

The Impact of the *Living Well After Cancer* Program on Multiple Indicators of Wellness and Quality of Life

A Community-Based Feasibility Study



In Brief

Many cancer survivors experience lingering physiological and psychological symptoms post treatment. Unfortunately, hospitals and cancer programs and practices often lack the resources necessary to properly address these conditions. The *Living Well After Cancer* program is a community-based wellness program that offers survivors of all types of cancer a chance to address these symptoms outside of the clinical setting. In this study, we evaluated the effect of this program on various factors of wellness and quality of life, including self-confidence, mood and emotions, social roles and activities, and support. Participation in the *Living Well After Cancer* program was associated with a significant improvement in many wellness and quality of life indicators, supporting the feasibility and efficacy of this program.

As a result of improved early detection, screening, and treatment, the number of cancer survivors continues to grow in the United States—with the population expected to reach more than 20 million by 2026.¹ With the growing population of cancer survivors, there is an urgent need for public health initiatives to address and improve the quality of life (QOL) of these individuals following treatment. Considering this, the promotion of physical activity should be an important component of cancer care, from diagnosis to survivorship. In fact, growing evidence suggests that increased physical activity is associated with a decrease in mortality risk among cancer survivors.²

A meta-analysis of 44 studies—including participants with different cancer types—asserted that cancer survivors who were randomly assigned to an exercise intervention had a significant reduction in cancer-related fatigue levels.³ Additionally, physical activity following a breast cancer diagnosis is associated with up to a 24% lower risk of recurrence, 41% lower risk of breast cancer mortality, and a 48% lower risk of all-cause mortality.^{4,7} A cross-sectional study from Singapore also demonstrated the importance of regular physical activity in decreasing the risk of cancer recurrence; all-cause mortality; and breast, colon, and prostate cancer-specific mortalities among cancer survivors.⁸

The positive benefits of physical activity on general health are well documented in literature. Research strongly suggests that physical activity improves cardiovascular fitness, strength, body composition, fatigue, anxiety, depression, self-esteem, physical function, bone health, and QOL.⁹ However, the benefits of physical activity extend beyond psychosocial wellness, as it is also closely associated with an improved QOL.¹⁰

Nonadherence to the physical activity guidelines among cancer survivors can be attributed to several factors, including lack of time, increased fatigue, treatment-related adverse effects, and lack of awareness regarding exercise recommendations and benefits.⁸

The literature suggests that exercise may reduce the physical and psychological impact of cancer survivorship, improve QOL, prevent recurrence, and improve overall survival.¹¹ However, meeting the recommended frequency and duration of physical activity appears to be a challenge for cancer survivors. For cancer survivors between the ages of 18 and 64, the American College of Sports Medicine recommends at least 150 minutes per week of moderate-intensity aerobic physical activity or 75 minutes per week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic physical activity.⁹ Despite these recommendations, many cancer survivors do not meet these guidelines.⁹

Nonadherence to the physical activity guidelines among cancer survivors can be attributed to several factors, including lack of time,

increased fatigue, treatment-related adverse effects, and lack of awareness regarding exercise recommendations and benefits.⁸ The need for increased physical activity in cancer survivors is and will continue to be an important public health issue, especially as survivorship rates increase. Thus, the following feasibility study aims to address this public health issue by assessing the impact that a moderate physical activity intervention has on the QOL of cancer survivors. This paper will examine the impact of the *Living Well After Cancer* program on the following multiple indicators of wellness:

- Self-confidence
- Feelings and mood
- Social roles and activity
- Support of cancer survivor participants.

Methods

The pilot study utilized a quasi-experimental design to evaluate the viability of conducting pre- and post-intervention testing on participants in the *Living Well After Cancer* program. Participants were required to complete a validated questionnaire that inquired about their demographics and assessed various aspects of physical, mental, and social well-being. The protocol and informed consent were approved by the City of Hope's institutional review board and Claremont Graduate University's, and all methods were performed in adherence to the relevant guidelines and regulations governing research involving human subjects. The end points were assessed at baseline and after completing the program (at week 13).

Participants and Recruitment

The study included individuals who have survived cancer (regardless of the type or stage at diagnosis) and were registered in The Claremont Club's *Living Well After Cancer* program. Recruitment took place during the orientation sessions of 4 cohorts that commenced in September 2017, February 2018, September 2018, and February 2019. All participants provided written consent after receiving comprehensive information about the study.

Outcome Measures

To assess the impact of the *Living Well After Cancer* program on multiple indicators of wellness, researchers utilized the Patient Reported Outcomes Measurement Information System (PROMIS). PROMIS evaluates physical, mental, and social health in various health conditions across these domains: depression, anxiety, fatigue, sleep disturbance, pain interference, and ability to participate in social roles and activities.¹²

At baseline and post intervention, participants filled out short forms to assess the effect of the program on their QOL through the PROMIS domains. These forms included: Anxiety (4 items), Depression (4 items), Fatigue (6 items), Pain Interference (6 items), Physical Function (4 items), Sleep Disturbance (4 items), Ability to Participate in Social Roles and Activities (4 items), Satisfaction with Participation Social Roles (4 items), Self-Confidence in Managing Daily Activities (4 items), Self-Confidence in Managing Emotions (4 items), Self-Confidence in Managing Symptoms (4 items), Companionship (4 items), Emotional Support (4 items), Cognitive Abilities (4 items), and Cognitive Function (4 items).

These PROMIS measures are standardized to a T-score metric ($M=50$; $SD=10$). Higher T-scores represent an increase in the construct the item is measuring. Therefore, a decrease in T-score after the intervention would indicate a worsening of certain constructs measured, including pain interference, fatigue, sleep disturbance, depression, and anxiety. However, an increase in T-score after the intervention would indicate an improvement of other constructs, including physical functioning and the ability to participate in social roles and activities. PROMIS measures were scored using the Assessment Center Scoring Service.

Program Description

The *Living Well After Cancer* program in Claremont, California, is a community-based initiative that provides cancer survivors with resources to manage and mitigate long-term symptoms. Founded in 2005, the program has served over 1340 individuals, with each individual program spanning a period of 13 weeks. This includes exercise classes at the Claremont Club offered twice a week. Additionally, participants are provided with social support through gendered cohorts which encourages healthy lifestyle modification such as increased physical activity, improved nutrition, and regular follow-up visits.¹³

So far, the success of the program has been evident among participants, with a significant decrease in several metabolic measures and an increase in physical fitness.¹⁴ This study aimed to assess the effects of the *Living Well After Cancer* program on various indicators of wellness, such as self-confidence, emotions, social roles and activities, and support for participants.

Statistical Analyses

Statistical analyses were conducted using R version 3.6. Normality probability plots and the Shapiro-Wilk statistic were used to determine normality. Appropriate nonparametric statistics were applied. Normally distributed pre- and post-outcome measures were tested using a paired T-test with a significance level of $\alpha=0.05$. Nonparametric data were analyzed using Wilcoxon signed-rank tests. Pairwise deletion was used to address missing data.

Results

During each orientation session, researchers provided a concise overview of the study and notified the attendees that only 20 individuals would be selected for enrollment. Out of the total 88 participants who provided written informed consent, 78 attended the baseline testing (88%) and 64 individuals attended the post-program testing session (72%).

Table 1 displays the baseline characteristics of the 78 study participants who were enrolled at baseline and completed the baseline QOL questionnaire. On average, participants were 58 years of age or older with a primary diagnosis of breast cancer ($n=49$, 64.47%). There were 64 (82.05%) females and 14 (17.95%) males. Most of the participants were non-Hispanic/Latino ($n=58$, 74.35%). The majority of participants attained vocational training, some college education, a 2-year associate in arts degree ($n=29$, 37.18%), or a graduate/professional degree ($n=26$, 33.33%). Over two-thirds ($n=53$, 67.95%) of the participants

Table 1. Baseline Characteristics of Study Participants

VARIABLE	MEAN	SD
AGE	58*	10.82
VARIABLE	SIZE (n)	PERCENT (%)
SEX		
Female	64	82.05
Male	14	17.95
ETHNICITY		
Hispanic/Latino	16	20.51
Not Hispanic/Latino	58	74.36
I'd rather not say	4	5.13
Not reported	0	0
EDUCATION		
High school or less	5	6.41
Vocational, some college, or 2-year associate in arts degree	29	37.18
4-year college	14	17.9
Graduate/professional school	26	33.33
Not reported	4	5.12
MARITAL STATUS		
Never married	8	10.26
Married, in a civil union, domestic partnership, or living as married	53	67.95
Divorced/separated	12	15.38
Widowed	5	6.41
Not reported	0	0
PRIMARY CANCER DIAGNOSIS		
Breast	49	64.47
Others	27	35.53
Not reported	2	2.56

*Calculated for the 78 participants who returned the demographic baseline questionnaire.

were married, in a civil union, domestic partnership, or living as married.

Table 2 presents the impact of the *Living Well After Cancer* program on the well-being and QOL of participants by comparing their baseline and post-intervention scores across different dimensions. The results showed significant improvements in anxiety and fatigue, with mean differences of 2.64 (P=.011) and 3.02 (P=0.005), respectively. Pain interference and physical functioning also significantly improved post intervention, with mean differences of 2.42 (P=0.025) and 2.13 (P=0.001), respectively. Sleep disturbance and social satisfaction also demonstrated significant progress after the program,

with mean differences of 3.41 (P=0.001) and 1.81 (P=0.024), correspondingly. Furthermore, compared to baseline, self-confidence in managing daily activities, self-confidence in managing emotions, and emotional support showed significant improvements, with P values of 0.004, 0.001, and 0.038, respectively. The mean differences across these dimensions ranged from 2.79 to 3.35, demonstrating significant improvements post intervention.

Cognitive abilities and cognitive concerns also displayed significant improvement post intervention, with mean differences of 2.37 (P=0.008) and 2.38 (P=0.001), respectively.

However, the results reflected nonsignificant improvements in

Table 2. Changes in Participants Quality-of-life Dimensions Before and After the Living Well After Cancer Program

QUALITY OF LIFE DIMENSION	n	BASELINE MEAN (SD)	FOLLOW UP MEAN (SD)	MEAN DIFFERENCE	P-VALUE
Fatigue	64	51.16 (10.65)	48.13 (9.07)	3.02	.005
Anxiety	64	55.14 (9.41)	52.50 (7.73)	2.64	.011
Cognitive ability	64	47.93 (9.43)	50.30 (9.57)	2.37	.008
Cognitive concerns	64	34.55 (8.16)	32.17 (7.87)	2.38	.001
Companionship	63	53.07 (8.99)	53.86 (8.28)	0.79	.294
Depression	64	49.17 (8.60)	48.83 (7.86)	0.34	.682
Emotional support	64	53.38 (8.90)	54.99 (8.43)	1.62	.038
Pain Interference	64	51.39 (9.34)	48.97 (7.72)	2.42	.025
Physical functioning	64	46.29 (7.54)	48.41 (7.45)	2.13	.001
Self-efficacy in managing daily activities	64	49.03 (7.35)	51.82 (7.20)	2.79	.004
Self-efficacy in managing emotions	64	47.76 (7.24)	51.11 (8.37)	3.35	.001
Self-efficacy in managing symptoms	63	50.21 (8.83)	51.87 (7.86)	1.67	.090
Sleep disruption	64	51.05 (7.72)	47.65 (7.60)	3.41	.001
Social participation	63	49.53 (8.55)	50.93 (8.40)	1.40	.060
Social satisfaction	63	50.66 (6.49)	52.47 (6.69)	1.81	.024

depression ($P=0.682$), companionship ($P=0.294$), self-efficacy in managing symptoms ($P=0.090$), and social participation ($P=0.060$) post intervention.

Discussion

This pilot study examined the impact of a community-based exercise program on multiple indicators of wellness, including self-confidence, feelings and moods, social roles and activity, and support in a population of cancer survivors. These psychosocial parameters were assessed before and after participation in the program. Results of this study indicated statistically significant improvement in anxiety, fatigue, pain interference, physical functioning, sleep disturbance, social satisfaction, cognitive abilities, cognitive concerns, self-confidence in managing daily activities, self-confidence in managing emotions, and emotional support following participation in the *Living Well After Cancer* program. While not statistically significant, this study also found slight changes in depression, companionship, social participation, and self-efficacy in managing symptoms.

The results of this study are largely consistent with findings in previous literature regarding physical activity and cancer survivors. Alfano et al investigated physical activity and health-related quality of life (HRQOL) in a cohort of breast cancer survivors and found that increased physical activity after cancer was significantly related to lower fatigue and pain and better physical functioning.¹⁵ Likewise, a more recent study that similarly examined the association between physical activity and HRQOL in breast cancer survivors demonstrated that breast cancer survivors who practice more physical activity were

more likely to have low scores for fatigue and pain and higher scores of sexual functioning.¹⁶ Future research is needed to further explore the relationship between physical activity and indicators of QOL in cancer survivors.

Perhaps the most studied dimension of QOL in cancer survivors is fatigue. This pilot study found a significant reduction in fatigue levels from pre- to post-intervention. The reduction in fatigue found through this study is consistent with the literature on exercise interventions and fatigue.¹⁷⁻¹⁹ A meta-analysis by Meneses-Echávez et al reported that supervised aerobic exercises are effective in reducing cancer-related fatigue in breast cancer survivors.¹⁷ A review of 59 trials by Mishra et al found that exercise interventions resulted in a decrease in fatigue from baseline to follow-up.¹⁸ Thus, the results of our study are consistent with the literature in terms of physical activity being associated with reduced levels of fatigue.

Psychological function and anxiety are important dimensions of QOL that have been extensively studied in cancer survivors. Stout et al conducted a systematic review of 51 studies that investigated the effect of exercise interventions on these outcomes. The review demonstrated that exercise interventions significantly improved psychological function and anxiety in cancer survivors.²⁰ While the specific magnitude of the effect and the types of exercise that were effective varied across studies, these results are consistent with our study's finding that exercise is associated with reduced anxiety levels in cancer survivors.

Furthermore, pain interference and physical function are important dimensions of QOL that have been shown to significantly improve

following physical activity interventions. While more research is needed to confirm the impact of physical activity on pain interference, Ferioli et al investigated the effects of exercise on pain among cancer survivors and found a positive effect in most patients undergoing or having finished treatment.²¹ This aligns with our study's findings, but more research is necessary to further establish the relationship. However, the impact of exercise on physical function among patients with cancer has been well studied by the same scholars, who reviewed the literature on the influence of physical activity on various aspects of physical function, such as bone and muscle loss, weight imbalance, cachexia, and peripheral neuropathy, and demonstrated a consistent body of evidence supporting that exercise has a crucial impact on physical function.²¹

Our analysis also found a significant reduction in sleep disruption, which is consistent with previous research. For example, a randomized controlled trial by Rogers et al reported a significant improvement in global sleep quality, as measured by the Pittsburgh Sleep Quality Index, for participants who received an aerobic physical activity intervention.²² However, in contrast, Sprod et al did not find a statistically significant improvement in sleep quality for participants in the exercise group post intervention.²³ One potential mechanism that may explain how exercise impacts sleep is by regulating proinflammatory cytokines.²⁴ This regulation, in turn, can influence neural processes in the brain and is thought to improve sleep. When combined, these findings suggest that the improvements in sleep quality seen in this study may be attributed to the exercise intervention.


A promising aspect of the current study is the observed improvements in psychosocial dimensions of QOL. Post-intervention results showed significant improvements in satisfaction with participation in social roles, self-confidence in managing daily activities, self-confidence in managing emotions, and emotional support. Improvements in companionship and self-efficacy in managing symptoms were not statistically significant. Despite limited studies exploring these dimensions of QOL, Musanti, Chao, and Collins found improvements in social role satisfaction among cancer survivor participants in a community exercise program.¹⁹ Furthermore, Luoma et al found that among breast cancer survivors, peer support from those participating in group exercise interventions helped participants to improve psychological support and gain a sense of normality.²⁵ Additionally, the researchers asserted that participants may gain a sense of mastery over their disease through simply participating in the intervention and meeting other breast cancer survivors.²⁵ These findings reinforce the enhanced psychosocial aspects identified in our study, which contribute to an enhanced quality of life for cancer survivors.

Regarding research into the influence of physical activity on the cognitive abilities of cancer survivors, research conducted by Hartman and colleagues suggests that physical activity may also be effective for some domains of cognitive functioning.^{26,27} These findings are consistent with those of our intervention study, which found a significant improvement in cognitive abilities compared to baseline. Additionally, another randomized controlled trial found that a 12-week physical activity intervention significantly improved processing speeds among breast cancer survivors, providing further support to our findings.²⁸ However, researchers have indicated that more studies are needed, specifically among cancer survivors in general, to reach a deeper understanding of the relationship between physical activity and improved cognitive functioning.^{26,27}

Limitations

Considering that our study is indeed a pilot intervention, we would be remiss to not acknowledge the limitations of our findings. First, our study consisted of a single group where all participants received the intervention. Thus, it is not possible to tell if improvements in QOL were due to participation in the intervention or the natural course of cancer survivorship. Second, due to the quasi-experimental design of the study and the cross-sectional nature of the data, causal inferences cannot be made from the observed associations. However, as reviewed in the literature above, previous experimental studies and meta-analyses have found evidence suggesting that physical activity can lead to improvements in QOL. Third, only univariate associations were assessed in this study because it was not powered for multivariate analysis; therefore, we were unable to control for potential covariates and confounders.

Conclusion and Implications

The *Living Well After Cancer* program is a community initiative designed to evaluate whether integrating physical activity can enhance well-being, social roles and activities, mood and emotions, self-confidence, and support among cancer survivors. Results from this pilot study support that participation in our exercise intervention led to significant improvements in various indicators of QOL, including anxiety, fatigue, pain interference, physical functioning, sleep disturbance, satisfaction with participation in social roles, self-confidence in managing daily activities, self-confidence in managing emotions, emotional support, cognitive abilities, and cognitive concerns. These results suggest promising directions for research into the QOL of cancer survivors and can provide valuable insights for developing future community programs aimed at enhancing their overall well-being and QOL. 

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