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An exerciSe program to improve depression And sleep Disorders in oncology patients: The **SAD** study

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ABSTRACT

Purpose: The purpose of this study was to determine if a structured supervised outpatient exercise program specifically for cancer patients would be associated with improvements in insomnia and depression after attending for 10-weeks.
Design: Descriptive observational study.
Sample and setting: 75 adult subjects attended an outpatient hospital based exercise program specifically for cancer patients and coordinated by an exercise physiologist and a physical therapist.
Method: Two validated instruments were administered to measure insomnia (Athens Insomnia Instrument) and depression (Zung Self-Rating Depression Scale) at baseline (prior to the start of the program) and repeated after 10-weeks of exercise.
Results: Forty (53.3%) completed the full 10 week program. Of the 40 that completed the program, an improvement in insomnia scores was seen (p-value < 0.01) as well as depression scores (p-value = 0.01). Baseline insomnia scores were not different between subjects that did not complete the program compared to those who did (p-value = 0.4401). However, baseline depression scores were higher in subjects who did not complete the program compared to subjects who did (p-value = 0.0462).
Conclusions: Exercise improved depression and insomnia in cancer patients. By improving these symptoms, mortality, morbidity, and costs may be improved in the oncology population. Exercise programs can provide not only the health benefits of exercise, but also give cancer populations support from their peers which may improve their overall quality of life.

1. Introduction

There has been considerable progress in reducing the incidence and mortality rates of individuals diagnosed with cancer in the United States. It is estimated that 15.5 million Americans are alive with a history of cancer as of 2016 (Bluethmann et al., 2016). With this large population of cancer survivors, it becomes important to understand their physiological and psychological needs in order to improve morbidity. Cancer diagnoses can lead to significant stress responses; two common psychological stress responses are insomnia and depression which affect quality of life in this population and lead to other physiological responses. Insomnia has been reported in as many as 60% of cancer patients while approximately 20% meet the diagnostic criteria for insomnia disorder (Mercier et al., 2017). Insomnia has negative consequences such as the development of psychiatric disorders, exacerbation of pain, impaired immunity, fatigue, psychological distress, impaired cognitive functioning, poor adherence to treatments, and increased mortality and morbidity (Giese-Davis et al., 2011; Matthews et al., 2018; Mercier et al., 2017). Moreover, consequences of insomnia have demonstrated to be a costly healthcare burden (Daley et al., 2009). Utilization of sedative and/or hypnotic medications among cancer patients to treat sleep disorders is approximately 25% and have side effects with long term use (Casault et al., 2012; National Institute of Health, 2005). Therefore, this emphasizes the need to find ways to treat insomnia with non-pharmacological interventions when possible.

Depression, another common complaint amongst cancer patients occurs in up to 50% of the population, a rate three to five times higher than the general population (Sotelo et al., 2014). Studies have revealed that depression has been associated with an increased mortality rate

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and utilizing interventions to treat it, have demonstrated an increase in survival rates in women with metastatic disease (Falagas et al., 2007; Giese-Davis et al., 2011). Depression in cancer populations can increase length of hospitalizations, reduce the ability for self-care, and decrease treatment compliance (Sotelo et al., 2014).

Because both depression and insomnia have negative consequences in patients with cancer, methods to reduce the occurrence rate are crucial. Evidence suggests that exercise may have a positive effect on physical functioning and fatigue in cancer populations (Mercier et al., 2017). In addition, in a meta-analysis of exercise and depression in cancer survivors, aerobic exercise showed a decrease in depressive symptoms and more so when the exercise was supervised (Brown et al., 2012). In addition, structured or supervised exercise programs where multiple people attend at the same time, may provide peer support if aimed at a certain population. In a study of 150 breast cancer patients, peer support improved their quality of life and depressive symptoms which may occur along with the exercise in a structured and supervised program (Huang and Hsu, 2013). Little evidence exists on whether structured supervised exercise programs help cancer patients improve their depression and sleep disorders.

2. Objectives

The purpose of this study was to determine if a structured supervised outpatient exercise program specifically for cancer patients would be associated with improvements in insomnia and depression ratings after attending a program for 10-weeks.

3. Sample and Setting

A not-for-profit community hospital in Stockton California has provided a structured exercise program specifically for cancer patients for many years. These patients are referred by local oncology offices. This 10-week program is provided free of charge and can be started at any time of an individual's cancer diagnosis. Male and female patients (18 years or older) were recruited to this study by referral from the exercise program staff to the research team prior to them starting their first exercise session. The program is coordinated by an exercise physiologist with a certification specifically in cancer exercise and a physical therapist certified as a lymph edema specialist. The program consists of two days a week of exercise which includes a warm up session, cardiovascular circuit training, strength training, and a cool down session lasting approximately 90 min each session. Subjects included in the study were currently receiving treatment (chemotherapy and/or radiation) for any type of cancer or were within six months from completion. Patients were excluded if they were within eight weeks of surgery, had not had any type of treatment within the prior six months, or had cognitive issues according to their physician at the time of starting the program that would hinder their ability to complete the questionnaires.

4. Methods

The research site is part of a 40 facility Catholic healthcare system. Regional Institutional Review Board approval was obtained prior to any research activities with patients. Oncology patients were referred by their oncologist's office to the program and those that met criteria for the study, were approached for participation in the study. The research staff met with the patient in a quiet and private location to review the consent form and the procedures required for the study. Time was allowed for questions and if the patient agreed to participate, they then signed the consent form. On the first day of starting their 10-week program, two instruments were administered in paper form for the patient to complete in a quiet private area, one to measure insomnia (Athens Insomnia Scale [AIS]) and the second for depression (Zung Self-Rating Depression Scale [ZSDS]). These two instruments were again administered to the patient on the last day of the 10-week program, and results were compared. The AIS is a validated quantitative instrument showing a high measure of reliability and validity which is used frequently in sleep/insomnia research and in clinical practice in multiple countries (Soldatos et al., 2000; Sun et al., 2011). It consists of eight questions using a likert-type scale. The higher the score, the more likely the individual has sleep disturbances with the highest score possible of 24. The ZSDS is a quantitative 20 question survey to assess self-reported depression at the time the scale is administered and was validated in the 1960's (Zung, 1965). Answers to specific questions range from “a little of the time” to “most of the time” and also use a Likert-type scale. The higher the number, the more likely the individual is depressed. A score above 50 usually indicates depression with the highest possible score being 80.

Statistical analysis was completed utilizing the statistical software R, version 3.2.2 (R Foundation for Statistical Computing, New Zealand). In order to compare the baseline scores to their final scores, for the 40 subjects who completed the study, we used the paired t-test. Since the sample size was relatively big (> 30), normality of the data was not tested as Central Limit Theorem ensures normality of the distribution of the sample mean even if the population distribution was not normal. Note that we used a significance level of 0.05 for all of our tests, so if a test resulted in a p-value which was smaller than 0.05, we concluded that there was a significant difference between the two means in question. All of the p-values listed here are for two-tailed tests.

5. Results

A total of 75 oncology patients enrolled and of these, 40 (53.3%) completed the full 10 week program. Sixty-two females enrolled of which 37 completed the program (59.7%) and 13 males enrolled of which only three completed the program (23.1%). The average age of all subjects was 59 $\pm$ 10 years. Most subjects had either breast cancer (n = 43; 57.3%) or lung cancer (n = 12; 16.0%).

A significant improvement was seen in insomnia symptoms from baseline scores (mean 9.5; SD 3.7) compared to their final scores (mean 6.3; SD 3.5; t = 4.468; p-value= < 0.01). Note that the power of the paired *t*-test to detect this difference in the two population means with the given sample size, the standard deviations and a significance level of 0.05 is over the 90%. In addition, depression scores also significantly improved from baseline (mean 37.4; SD 9.7) compared to the end of program (mean 33.0; SD 9.7; t = 2.427; p-value = 0.01) See Table 1 (significant p-values, from two-tailed tests, are marked by an asterisk). Again, the power of the paired *t*-test to detect this difference in the two population means with the given sample size, the standard deviations and a significance level of 0.05 is close to 80%. We further examined insomnia and depression scores and compared results between those who completed the program and those who did not complete the program. Since the two groups of patients were independent of each other, we used two-sample t-tests for these comparisons. From the group of 75 patients, 40 completed the program while 35 did not. As before, due to the relatively large sample size in each group (> 30), a normality test was not necessary. Using a significance level of 0.05, we found that baseline insomnia scores of subjects who did not complete the program (mean 9.7; SD 4.5) was no different than those who did complete the program (mean = 9.5; SD 3.7; t = 0.151; p-value = 0.4401). However, depression scores at baseline were higher in subjects who did not

Table 1
Mean scores of subjects who completed the program.

	Baseline Mean n = 40 (SD)	Post Program Mean n = 40 (SD)	p-value
Athens Insomnia Score	9.5 (3.7)	6.3 (3.5)	< 0.01*
Zung Depression Scale	37.4 (9.7)	33.0 (9.7)	0.01*