Background: Guidelines suggest that aerobic endurance training and moderate resistance training lessen the effects of cancer-related fatigue (CRF). However, specifics regarding frequency, intensity, and type of physical activity required to alleviate fatigue are less specific. In addition, outcomes of these interventions during the initial stages of active treatment are not well documented.

Objectives: The purpose of this article is to review the current evidence-based literature regarding the effects of physical exercise on CRF and the role that the clinical nurse leader (CNL) can play in implementing interventions to address CRF and promote physical exercise to improve patient outcomes.

Methods: A literature review of the effect of physical exercise on CRF was conducted using the CINAHL®, PubMed, and Google Scholar databases.

Findings: As leaders in health care, CNLs have the knowledge and skill to take an active role in managing CRF and to develop evidence-based interventions to address fatigue in this patient population. Interventions may include creating and evaluating individualized exercise plans for inpatients with cancer and/or developing educational programs for the inpatient setting that may be continued after discharge and during outpatient treatment.

Key words: fatigue; cancer program quality; caregiver strain and burden; complementary/alternative therapies; exercise/physical activity; quality of life

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Cancer-related fatigue (CRF) is the most common side effect of cancer and its treatment (Kuchinski, Reading, & Lash, 2009). The National Comprehensive Cancer Network ([NCCN], 2016) defines CRF as “a distressing, persistent, subjective sense of tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning” (p. 1). Of note, 69%–99% of patients with cancer experience CRF during the course of treatment (Kuchinski et al., 2009). Although CRF may subside or improve after treatment, it can often persist for months or years (Kuchinski et al., 2009). CRF is much different from the fatigue that a healthy individual experiences (National Cancer Institute [NCI], 2013). In healthy people, sleep and rest can relieve fatigue experienced from typical day-to-day activities (Kuchinski et al., 2009). However, when patients with cancer experience fatigue, they may feel debilitated and be able to perform fewer activities, affecting their quality of life (Cramp & Byron-Daniel, 2012). This may result in sleeping more hours, worse mental fatigue, mood changes, and absences from school or work, leading to loss of money and health insurance (Chang et al., 2008).

The pathophysiology of fatigue in patients with cancer is not fully understood, but a combination of treatment (chemotherapy, radiation, and/or biologic therapy) and the physiologic changes from the disease itself are thought to be the culprits. As it relates to treatment, CRF is hypothesized to result from excess tissue damage or the accumulation of by-products produced by cell death. Fatigue may also be the side effect of treatment-induced anemia, medications, metabolic and hormone disturbances, decreased caloric intake as a result of loss of appetite, age, and the amount of plasma in the blood. It may also be exacerbated by pain, depression, and anxiety (NCI, 2013).
Regardless of how CRF develops, it continues to be a leading problem for patients with cancer (Kummer, Catuogno, Perseus, Bloch, & Baumann, 2013). Although attempts to treat CRF with medication have not been successful, previous research and evidence-based literature strongly suggest that exercise may attenuate CRF (Andersen et al., 2013). However, current NCCN (2016) guidelines remain vague and do not allude to specifics, such as frequency, intensity, and types of physical activities. In addition, the result of using these interventions during the initial stage of active treatment, such as during chemotherapy or radiation therapy, is not well documented (Kummer et al., 2013). According to the Centers for Disease Control and Prevention ([CDC], 2014), the average hospital length of stay for patients with cancer associated with initial diagnosis and treatment (e.g., surgery or induction chemotherapy) is 6.3 days. Although most patients with cancer are treated on an outpatient basis, the initial hospital stay can provide a platform for establishing an exercise regimen appropriate for inpatient and outpatient settings and possibly alleviate early onset CRF.

The purpose of this article is to review the current evidence-based literature regarding the effects of physical exercise on CRF based on frequency, intensity, time, and type of activity. This article will also discuss the role the clinical nurse leader (CNL) can play in implementing these findings to decrease the prevalence of CRF in patients with cancer.

As leaders in the nursing profession, CNLs are known as highly skilled, competent, and knowledgeable nurses that are focused on improved patient outcomes and putting evidence-based literature into action (King & Gerard, 2012). Because of the focus on cost-effective care, as well as quality and safety outcome improvements, CNLs have an opportunity to serve a unique role in using evidence-based interventions to further reduce CRF in patients with cancer (Stanley et al., 2008). They have the knowledge and skill to take an active role in chronic disease management and assess and manage physical symptoms, such as CRF (King & Gerard, 2012). The findings from this article can provide CNLs with a platform to successfully implement specific exercise interventions to manage CRF in people with cancer.

Literature Review

A literature review of the effect of physical exercise on CRF was conducted using the CINAHL®, PubMed, and Google Scholar databases. The initial dates of publication selected were from 2008–2014 to ensure that the most up-to-date research was being reviewed. One study published in 2003 was included in this review because it provided critical data that served as the basis for the current NCCN guidelines (combined aerobic and resistance training). The inclusion criteria were (a) at least one study outcome was fatigue related to the cancer diagnosis; (b) use of systematic reviews with meta-analyses, as well as randomized and experimental control studies; and (c) at least one experimental group needed to have an exercise intervention in the inpatient setting. Exclusion criteria included pediatric populations aged younger than 18 years or if the intervention was implemented only in the outpatient setting. Combinations of the following terms were used in the database searches: cancer, exercise, fatigue, nurse, chemotherapy, and radiation. This search resulted in 32 articles in PubMed and 21 articles in CINAHL. After reviewing the abstracts and articles and applying the inclusion and exclusion criteria, a total of seven articles were chosen for this review.

NCCN (2016) guidelines state that patients with cancer should aim for 30 minutes of aerobic exercise at least five days per week coupled with light resistance training. This can be broken up into multiple sessions throughout the day or completed at one time. However, if patients have been exercising more frequently or for longer durations prior to their cancer diagnoses and treatment, they may only be required to adjust the intensity or decrease their total exercise time (NCCN, 2016). The evidence-based literature included in the current review supports a multiprong approach of high-intensity (85%–95% of maximum heart rate) and low-intensity (50%–70% of maximum heart rate) aerobic activity, resistance training, relaxation training, and massage therapy to further reduce CRF in patients with cancer. In addition, evidence supports that an individualized training program may be the most effective approach for patients experiencing CRF (Coleman et al., 2003; Cramp & Byron-Daniel, 2012; Kuchinski et al., 2009).

The Johns Hopkins Nursing Evidence-Based Practice Rating Scale was used to evaluate this literature review. This scale provides a method to rate evidence-based studies in two ways. First, the study is rated by its strength, or level, of evidence. The study is then graded for the quality of criteria in evaluation of evidence. Level I strength is the highest rating and includes experimental studies; randomized, controlled trials (RCTs); and meta-analyses of RCTs. Level II strength includes evidence from a quasieperimental study, and level III evidence includes nonexperimental studies, qualitative studies, or meta-syntheses. A study can be given a quality rating of A (high), B (good), or C (low/major flaw). High-quality ratings include consistent results with sufficient sample, adequate control, and definitive conclusions, as well as consistent recommendations based on extensive literature review that includes thoughtful reference to scientific literature. Good-quality ratings included reasonably consistent results with a sufficient sample, some control, and fairly definitive conclusions, as well as reasonably consistent recommendations based on a fairly comprehensive literature review that includes some reference to scientific evidence. Low-quality ratings included little evidence with inconsistent results, insufficient sample sizes, and inability to draw conclusions. For the purpose of this literature review, only studies with level I strength of evidence with a quality grade of A or B were analyzed (Newhouse, 2006).

The seven studies in this review included three RCTs, one experimental design, two meta-analyses, and one Cochrane Review. The populations included a variety of malignancies, including hematologic malignancies (acute myeloid leukemia [AML], chronic leukemia, Hodgkin lymphoma, and non-Hodgkin lymphoma) and solid tumors (breast, ovaries, testes, prostate, cervix, pharynx, esophagus, brain, pancreas, stomach, and lung). The focus of the current review is exercise interventions in the inpatient setting. Some studies in the review included mention of outpatient interventions but only in comparison to an inpatient intervention group.

In a prospective randomized trial by Andersen et al. (2013), 213 patients with varying cancer diagnoses who were currently undergoing chemotherapy treatment were selected from the Body and Cancer Trial. Participants were randomized into the intervention group or a waitlist control group. The intervention
TABLE 1. Literature Review on Exercise Interventions

<table>
<thead>
<tr>
<th>Study</th>
<th>Objective</th>
<th>Design and Sample</th>
<th>Results</th>
<th>Level of Evidence</th>
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<tbody>
<tr>
<td>Andersen et al., 2013</td>
<td>To evaluate whether a six-week supervised multimodal exercise intervention, adjunct to chemotherapy and standard care, can reduce the patient’s CRF level</td>
<td>CRF was significantly reduced in the intervention group. No statistically significant effect was found on the general quality-of-life score or any of the individual well-being scores. This six-week supervised multimodal exercise intervention led to significant reduction in self-reported CRF in patients undergoing chemotherapy.</td>
<td>IA</td>
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<td>Chang et al., 2008</td>
<td>To determine the effects of a walking program on CRF in relation to patients with AML receiving chemotherapy</td>
<td>Patients with AML in the three-week intervention group had a significantly greater increase in 12-minute walking distance than the control group. Patients in the intervention also had lower levels of fatigue intensity and interference, symptom distress, anxiety, and depressive status than the control group. Although preliminary, results strongly suggest that three weeks of systematic walking exercise is clinically feasible for patients with AML undergoing chemotherapy and can effectively improve fatigue-related experiences.</td>
<td>IB</td>
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</tr>
<tr>
<td>Coleman et al., 2003</td>
<td>To test the feasibility and effectiveness of exercise for patients with other types of cancer and with bone involvement</td>
<td>Because of the small sample size in the feasibility study, the effect of exercise on lean body weight was the only end point that obtained statistical significance. The exercise group maintained lean body weight, and the usual care group lost lean body weight. Results suggest that an individualized exercise program for patients receiving aggressive treatment for multiple myeloma is feasible and may be effective for decreasing fatigue and mood disturbance and for improving sleep.</td>
<td>IB</td>
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<tr>
<td>Cramp &amp; Byron-Daniel, 2012</td>
<td>To evaluate the effects of exercise in relation to CRF during and after cancer treatment</td>
<td>Statistically significant findings showed that aerobic exercise is effective against CRF in patients with solid tumors. Fatigue was reduced in patients with breast and prostate cancers who received exercise interventions during and after adjuvant cancer therapy, but not for those with hematologic malignancies. Aerobic exercise significantly reduced fatigue, but resistance training and other forms of exercise are not statistically significant. Additional research is needed to understand the optimal type, intensity, and timing of an exercise intervention.</td>
<td>IA</td>
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<td>Kuchinski et al., 2009</td>
<td>To determine if patients receiving treatment for cancer experienced less treatment-related fatigue if they participated in a regular, committed exercise regimen compared to those who did not exercise regularly</td>
<td>Eight of the 10 studies showed that regular committed exercise resulted in less fatigue among the intervention group regardless of setting. Evidence shows that an individualized exercise program for patients undergoing chemotherapy or radiation therapy could be beneficial. Studies showed no adverse effects from exercise, such as increased fatigue or falls.</td>
<td>IA</td>
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AML—acute myelogenous leukemia; CRF—cancer-related fatigue; RCT—randomized, controlled trial

(Continued on the next page)
Kummer et al., 2013
To examine the relationship between CRF and physical activity in the course of inpatient rehabilitation and treatment
Experimental design with 35 patients aged from 33–79 years. About half were female, and types of cancer included oral cavity, respiratory system, breast, genitourinary organs, and leukemia. Intervention included a three-week rehabilitation program in an inpatient setting that included daily exercise therapy. Daily therapy consisted of aerobic endurance training for 30 minutes three to six times per week, moderate resistance training two to three times per week for 45–60 minutes, coordination exercises, relaxation training, and individual physiotherapy. No control group existed.
All 35 participants were able to complete their prescribed exercise therapy program, including questionnaires. At discharge, patients in the intervention group experienced less fatigue and an increase in physical activity levels. The most significant effects in the findings were associated with a weekly energy expenditure of 3,000 kcal. Recommendations include weekly physical activity level of 8 hours of moderate walking or 11 hours of moderate exercise per week. Safety regarding a further increase of physical activity level and potential health effects was not well documented. Exercise is possible and safe in the initial stages of cancer rehabilitation and treatment.

Velthuis et al., 2010
To evaluate effects of different exercise prescription parameters during cancer treatment on CRF and to gain insight into the safety and feasibility of exercise during adjuvant cancer treatment
Meta-analysis of 1,097 articles. Of those, 50 RCTs were potentially relevant based on title and abstract, and 19 met the inclusion criteria. Studies were pooled based on cancer diagnosis, home-based versus inpatient exercise programs, and type of exercise. Interventions involved studying the effects of exercise (aerobic, strength training, flexibility, or a combination) during cancer treatment on CRF.
During breast cancer treatment, home-based exercise programs led to a small, nonsignificant reduction, and supervised inpatient aerobic exercise showed a medium to significant reduction in CRF compared with no exercise. A subgroup analysis of home-based (n = 65), supervised (n = 98), and resistance exercise programs (n = 208) in patients with prostate cancer showed a significant beneficial effect of exercise on CRF when results of all exercise regimens were pooled. However, researchers were unable to prove effectiveness of home-based, supervised, and resistance exercise separately. They were also unable to determine the most effective parameters of exercise for frequency, duration, and intensity because of heterogeneity between the studies.

AML—acute myelogenous leukemia; CRF—cancer-related fatigue; RCT—randomized, controlled trial

Most studies explored the effects of exercise interventions on patients with breast, prostate, colon, lung, or varied malignancies, but not many included people with hematologic malignancies (see Table 2). In one RCT by Chang et al. (2008), the effect of exercise and fatigue-related experiences in 24 patients with AML who were receiving chemotherapy treatment were examined. Patients were randomized into a standard of care control group or intervention group, which consisted of a three-week program of 12 minutes per day of walking for five days each week. Patients were instructed to walk in the hospital hallway at an intensity that met their target heart rate, which was the resting heart rate plus 30 beats per minute. Seven indicators, including 12-minute walking distance, fatigue intensity (average fatigue intensity and worst fatigue intensity), and fatigue interface (with daily life), were used to measure fatigue outcomes. The fatigue experience (intensity and interface) was measured using the Brief Fatigue Inventory (BFI), a 10-item test that rates responses on an 11-point scale from 0–10, with 0 indicating no fatigue and 10 indicating worst fatigue. The reliability of the BFI for this study ranged from 0.85–0.9 across all data collection times. When compared...
to the control group and to baselines, all fatigue indicators showed significant improvement for these patients, as well as a decrease in patients' distress from other symptoms. Preliminary findings suggest that standardizing a walking exercise regimen during cancer treatment can improve cancer-related symptoms, including fatigue.

Coleman et al. (2003) recognized that CRF and sleeping difficulties are symptoms that are often experienced simultaneously during cancer treatment. In this RCT, the effectiveness of the combination of individualized aerobic and resistance training exercise programs was tested with patients with bone metastases by looking at outcomes of CRF and insomnia. In this study, patients with multiple myeloma were receiving high-dose chemotherapy and peripheral blood stem cell transplantsations. Each participant in the intervention group received an individualized exercise prescription. Results were compared to a control group that received usual care, which was encouragement to remain active and walk for 20 minutes at least three times per week. The intervention group received an individualized exercise program based on their exercise history, strength levels, and aerobic capacity for a total of six months. Patients were assigned to keep an exercise log to document frequency, intensity, and duration of exercises. Fatigue was assessed using the Profile of Mood States scale. An actigraph device was used to assess sleep, and the BOD POD® machine was used to assess muscle strength. Compared to the control group, the intervention group gained muscle strength, showed a decrease in fatigue, and increased the total minutes of nighttime sleep. This was the first study to test the combined effect of aerobic and resistance exercise interventions on fatigue and sleep in this population.

Kummer et al. (2013) recognized exercise as an effective intervention to manage CRF. In this study, 35 patients had a variety of cancer diagnoses, mostly including cancers of the digestive, respiratory, and intrathoracic organs (n = 28). The intervention focused on the relationship between exercise and CRF in the initial stages of cancer treatment. During a period of six months, all study participants completed a three-week rehabilitation program that consisted of endurance training (treadmill or arm/bicycle ergometer) three to six times per week for as many as 30 minutes, in addition to resistance training (body weight, resistance bands, light weights, and balance pads) for 45–60 minutes two to three times per week. Patients’ physical function was monitored by heart rate, blood pressure, oxygen saturation, and subjective exertion, and physical endurance was measured by a standardized six-minute walk test. Although patients were able to use free time to do additional walking or other voluntary physical activities, the total amount of physical activity was similar among participants. Using two instruments to measure fatigue (Multidimensional Fatigue Inventory and the Freiburg Questionnaire of Physical Activity), the findings demonstrated that each dimension of CRF decreased when compared to baseline (p = 0.001–0.003), and physical activity increased significantly (p = 0.001). This study showed that exercise is safe and possible during the initial stages of cancer treatment and rehabilitation, but more research needs to be done to determine the maximum safe level of physical activity (maximum heart rate).

In a meta-analysis by Kuchinski et al. (2009), 10 studies that fit preestablished criteria were reviewed and graded using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The majority of studies (n = 8) revealed that patients who consistently exercised experienced less fatigue when compared to the control groups. Five of the 10 studies determined that exercise seems to be most effective when an individualized exercise plan based on current health status and previous activity levels is used. Similar to Andersen et al. (2013), 4 of the 10 studies reviewed by Kuchinski et al. (2009) found that using a multimodal approach and including yoga, range-of-motion exercises, and resistance training added to usual exercise regimens decreased CRF.

Another meta-analysis by Velthuis, Agasi-Idenburg, Aufdemkampe, and Wittink (2010) described the most common exercise prescription. The 19 RCTs included in this review focused on the effects of exercise and CRF during cancer treatment and the evaluation of specific exercise parameters. The frequently used exercise intervention consisted of low to moderate intensity (50%–70% of maximum heart rate) and regular frequency (three to five times per week) for at least 20 minutes and included aerobic and resistance training. However, this meta-analysis noted that healthcare professionals need to better understand how age, cancer type, treatment, presence of symptoms, and previous physical fitness levels can affect the frequency, duration, intensity, and type of exercise most appropriate for patients with cancer. This meta-analysis found that supervised aerobic activity showed a moderate and significant reduction in CRF (standard mean difference [SMD] = 0.3, 95% confidence interval [CI] [0.09, 0.51]) compared to no exercise. Because of the heterogeneity of the included studies, the most effective exercise parameters of frequency, intensity, and duration were unable to be determined, suggesting the need for more prospective studies focusing on this area.

A Cochrane Review by Cramp and Byron-Daniel (2012) aimed to evaluate the effectiveness of an inpatient exercise intervention in relation to CRF during and after cancer treatment. A total of 56 studies with 4,068 participants were identified, a majority of whom were patients with breast and prostate cancers. It was found that, when compared to the control group, the aerobic exercise interventions (walking and cycling) were more effective than no exercise regimen (SMD during and after adjuvant cancer treatment = 0.27, 95% CI [-0.37, -0.17]). Results for resistance training and alternative forms of exercise, such as meditation, were not significant. In addition, further research needs to be conducted to determine optimal type, intensity, and frequency of prescribed exercise interventions.

Cramp and Byron-Daniel (2012) and Kummer et al. (2013) recognized the need and demonstrated the benefit and safety of starting an exercise regimen early on in inpatient cancer treatment, noting the immediate effects on decreasing CRF. Chang et al. (2008) verified the current NCCN standards of low-intensity aerobic activity (50%–70% of maximum heart rate) as the bare minimum amount of exercise in which an inpatient should participate to feel the positive effects against CRF. However, Andersen et al. (2013), Cramp and Byron-Daniel (2012), and Velthuis et al. (2010) suggested that further decreases in CRF might be achieved if standards for optimal frequency, duration, intensity, and type of exercise are established for inpatients. Cramp and Byron-Daniel (2012) and Coleman et al. (2003) found that an individualized exercise program for inpatients could help to maximize patients’ aerobic capacity and physical activity, reducing fatigue. Finally, Kuchinski et al. (2009) determined
that, in addition to a multimodal approach, exercise regimens should be individualized to each patient for them to achieve the maximum benefit of an exercise program.

### Recommendations for Practice

An evidence-based approach to research and patient care has been recognized as the most effective method for improving patient outcomes (Penz & Bassendowski, 2006). This approach involves making decisions about patient care by combining the most up-to-date evidence from research with practical experience to make a decision that is ultimately best for the patient (Penz & Bassendowski, 2006). Because CRF continues to be the main symptom experienced as a result of cancer and its treatment (Kuchinski et al., 2009), CNLs have the opportunity to make a positive impact on rates of CRF. CNLs are leaders who

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**TABLE 2. Critique Templates for Research Studies**

<table>
<thead>
<tr>
<th>Study</th>
<th>Strengths</th>
<th>Weaknesses</th>
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<tbody>
<tr>
<td>Andersen et al., 2013</td>
<td>Adequate sample size (N = 213); randomized design with control sample; participation by patients with early and advanced stages of cancer; high adherence rate (73%); intention-to-treat analysis and a validated questionnaire used</td>
<td>Heterogeneity of the patients with respect to diagnosis and to cytotoxic treatment schedules; patients were young and well educated; unable to isolate, separate, and compare effect of each intervention component; unable to measure effect of involving peer support group and encouragement from coaches to patient’s energy and activity level; self-referral of participants</td>
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<tr>
<td>Chang et al., 2008</td>
<td>100% completion by participants; search strategies used were well defined; outcomes assessed before, during, and after chemotherapy for accurate measurement of CRF as related to physical activity; exercise regimens similar among intervention group participants; exercise regimens explicitly detailed</td>
<td>Small sample size; long-term effects not able to be analyzed; patients only followed for one chemotherapy course; a longer period is strongly suggested to evaluate the effects of the exercise program; experimental group had twice as many males as the control group; difference in gender distribution not significant but not able to be analyzed because of small sample size</td>
</tr>
<tr>
<td>Coleman et al., 2003</td>
<td>Randomized design with control group; participation by patients with early- and advanced-stage cancer; results gathered beginning about three months before the first transplantation, continuing through the first transplantation, and ending about three months after the first transplantation; results based on a validated questionnaire and equipment</td>
<td>Small sample size; patient may not have entered study at true baseline; high attrition rate; unable to isolate, separate, and compare effect of each intervention component; statistically significant results for only one outcome (lean body weight)</td>
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<td>Cramp &amp; Byron-Daniel, 2012</td>
<td>Two review authors independently assessed the risk of bias of studies and extracted data based on predefined criteria; where data were available, meta-analyses were performed for fatigue using a random-effects model; clearly defined inclusion and exclusion criteria; studies compared exercise with no exercise; presence of control group; studies that explored multidimensional programs in which the effects of exercise alone could not be determined were excluded</td>
<td>Intervention could take place in any setting and all types of exercise were considered; difficult to draw specific conclusions; heterogeneity of fatigue measurements used; diverse range of studies with small sample size in several of them; few of the included studies provided information about people who refused participation in the trial</td>
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<tr>
<td>Kuchinski et al., 2009</td>
<td>High level of evidence from studies reviewed; search strategies used were well defined; all studies evaluated based on the PICO outline; level of evidence presented in these studies was established using PRISMA; participation by patients with early- and advanced-stage cancer</td>
<td>Lack of a universal definition for fatigue; lack of a universal measuring instrument to evaluate the effectiveness of interventions; review limited to research conducted from 2000–2006; review limited to four types of cancer; 40% of reviewed studies had small sample size</td>
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<td>Kummer et al., 2013</td>
<td>Exclusion criteria included serious and acute cardiovascular and metabolic diseases that could be exacerbated by exercise or might lead to health complications and terminal disease status with palliative care in place; search strategies used were well defined; intervention carefully monitored; no dropouts and 100% participation</td>
<td>Small sample size; validity of results limited to types of cancer; majority of patients diagnosed with cancer of the digestive organs or respiratory system; because of legal requirements and ethical reasons, clinical trials in inpatient rehabilitation are bound by certain restrictions, resulting in limitations of internal validity; no control group; possible subjectivity because of self-report</td>
</tr>
<tr>
<td>Velthuis et al., 2010</td>
<td>Clearly defined inclusion and exclusion criteria to minimize bias and target relevant data; purpose of the study is clearly identified in the introduction; search strategies were well defined; measurement instruments were clearly defined; results were clearly laid out in table and text format; implication for practice was based off of the results found; two reviewers independently rated the methodologic quality of included studies using the PEDro scale</td>
<td>Conclusion based on limited amount of data; three studies including 340 patients; not possible to determine the clinical relevance of findings because of a wide range of measurement instruments for CRF; only short-term effects analyzed</td>
</tr>
</tbody>
</table>

CRF—cancer-related fatigue; PICO—population/patient, intervention/indicator, comparator/control, outcome; PRISMA—Preferred Reporting Items for Systematic Reviews and Meta-Analyses
focus on patient outcomes, practice within an interdisciplinary team, and base their decisions on evidence-based practice (Stanley et al., 2008). As a result of this literature review, three ways were noted in which findings can implicate the CNL role, the nursing profession as a whole, and CRF rates.

From the review of the literature and several meta-analyses, exercise has been noted to decrease CRF in early and late stages of the disease. The first recommendation for practice implementation focuses on the need to perform a physical health and exercise assessment on the patient before deciding on the most appropriate exercise regimen. As a leader on the nursing team, CNLs have the ability to cultivate these standards for the unit’s practice standards and make them a part of usual care (Velthuis et al., 2010). Such standards involve making sure every nurse on the unit is educated regarding the benefits of exercise for CRF, so they can explain the rationale to their patients. This training can be expanded to include strategies to motivate patients to participate in exercise programs and manage their exercise regimens. In addition, active engagement of patients and supervision of the activities promotes safety and adherence to the recommended interventions (Velthuis et al., 2010). CNLs essentially become a cancer exercise specialist for the staff and the overall unit.

The second recommendation regarding CRF and exercise involves individualizing aerobic and resistance exercise regimens for inpatients with cancer based on physical health, strength, and previous exercise regimens. These exercise programs can be individualized based on frequency, intensity (low, moderate, or high), time, and type. If the exercise program is catered to each patient’s current health status, physical fitness level, vital signs, respiratory health, and psychosocial status, they are more likely to adhere to their exercise programs on a long-term basis and will also experience the most benefits (Cramp & Byron-Daniel, 2012). This can be accomplished in two ways. The first step involves the nurse initially and continually assessing, managing, and communicating the patient’s status to appropriate members of the oncology team. The process needs to be standardized in terms of how a patient is initially assessed, the specific prescription for an exercise program, and follow-up plans for reassessment to adjust the program based on health status and patient needs. The initial assessment and prescription would occur in the inpatient setting but would eventually continue in the outpatient setting after discharge.

The second step involves CNLs using members of the interdisciplinary team to maximize options for individualized care. For example, a physical therapist may provide suggestions for resistance exercises, in addition to aerobic exercises. Other disciplines could contribute to this multimodal approach, including massage therapists and yoga instructors (Kuchinski et al., 2009). If the hospital does not have these additional resources, CNLs could advocate for hiring these professionals with funding, such as grants, or using professional volunteers (e.g., licensed massage therapists). Current evidence suggests that exercise programs could be further customized based on intensity, duration, and types of exercise according to individual fitness levels; however, this research is still in the preliminary stages (Cramp & Byron-Daniel, 2012). The CNL should stay abreast of new evidence and recommendations regarding this subject to modify their unit standards accordingly.

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### Implications for Practice

- **Perform a baseline physical health and exercise assessment to create an individualized aerobic and resistance exercise regimen.**
- **Serve as a leader in staying abreast of new studies and clinical practice updates to educate members of the oncology unit and interdisciplinary team.**
- **Become an advocate and resource for creating and maintaining exercise space in the hospital and for writing grants to acquire exercise equipment for inpatients.**

The third step centers around the CNL as an advocate for additional resources for patients. With newer studies supporting the use of more resistance training and a variety of aerobic exercises to further decrease CRF, patients need to be able to do more than just walk laps around the oncology floor (Andersen et al., 2013). This poses the opportunity for CNLs to advocate and apply for grants that would fund the implementation of exercise equipment on the oncology unit. This would entail beginning discussions with the nurse manager and hospital administration to identify a space to install this equipment, as well as who would maintain the cleanliness and upkeep of machines. The money awarded from grants could fund equipment, such as treadmills, light weights, and resistance bands. By having this area developed on the inpatient unit, patients could be easily monitored without having to leave the unit to perform their exercises.

### Conclusion

Current literature supports NCCN exercise guidelines as an effective intervention to help alleviate CRF. However, preliminary and ongoing studies support the need to take a more multimodal approach and include progressive resistance training with varying intensities of aerobic fitness to further reduce CRF rates. In addition, other studies (Cramp & Byron-Daniel, 2012; Kummer et al., 2013) recognize the benefit of using exercise interventions early on in an inpatient setting. Early intervention provides a platform for establishing an exercise regimen appropriate for each patient and early CRF symptom treatment. Recommendations for future research include the need for additional prospective RCTs with large sample sizes to establish cause to modify current standards, including frequency, intensity, time, and type of exercise.

CNLs are highly skilled clinicians who are educated to implement evidence-based practice changes and improve quality of care and patient outcomes (King & Gerard, 2012). In this emerging role, CNLs are in a unique position on the oncology team to help staff nurses provide evidence-based interventions and ensure implementation of current NCCN standards, as well as build upon and individualize them for patient needs. CNLs need to remain informed and well versed in new and relevant research regarding CRF. By obtaining and appropriately implementing this knowledge under the evidence-based model, CNLs play an instrumental role in providing the highest level of patient-centered care with individualized exercise programs to prevent, manage, and alleviate CRF.
References


