

# Physical and psychosocial responses to exercise in cancer patients: A two year follow-up survey with prostate, leukemia, and general carcinoma

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### ABSTRACT

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Two years after the inception of the SBAC cancer exercise program, we report on the health status, physical function, and psychosocial benefits of cancer patients to a 20 week supervised exercise regime followed by self-reported exercise. The participants were categorized by cancer type in this program including: Prostate [Pr] (n=12), and Carcinoma/Leukemia [C/L] (n=13). Demographic information on these groups include: Age (yrs.): 71±7.3 [Pr], 44.6±17 [C/L], Cancer Stage: 2.0±.6 [Pr], 2.5±.7 [C/L], and years after diagnosis: 4.7± 2.3 [Pr], 2.4± 2.5 [C/L]. Exercise lasted 20 weeks, & consisted of aerobic machines, progressive strength training, and specialty exercises. Participants completed a quality of life (QOL) survey after the exercise program. At two years, a follow-up survey on cancer status, health care information, and alternative health practices was solicited. Fitness results indicated changes in overall strength in both groups (+40% for Pr, +52% for C/L). Strength gains for the C/L group were significant (p=0.05). Time on aerobic machines also improved in both groups (+20% for Pr, +30% for C/L). Quality of life results indicated no perceived changes in 8 selected categories (ADL's, perceived fitness, and pain rating) for Pr, but significant changes in all categories for C/L groups. At two years, level of vigor (on a 10 point scale) was 8.5 for Pr and 9.0 for C/L. Vitamin supplementation was 77% for Pr and 84% for C/L. 92% of C/L group used alternative medicine (mostly meditation), but only 23% of Pr group used these modalities. One hundred percent of Pr group and 65% of C/L group continued to exercise at two year follow-up. Compared to other cancer groups, there were no out-of-pocket medical expenses for either group. There was one recurrence of cancer and one reported death in the Pr group, none in the C/L group. This study suggests that long term participation in exercise may improve both physical and psychological components in cancer recovery. Over time, patients continue to incorporate fitness and other quality of life practices into their lives. Fitness and quality of life changes are more pronounced in C/L due in part to cancer stage, time after diagnosis, & severity of medical intervention before beginning exercise.

**Key Words: rehabilitation, follow-up survey, quality of life, fitness**

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### Introduction

According to the American Cancer Society's 1997 statistics, 335,000 men between the ages of 45 and 85 will be diagnosed with prostate cancer this year. Out of that number, almost 42,000 men will die (1). Prostate cancer ranks third behind lung and breast cancers in terms of morbidity and mortality. Outside of nutritional intervention, there are no strong identifiable risk factors that may be modified for the prevention of Prostate cancer.

1997 ACS statistics reported 35,500 persons diagnosed with Leukemia (all leukemia sub-types), and this cancer claimed 34,000 lives. Overall 5 year survival rates for all cancers in the US is 40%. When adjusted for life expectancy factors (heart disease, accidents, etc), that number rises to 56%. The general recommendations for most of these patients is to undergo surgery, radiation, and/or chemotherapy as part of their initial medical treatment, but long term therapies are often not routinely prescribed. However, in the field of cancer treatment, survivability and quality of life are perhaps the two most important issues faced by practitioners who work with

recovering patients. Over the course of the past decade, the most efficacious type of therapeutic intervention for breast cancer patients has been psychotherapy, which has been used by Fawzy (2) and Spiegel (3) to help extend survivability. Unlike breast cancer, Prostate cancer is usually diagnosed in older men (over 80% of prostate cancers are diagnosed in men over age 65 (1), and whose quality of life issues are different. Leukemia patients sometimes undergo large doses of chemotherapy, combinations of anti cancer drugs, antibiotic blood transfusions, and bone marrow transplantation because their cancer type is blood-borne, and has a higher likelihood of becoming metastatic. Their age at diagnosis may range from early childhood to post retirement.

Exercise has been used as an adjunctive therapy for cancer patients since the early 1980's when Winningham and colleagues developed the WAIT (Winningham Aerobic Interval Training) scale while reporting the effects of low-intensity aerobic training on cancer patients (4-6). Most physical activity research has been epidemiological, where regular activity has been shown to improve the primary

prevention incidence rates in certain cancers, such as breast and colon (9-12).

With few reports on cancer rehabilitation (13-15,17) and exercise programming (7,18) information on the type of exercise programming, dose-response, and long-term consequences of physical conditioning on persons diagnosed with cancer is still not standardized. To date, there are no known reports of specific exercise protocols for individuals with prostate cancer or leukemia.

Therefore, the purpose of this investigation was to report on the health status of participants in an out-patient exercise and wellness program after their diagnosis and treatment for cancer. We included information on the physical status of the subjects, and also their personal rating of the psychosocial benefits of their participation, and relevant health care information that may be affected by participation in such a community program. The second purpose of this report was to detail a two year follow up survey on participants of the exercise and wellness program and describe the health status of the participants over time.

**Methods**

**Characteristics of the Exercise Program**

At the Santa Barbara Athletic Club in California, cancer patients performed a combination of aerobic exercise, specialty exercises, and progressive resistance exercises on strength training machines twice per week for up to 20 weeks. Demographic data is presented in Table I.

<b>Characteristic</b>	<b>Prostate Group</b>	<b>Carcinoma/Leukemia Group</b>
<b>Number</b>	12	13 (7 = women)
<b>Age (years)</b>	71±7.3	44.6 ± 17
<b>Height (cm)</b>	27.6 ± .78	25.1 ± 1.15
<b>Weight (kg)</b>	80 ± 15.5	53.6 ± 11
<b>Cancer Stage (1-4 ranking)</b>	2.0 ± 0.6	2.5 ± 0.7
<b>Time After Diagnosis (years)</b>	4.7 ± 2.3	2.4 ± 2.5
<b>Annual Physician Visits</b>	4.5 ± 2.9	3.1 ± 1.4

(data presented as mean±SD)

The goal of exercise was to improve aerobic capacity, functional strength, and range of motion in a pain free fashion. Subjects also participated in specific wellness components (yoga, movement, and relaxation techniques) in a group setting of their peers.

Participants were referred to the SBAC exercise program from a local cancer treatment center based on an initial questionnaire distributed by the center to those who were interested in participating in an out-patient program. Referral criteria was a Karnofsky rating scale >70, with no

overt orthopedic limiting factors. There were no restrictions from the standpoint of current chemotherapy status or taking contraindicated medications. Out of the participants, 16% (2/12) of the Prostate group, and 15% (2/13) of the Carcinoma/Leukemia group were currently undergoing chemo- or radiation therapy during their exercise program.

All participants also completed a questionnaire on their last week of the exercise program. This post-conditioning questionnaire was modified from a Rotterdam quality of life survey given routinely to cancer patients after they have undergone radiation or chemotherapy<sup>19</sup>. This version of the survey includes two sections on exercise and rehabilitation, and components of wellness. The components of the aerobic and strength testing, along with the survey characteristics are described elsewhere (18). Participants did not perform 1 RM or maximal VO<sub>2</sub>'s for aerobic capacity. They performed volitional fatigue on aerobic machines during the first week, and power output data was recorded. That same week, functional strength was assessed using an estimated RM scale developed by Hatfield (22). This scale works well for patients who cannot lift maximal loads (such as surgery and/or cancer participants).

**Characteristics of the Follow-up Survey**

The follow-up survey was conducted by telephone on both groups of cancer patients who participated in the health club-based exercise program for up to 20 weeks. The program began in the spring of 1994, and since its inception, over 75 participants have taken part. Each survey lasted approximately ten minutes, and included 33 questions, grouped into four information sections: general, cancer, health care, and exercise.

Each participant was asked each question, and responses were entered. If the question was not known, no answer was recorded. In general, all questions were answered and there was no confusion regarding any section. The 2 year follow up survey response rate for both groups was 100%.

**Statistical Analysis**

Demographic data on subjects was analyzed using descriptive statistics. Data on pre- to post on both fitness criteria and two year follow up survey questions were analyzed using Student's paired t-test. The average of the t-tests used in Table II and Table III were corrected for using Dunn's multiple comparison test (20).

**Results**

**Improvement in physical condition**

By the end of week 20 of the supervised exercise program, participants in the Prostate group showed a an average of 38% increase in total body strength (upper and lower body exercises). However, none of the results reached statistical significance (p = 0.17). Time on aerobic machines increased 24% (8.4 to 10.4 minutes, p = 0.17), and functional aerobic capacity (measured in METS) improved by 5% (p=NS). In contrast, members of the Carcinoma/Leukemia group improved their overall strength by almost 52%, with three out of four stations improving significantly (p = 0.05). The

Carcinoma/Leukemia group also improved their time on machines by 30% (p=NS), and their MET value increased from 4.15 to 6.32 (p=NS). Results of both strength increases and aerobic conditioning improvement are seen in Table IIa.

In 7 out of 8 categories of the modified Rotterdam survey, the Prostate group had no significant changes in their psychosocial responses. The only category which gained statistical significance was the section on the perception of

**Table 2a: Prostate Group Fitness Results**

Mode	Category	Pre	Post	%	p-value
<b>Strength:</b>	Bench Press (kg)	13.4 ± 5	19.0 ± 7	42.0	0.12
	Lat Pulldown (kg)	20.8 ± 9	25.7 ± 11	23.6	0.19
	Hip Extension (kg)	20.3 ± 8.4	31.0 ± 17	52.4	0.18
	Leg Press (kg)	25.5 ± 12	34.0 ± 11	33.8	0.20
<b>Average</b>				37.9	0.17 <sup>a</sup>
<b>Aerobics</b>	Time	8.4 ± 2.3	10.4 ± .9	24	0.17
	METS	4.0 ± .8	4.2 ± .9	5	0.20

(<sup>a</sup> = Survey data corrected using Dunn's multiple procedure test<sup>24</sup>)

**Table 2b: Carcinoma/Leukemia Fitness Results**

Mode	Category	Pre	Post	%	p-value
<b>Strength</b>	Bench Press (kg)	9.49 ± 1.7	14.0 ± 4	48	0.018
	Lat Pulldown (kg)	15.2 ± 3	22.1 ± 12	49	0.13
	Hip Extension (kg)	16.6 ± 5.5	25.9 ± 14	50	0.05
	Leg Press (kg)	25.8 ± 9.9	41.4 ± 17	60.5	0.03
<b>Average</b>				51.8	0.05 <sup>a</sup>
<b>Aerobics</b>	Time	10.9 ± 3	13.5 ± 3.5	30	0.19
	METS	4.15 ± 1.6	6.32 ± 3.3	51	0.20

(<sup>a</sup> = Survey data corrected using Dunn's multiple procedure test)

strength (25% change), which showed a strong relationship with the actual gain in strength seen by this group (overall 38%) – Pearson's correlation coefficient; r=.53.

In contrast, the participants in the Carcinoma/Leukemia group saw an average of 52% improvement in their overall strength, and significant changes in each of the eight categories in the modified Rotterdam survey. Their changes in the first three sections (which detail activities for daily living issues) averaged almost a 13% change from their pre-exercise responses. In the areas of perception of change in strength and endurance, again their responses were over 33% different. The final three questions, which dealt with pain management issues saw an average improvement of over 19%.

The percentage of the Prostate group who continue to participate in either group exercise in a health club setting, or on their own throughout the 2 years (at least 3 days per week) is 100% (12/12). The percentage of the Carcinoma/Leukemia group is 61% (8/13).

**Physical characteristics**

Although touted as an important element in cancer survivorship<sup>12</sup>, another important observation is the lack of any referral to Physical Therapy by any of the participants or controls. Only one participant in each group was referred for Physical Therapy. This seems to contradict recommendations made for all cancer patients during their in-patient phase post surgery<sup>21</sup>.

A large percentage of Carcinoma/Leukemia groups (92%) used some type of alternative/complimentary health venue as part of their recovery process, the overwhelming element being meditation/visualization. Eighty four percent of this group also consumed vitamin supplements. The Prostate group used vitamins at a rate of 77%. Their use of alternative medicine was substantially lower - only 23% of Prostate participants used visualization or meditation on a regular basis. Compared to other reported groups at two years, both the Prostate and Carcinoma/Leukemia groups reported no out-of-pocket expenses during their two year participation in the exercise program.

**Recurrence of Cancer/Survivability**

The American Cancer Society statistics state that for the average Caucasian cancer patient, the five year survival rates

are 50%. At two year follow-up, we report one recurrence of cancer in the Prostate group, and one death. There were no reports in the Carcinoma/Leukemia group. The level of vigor for the Prostate group was 8.5 out of a 10 point scale, and for the Carcinoma/Leukemia group, it was 9.0. In fact, out of a total of over 75 participants in the SBAC program, for those who have completed the 20 week exercise program, the Prostate group member represents the only death in over two years.

**Discussion**

The results of this report show that the improvements made in both strength and aerobic conditioning in men with Prostate cancer (38% in strength, 24% in time on aerobic machines) were not sufficient to produce significant results. Due to the small sample size of this group, it would initially seem that having more participants would have changed the significance of the numbers. Also, when looking at the actual numbers involved, time on aerobic machines improved by 2.0 minutes, and strength by 7.4 Kg (16 lb.). Even though any change in strength and aerobic capacity is important, numerically these changes are not enough to produce statistical significance. The actual values may also shed light on the seemingly large improvements made in both fitness parameters in the Prostate group.

**Table 3: Results of the Modified Rotterdam Survey**

<b>value<sup>a</sup></b>	<b>Prostate</b>			<b>Carcinoma/Leukemia</b>		
	<b>Pre</b>	<b>Post</b>	<b>p-value</b>	<b>Pre</b>	<b>Post</b>	<b>p-value</b>
<b>How much of your usual household tasks are you able to complete?</b>	8.0 ± .3	8.8 ± .35	NS	6.7 ± 2.7	7.3 ± 2	<0.05
<b>Has nausea affected your daily function?</b>	8.6 ± .63	8.7 ± .7	NS	6.2 ± 2.3	7.43 ± 1.5	<0.05
<b>What is your outlook on the future?</b>	8.0 ± 1	8.1 ± .7	NS	6.2 ± 2.1	6.9 ± 1.6	<0.05
<b>Do you feel stronger?</b>	4.4 ± 2.3	5.4 ± 2.1	<0.05	4.4 ± 2.3	5.9 ± 2.2	<0.05
<b>Do you have more endurance?</b>	4.2 ± 1.7	4.6 ± 2.1	NS	4.3 ± 2.2	5.6 ± 2.3	<0.05
<b>The amount of pain that interferes with your general activity</b>	7.1 ± .9	7.4 ± 1.4	NS	5.95 ± 2.2	7.0 ± 1	<0.05
<b>The amount of pain that interferes with your mood</b>	7.5 ± 0	7.5 ± 0	NS	6.1 ± 2.1	7.1 ± 1.7	<0.05
<b>The amount of pain that interferes with your enjoyment of life</b>	7.4 ± 0	7.4 ± 0	NS	5.72 ± 2	6.91 ± 1.8	<0.05

(\* = based on a 9-point scale, N= 15 observations for each question, 46-49 total observations for each section) (a = Survey data corrected using Dunn's multiple procedure test<sup>24</sup>)

(NS = non-significant values)

Since the Prostate group's diagnosis has twice as early as the Carcinoma/Leukemia group, their healing time was also longer. Thus, changes in quality of life may be due to passing of time, and their recovery more complete. The improvement of the Prostate group of 38% is impressive for their age, regardless of statistical significance. They are improving their overall risk for falls, osteoporosis development, and sarcopenia. Their lack of statistical significance for quality of life responses indicates that their quality of life was already good going into the exercise program. They did not suffer from any of the medically-related problems that their class members did, such as response to chemotherapy, residual effects of medical treatment, surgical scar tissue and range of motion difficulties. Although they were on average 27 years older than the Carcinoma/Leukemia group, the medical differences probably played more of a role in the ability to perform (and excel) in exercise. Our group of Prostate participants suffered from no overt orthopedic problems, and were not undergoing medical treatment. Their ability to exercise (100% participation after 2 years) is testament to the fact that their quality of life is good enough to help them continue with their physical fitness program. Members of the Carcinoma/Leukemia group still have medical concerns to deal with, and this may have precluded some of them from exercising over time (65% continue to exercise after 2 years). Their physical condition may also have correlated with their statistical improvements in quality of life and fitness function. This information concurs with data presented from Dimeo et

al<sup>23</sup> who stated that patients on high dose chemotherapy and stem cell transplantation (both intense medical intervention) improved physical factors (hematocrit) and aerobic conditioning (increased VO<sub>2</sub> max).

With an average of 44 years, the Carcinoma/Leukemia participants improved by almost 52% in strength, and 30% in aerobic time on machines. Their improvements may be due to a younger age, or perhaps with their level of medical intervention involved. In this group, all had undergone chemotherapy vs. one in the Prostate group. Also, 2 of the Carcinoma/Leukemia group were still undergoing treatments during the exercise participation. That makes their gains even more remarkable.

It is interesting to contrast the changes in these groups of participants in the SBAC wellness program. On one hand, it would seem that exercise has little effect on both the physical function and quality of life of men with Prostate cancer. On closer observation, we should look at the relative changes made in each category based on a few factors, such as age entering the program, previous physical function, gender, and cancer treatment, which may be the most confounding influence of progress.

## Conclusions

In conclusion, we report on the health and fitness status of cancer patients participating in an out-patient exercise and wellness program at a community health club. Gains were seen in fitness in both groups, with significant changes being seen in patients with Carcinoma and Leukemia. At two year follow up survey, we report a lack of Physical Therapy referrals, no out of pocket expenses for either group, use of some alternative health modalities (meditation, prayer, etc.), and vitamin supplements by a majority of all patients. One death and one recurrence of cancer are reported in the Prostate group, and none for the Carcinoma/Leukemia group. The strength of this report is that is possible to condition persons with cancer in a supervised program. Over time, the majority of these groups continued to exercise. We conclude that exercise has benefits both physically and psychosocially in cancer patients over time. However, changes are seen in those who begin exercise closer to their medical interventions.

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## References

1. American Cancer Society. **Cancer Facts and Figures**. ACS Publications, Atlanta, GA, 1997.

2. Fawzy, F.I., Fawzy, N.W., Hyun, C.S., Elashoff, R., et al. Malignant melanoma: Effect of early structured psychiatric intervention, coping, and affective state on recurrence and survival 6 years later. **Arch. Gen. Psych.** 50:681-89, 1993.

3. Spiegel, D., Bloom, J., Kraemer, H, et al. Effect of psychological treatment on survival of patients with metastatic breast cancer. **Lancet** 14:888-91, 1989.

4. MacVicar, M.G., Winningham, M.L. Promoting the functional capacity of cancer patients. **Canc. Bulletin.** 38;5:235-39, 1986.

5. Winningham, M.L. MacVicar, M.G., Burke, C.A. Exercise for cancer patients: Guidelines and precautions. **Phys. Sportsmed.** 14;10:152-57, 1986.

6. Winningham, M.L., MacVicar, M.G. The effect of aerobic exercise on patient reports of nausea. **Oncol. Nurs. Forum.** 15;4:447-50, 1988.

7. Segar, M., Katch, V.L., Garcia, A., Haslanger, S., Wilkens, E. Aerobic exercise reduces depression, and anxiety, and increases self-esteem among breast cancer survivors. **Oncol. Nurs. Forum.** 25;1:107-13, 1998.

8. Pinto, B., Maruyama, N., Theborge, R. Exercise participation in breast cancer patients. **Psycho-Oncol.** In press, 1998.

9. Paffenbarger, R.S., Hyde, R.T., Wing, A.L. Physical activity and incidence of cancer in diverse populations: a preliminary report. **Am. J. Clin. Nutr.** 45:312-17, 1987.

10. Sternfield, B. Cancer and the protective effect of physical activity: the epidemiological evidence. **Med. Sci. Sports Ex.** 24:1195-1209, 1992.

11. Shephard, R.J. Physical activity and cancer. **Int. J. Sports Med.** 11:413-20, 1990.

12. Albanes, D., Blair, A. Taylor, P.R. Physical activity and risk of cancer in the NHANES I population. **Am. J. Pub. Health.** 7:744-50, 1989.

13. Fichtel, P., Berglund, G., Brodlin, O, et al. Participation rate in group rehabilitation with cancer patients. (abstract). **Psycho-Oncol.** 5;3:S-277:72, 1996.

14. Fow, R.N. Cancer rehabilitation: An investment in survivorship. **Rehab Manag.** Pg. 48-53, April/May, 1996.

15. Hicks, J.E. Exercise for cancer patients. In: Basmajian, J.V., and Wolf, S.L. **Therapeutic Exercise.** 5th edition., Chpt. 18, 1990.

16. Goldberg, L., Elliot, DL. **Exercise for the Prevention and Treatment of Illness.** FA Davis Publishers, Philadelphia, 1994.

17. Rosenbaum, E.R., Rosenbaum, I. **Rehabilitation Exercises for the Cancer Patient.** Bull Publishing, Palo Alto, CA, 1980.

18. Durak, E.P, Lilly, P.C. The Application of an Exercise and Wellness Program with Cancer Patients: A Preliminary Outcomes Report. **J. Streng. Condition. Res.** 8;4:1-3, 1998.

19. DeHaes, I.C., VanKnippenberg, F.C., Neijt, J.P. Measuring psychological and physical distress in cancer patients: Structure and application of the Rotterdam Symptom Checklist. **Br. J. Cancer.** 62:1034-38, 1990.

20. Dunn, O.J. Multiple comparisons among means. **J. Am. Statist. Assoc.** 56:52-56, 1961.

21. Winningham, M.L., Nail, L.M., Burke, M.B., et al. Fatigue and the cancer experience: the state of the knowledge. **Oncol. Nurs. Forum.** 21;23-35, 1994.

22. Hatfield, FC. **Fitness: The Complete Guide.** Chapter 7 - Strength Applications. ISSA Publications, Santa Barbara, CA. Second edition, 1994.

23. Dimeo, F, Tillman, M, Bertz, H., Finke, J, Fetsher, S, Mertelsmann, R, Keul, J. Aerobic exercise in the rehabilitation of cancer patients after high-dose chemotherapy

and autologous peripheral stem cell transplantation. **Cancer.**  
79:1117-22, 1997.

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