly increased following completion of the CEP ($\bar{X} = 1{,}555$ ft.) compared to before the CEP ($\bar{X} = 1{,}292$ ft., $t[37] = 6.37$, $p < 0.05$), walking an average of 263 more feet. Eighty-seven percent of the sample improved; 13% stayed the same or

Table 2. Patient Demographics

Characteristic	$\bar{X}$	SD
Age (years)	63	10.61
Characteristic	**n**	**%**
Gender		
Female	30	77
Male	9	23
Cancer type		
Breast	15	39
Lung	6	15
Prostate	3	7
Ovary	2	5
Multiple myeloma	2	5
Rectal or anal	2	5
Lymphoma	2	5
Skin or melanoma	2	5
Plasmacytoma	1	3
Leukemia	1	3
Non-Hodgkin lymphoma	1	3
Endometrial	1	3
Peritoneal	1	3
Cancer stage		
0	1	3
I	9	23
II	8	21
III	10	26
IV	6	14
Unknown	5	13

N = 39

Note. Because of rounding, not all percentages total 100.

decreased over time. In addition, no significant difference was observed in the amount of perceived exertion (indicated by Ratings of Perceived Exertion) as a result of the extra distance.

Change in Mood

Patients reported a significant decrease in their TMD after participation in the CEP ($\bar{X} = 12.21$) as compared to before the CEP ($\bar{X} = 23.28$, $t[38] = 5.96$, $p < 0.05$). Eighty percent of the sample improved; 20% stayed the same or decreased over time.

Discussion

The findings demonstrate positive changes in fatigue, physical function, and mood in patients of various types and stages of cancer after completion of a 16-session comprehensive exercise program that included exercise, education, and support. Because the three intervention components of this study were not separated, we cannot be certain which of the three components, if any, exerted the strongest influence on the positive outcomes or whether the outcomes might have been different if the intervention was limited to only one or two of the components. The researchers suggest that it is the combination of components that makes the program successful, but that cannot be proven at this point.

The CEP was unique in many ways. First of all, it demonstrated significant changes in outcomes after only 16 sessions that, on average, took approximately 11 weeks to complete. Most currently published studies used exercise interventions that meet the ACSM guidelines for developing and maintaining cardiorespiratory fitness for healthy individuals using criteria of three to five days per week, 20–60 continuous minutes, and 60%–90% of maximum heart rate (Courneya & Friedenreich, 1999). Significant positive effects were noted in the present study even with a more conservative exercise regimen. Given that most (69%) patients were on treatment or within six months of completion and 45% had never participated in a regular exercise program, a lighter exercise program might have been more appropriate for this population. The evidence may emphasize the need for individualizing exercise regimens to patient needs and readiness and add support to the notion that exercise at many levels can produce positive results when applied appropriately to the cancer population.

In the CEP, the intensity of exercise was low to moderate (30%–60% HRR), which is well below the ACSM guidelines stated previously. The CEP frequency of two days per week also was below ACSM standards. This allowed patients with low levels of physical function, who would not tolerate exercise at high intensities or frequencies, to participate. Significant deconditioning in patients usually is a result of aggressive cancer treatment or a more advanced cancer status such as stage IV. Those patients may have been excluded in other studies, but the authors believe this population needs the most assistance and has the greatest potential for benefit from an exercise program. Lower levels of exercise also may promote compliance.

The CEP also differs from other programs by including patients currently on treatment as well as those who have finished treatment. Furthermore, a variety of diagnoses and stages were represented. The second most prevalent cancer type was lung (15%), which rarely is represented in exercise studies despite the fact that lung is a common cancer diagnosis. This may be because patients with lung cancer usually are low functioning and diagnosed at more advanced stages, resulting in their probable exclusion from other exercise studies. The CEP also included a large number of patients with late stage disease and recurrent cancers. Studies that focus on the benefit of exercise including a stage IV population are rare. One study did provide evidence that patients of a noncurable diagnosis can benefit from physical activity (Oldervoll et al., 2006).

The data collected from the CEP support much of the research that has been published to date. The CEP also was unique because the program from which the data are collected is an ongoing program that continues to accept patients with all types of cancer diagnoses and stages at any level of physical function. Patients received more than improvements in physical function, fatigue, and mood; they also were able to be part of a program that gave them continued support along each step of their cancer journey.

Limitations

The program was limited by lack of a control group and uniformity. Patients only were able to be compared against themselves. However, the heterogeneity of the group is a unique and notable aspect of the program and demonstrates that regardless of diagnosis and stage, improvements can be achieved.

Patients varied the mode of exercise they performed based on their ability and fitness level. Some patients performed seated exercise the entire 40 minutes, others walked on the treadmill, or a combination of both was prescribed. A substantial literature base suggests that walking is an effective form of exercise (Holmes, Chen, Feskanich, Kroenke, & Colditz, 2005; Mutrie et al., 2007; Winningham, 1991) and limited evidence regarding the benefits of seated exercise (Headley, Ownby, & John, 2004). The authors cannot comment on the benefit of one form of exercise over another.

All patients completed 16 sessions of exercise; the exact time frame of completion differed based on days missed because of illness, schedule, transportation, or other reasons. The average time to completion was 11 weeks, with 31% completing the program in exactly eight weeks with no absences. What effect these breaks in exercise may have had on the final outcome is unknown; however, despite the fact that most patients (69%) did have some degree of a break in exercise consistency, significant improvements still were achieved. Educational sessions were a very important component of the program, but because the sessions were optional for the patients, which individuals attended education more regularly (or at all) than others and how this may have effected outcomes is unknown. The authors are unable to comment on the direct role that education played on the final outcome.

Table 3. Patient Treatment Status on Entry in the Cancer Exercise Program

Status	n	%
Currently on treatment	13	33
Less than six months since treatment	14	36
6–12 months since treatment	4	10
More than 12 months since treatment	8	21

N = 39

Home exercise was not prescribed for this population; independently performed exercise or physical activity was not documented. Because outside activity was not recorded, the authors are unable to comment on any effect it may have had on final outcomes. In the future, a home exercise program will be prescribed as appropriate and documented by the CEP specialist.

The CEP stresses the synergistic effect of exercise, education, and support, which was an assumption to some degree. The authors are unable to determine how the outcomes would have differed if only one component of the three was applied without the use of a control group. Further studies may need to be conducted comparing degree of benefit achieved by patients in comprehensive programs against patients in single-component exercise or support group programs such as the Group-Hope Trial (Courneya, Friedenreich, Sela, et al., 2003).

Nursing Implications

Per Levine's Conservation Model, the present study emphasizes the need to use exercise to offset CRF. The study encourages the use of low-to-moderate intensity exercise to benefit people with all types of cancer. Even though further studies need to be completed to determine the best mode, duration, and intensity of exercise for survivors, the authors can say with some certainty that low-to-moderate intensity exercise produces significant benefits for people with cancer without causing participant overload or dropout. The study results aligned with Levine's theory, validating favorable patient responses when incorporating exercise to treat fatigue.

Institutionally, the CEP has low overhead, and any healthcare institution with a trained exercise physiologist, minimal equipment, physical space, and educational resources could provide the service for their patients with cancer. Using current resources and collaborating among departments can grow the program effectively. Applicability can be found throughout nursing areas. For bedside nurses, appropriate recommendations could be made after assessment of patients' physical abilities. For bedridden patients, creative suggestions could include some form of appropriate hand, wrist, and arm circles and movements and leg lifts and circles per ability. For patients who are mobile, depending on limitations, walking could be encouraged on the unit for a specified time or distance. Nurses would be encouraged to monitor patients closely the first time and evaluate their exertion level, then make recommendations for the next time. Outpatient clinic nurses could refer patients to a monitored program, depending on availability, such as programs at local fitness facilities. For optimal results, oncology nurses should collaborate with the specific business to help them better understand the patient population, treatment considerations, and exercise parameters. Regardless of the setting, patients should be encouraged that any type of exercise on a routine basis will have positive implications to their overall health. As numerous studies have demonstrated, the effect of fatigue on cancer survivorship is immense for short- and long-term implications, with further studies encouraged to demonstrate results.

Author Contact: Lindsey Renee Hanna, MS, can be reached at lrhanna@chsmail.org, with copy to editor at ONFEditor@ons.org.

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