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BALANCE PERFORMANCE IN CANCER SURVIVORS WHO HAVE UNDERGONE CHEMOTHERAPY

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BALANCE PERFORMANCE IN CANCER SURVIVORS WHO HAVE UNDERGONE CHEMOTHERAPY

by

Pratibha Garg

B.S., Kurukshetra University, Kurukshetra, India 2008

A Research paper
Submitted in Partial Fulfillment of the Requirements for the
Master of Science Degree

Department of Kinesiology
in the Graduate School
Southern Illinois University Carbondale
December 2010
RESEARCH PAPER APPROVAL

BALANCE PERFORMANCE IN CANCER SURVIVORS WHO HAVE UNDERGONE CHEMOTHERAPY

By

Pratibha Garg

A Research paper Submitted in Partial Fulfillment of the Requirements for the Degree of Master in the field of Exercise Science

Approved by:

Dr. Philip M. Anton

Dr. Jared M. Porter

Graduate School
Southern Illinois University Carbondale
11.01.2010
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CHAPTER 1

INTRODUCTION

In the research literature pertaining to cancer rehabilitation, delineation is often made between “cancer patient” and “cancer survivor”. The term “cancer patient” typically refers to an individual undergoing treatment for active cancer, while “cancer survivor” refers to someone who has been through cancer treatment and is either in remission or is living with a reduced form of their original cancer. In recent years, there has been a concerted effort among cancer rehabilitation specialists to eliminate this delineation. For the purposes of this paper, a cancer survivor will be defined as “any individual that has been diagnosed with cancer, from the time of discovery and for the balance of life”, as suggested by the National Coalition for Cancer Survivorship.

There is both anecdotal and empirical research evidence to indicate that many cancer patients who receive chemotherapy find the variety and unpredictability of chemotherapy-related side-effects difficult to cope with (Cohn, 1982; Tierney, Taylor & Closs 1989). Up to 80% of cancer survivors treated with chemotherapy experience fatigue and this fatigue has a greater negative impact on survivors’ activities of daily living (ADL) and quality of life (QOL) than other cancer-related symptoms, such as pain, depression, and nausea (Hofman et al., 2007). A decreased capacity to perform ADL (walking up and down stairs, getting up from a chair, lifting objects from the floor/overhead, and walking for short distances) is one of the most common side-effects of chemotherapy (Curt et al., 2000; Dimeo, Stieglitz et al., 1997; Given, Given, & Stommel, 1994; Irvine, Vincent, Graydon, & Bubela, 1998; Lehman et al., 1978; Messias, Yeager, Dibble, & Dodd, 1997; Mustian et al. 2008; Schwartz, 1999; Stafford &
Preceded by Cyr, 1997). Decreases in ADL performance can be a major component of an overall decrement in quality of life for the cancer survivor (Courneya & Friedenreich, 1999; Dimeo, 2001; Ferrell, Grant, Dean, Funk, & Ly, 1996; Lehman et al., 1978).

Participants in the investigation conducted by Irvine et al. (1998) indicated that their ability to complete functional activities was negatively altered by 20.1% over the course of treatment (mean age 60, wide variety of cancers). Another study reported that a majority of their participants (mean age 52, wide variety of cancers) experienced a significant decline in their ability to perform daily activities and noted that many of these individuals reduced their hours of employment or took leave of their position entirely (Messias et al., 1997). Stafford and Cyr (1997) reported that 48% of their cancer subject group (mean age 75, wide variety of cancers) experienced difficulty with at least one ADL during their treatment. A survey of a large cohort of survivors of a wide variety of cancers (4,878 Participants, age range: 18-88 years) determined that individuals with a cancer history were 30% more likely to have at least one functional limitation and 11% more likely to be unable to work because of their health (Hewitt, Rowland, & Yancik, 2003). Similar data were reported by Ness, Wall, Oakes, Robison, and Gurney (2005) with physical performance limitations and participation restrictions reported to be 32 and 18 percent more likely in cancer survivors than in individuals with no cancer history. In another study conducted by Mustian et al. (2008), 553 of 753 of cancer survivors who were receiving chemotherapy treatment reported that cancer related fatigue interfered with their activities of daily living. A similar study reported fatigue and ADL dependence in 81% of older cancer survivors (Luciani et al., 2008).
Chemotherapy drugs are suspected as being among the most neurotoxic of the cytotoxic agents (Wujcik, 1992). The chemotherapeutic agents most often associated with chemotherapy-induced peripheral neuropathy are platinum compounds, taxanes, vinca alkaloids, thalidomide, and bortezomib (Park et al., 2008; Visovsky, Collins, Abbott, Aschenbrenner, & Hart, 2007). These neurotoxic chemotherapy agents inactivate the components required to maintain the metabolic needs of the axon resulting in axonal degeneration. Peripheral neuropathy occurs as the end result of peripheral, motor, sensory, and autonomic neuron damage. There are both motor (muscle weakness and atrophy) and sensory signs of peripheral neuropathy (loss of proprioception, ataxia, loss of balance, and a decrease in vibration sensation) (Visovsky, 2003).

The motor and sensory deficits related to chemotherapy induced peripheral neuropathy contribute to balance loss that can impact functional performance in a negative manner (Park et al., 2008). The ability to sustain balance is heavily involved in the performance of many ADL and is a major factor in the maintenance of independent living (Judge, 2003; Kolbe-Alexander, Lambert, & Charlton, 2006; Powell, Carnegie, & Burke, 2006). Cancer survivors have been reported in the past to frequently have difficulties with dizziness and balance that are the result of their treatments (Dodd, 1987). This data is outdated and relies primarily on anecdotal accounts. Furthermore, these accounts have only be substantiated in studies of cancer survivors with cerebral tumors (Syczewska, Dembowska-Baginska, Perek-Polnik, Kalinowska, & Perek, 2008) or those undergoing treatments that elicit an inordinate loss of muscle mass (Bylow et al., 2008). These studies target specific cancer survivor groups and severely limit the ability to generalize to the entire population of cancer survivors. Other studies have focused on fine
motor movements rather than the gross motor movements involved in the ADL mentioned above. Despite continued evidence of balance issues from anecdotal accounts, little attention has been focused on balance testing in cancer survivors who have undergone chemotherapy) (Visovsky et al., 2007).

**Statement of Purpose**

The purpose of this research was to assess balance performance, ADL performance, and quality of life in cancer survivors who are undergoing or have undergone chemotherapy treatment within the past two years and to compare this data to the balance performance, ADL performance, and quality of life of age and physical activity level matched apparently healthy controls.

**Hypotheses**

It was hypothesized that:

- **a.** cancer survivors who have undergone chemotherapy treatment will have significantly poorer balance performance when compared to age-matched apparently healthy controls.

- **b.** balance performance will correlate with ADL performance, particularly in cancer survivors who have undergone treatment.

- **c.** QOL will correlate with balance and ADL performance, particularly in cancer survivors who have undergone treatment.
CHAPTER 2

METHODS

Participants

Participants in this study were 19 male and female adults between the ages of 35 and 70 years (most prevalent age range for cancer diagnosis). Nine of these participants were individuals diagnosed with cancer who received chemotherapy treatment within the last 2 years (C: 57±6 years; 7 females and 2 males). The average time from last chemotherapy treatment for C was 8.4 months. The remaining 10 participants were age-matched, apparently healthy controls (H: 54±4 years; 6 females and 4 males). All participants were free of any major disease at the time of study participation (including vestibular disease).

Participants in group C were recruited via fliers posted in the oncology offices in Southern Illinois. Participants in group H were recruited via flyers posted on the Southern Illinois University Carbondale (SIUC) campus. Upon initial contact, the researchers evaluated the participants suitability for the study based on the aforementioned medical criteria.

Data Collection Procedures and Instruments

Once participants were deemed suitable for study inclusion, they were mailed a medical history (see appendix C), a cancer treatment history (see appendix D), a quality of life questionnaire (Ferrans and Powers Quality of Life Index – Cancer Version III©, see appendix A) (Ferrans, 1990), a physical activity level questionnaire (Baecke Self-Administered Habitual Physical Activity Questionnaire, see appendix B) (Baecke, Burema, & Frijters, 1982), and were scheduled for testing. The medical and cancer
histories were used to evaluate the participants’ readiness for participation. On the testing
day, the participants reported to Davies Hall (SIUC campus), returned all completed
paperwork, and signed an informed consent approved by the SIUC Human Subjects
Committee. Following these initial check-in procedures, participants completed the
following tests under the supervision of the researchers. For all of the tests, only one trial
was necessary and no familiarization trials were required.

**Balance**

Balance was tested using the AccuSwayPLUS® platform (AMTI) (Manor & Li, 2009). The Accusway System consists of a portable balance platform. It measures the
three forces (Fx, Fy, Fz) and three moments (Mx, My, Mz) involved in balance. For this
study, balance trainer software was used for data acquisition and analysis. Each
participant was asked to take a barefooted, double-legged stance on the platform with
arms at side, heels 5 cm apart and heels abducted 10 degrees. The outlines of both feet
were marked with a marker. After leaving the platform, the individual's base of support
was entered in the computer using the pointer wand. Participant was then asked to step on
the platform again with arms at side. Participants performed 30 seconds of the eyes open
closed base protocol. A member of the research team spotted each subject throughout the
test to ensure that the chance of an accidental fall was minimized. The center of pressure
average velocity (V; cm/s²) and center of pressure area (i.e., the area of a confidence
ellipse enclosing 95% of the center-of-pressure trajectory) (A; cm²) were analyzed by the
balance platform (Manor & Li, 2009).
Stair Climb and Descent

Each subject’s ability to climb and descend stairs was evaluated using the stair climb and descent test (Malmberg et al., 2002; Salen, Spangfort, Nygren, & Nordemar, 1994). The subject walked up and down a standard flight of stairs (12 steps, step rise: 7 in., step run: 11 in.) three times at a self-selected pace, using a handrail for support if necessary. A stopwatch was started at the moment the first step was contacted during the initial ascent and stopped at the moment both of the subject’s feet were in contact with the “landing” area at the end of the 3rd descent. The ascent/descent performance time served as the primary variable for the evaluation of stair climbing ability. A member of the research team spotted each subject throughout the test to ensure that the chance of an accidental fall was minimized. The stair climb and descent test was found to have reliability rating of at least 0.70 (Salen et al., 1994). In addition the test has been shown to be highly feasible with less than 5% of 1133 subjects excluded from participation in the test (Malmberg et al., 2002).

Sit to Stand

The sit-to-stand test is a test of lower body extremity muscle strength and was used to evaluate each subject’s ability to get into and out of a chair (Csuka & McCarty, 1985; Headley et al., 2002; Newcomer, Krag, & Mahowalk, 1993; Painter et al., 1999; Schicht, Camaiene, & Owen, 2001). The subject sat in a standard straight back, padded chair (seat height: 18.5 in.; seat depth: 18.1 in.) with arms folded across the chest (unless arm assistance was needed – “no arms” was encouraged). Following instructions on proper form and 1-2 practice trials, the subject stood up and sat down 10 times as quickly as possible. A stopwatch was started as soon as the subject began the initial “stand” and
was stopped when the subject sat down following the 10th repetition. The time that it took to complete the ten repetitions was used as the primary variable for the evaluation of the subject’s ability to get into and out of a chair. In order to ensure that the chance of an accidental fall was minimized, each subject was spotted throughout the test by a member of the research team. The sit-to-stand test has shown a test-retest reliability rating of 0.88 (Newcomer, et al., 1993) and coefficient of variation of 6.8% (Czuka & McCarty, 1985).

**Lift and Carry**

The ability of each subject to pick up an object from the floor and carry it a short distance was evaluated via a lift and carry task. (Ettinger et al., 1997; Rejeski et al., 1995; Sevick et al., 2000). Using the protocol of Rejeski et al., the subject lifted a 13.5 by 13.5 inch crate containing a 10-pound weight (total weight: 11.5 lb) from the floor to waist level, carried it at waist level for twenty feet (90° angle between upper and lower arm), set it on a shelf 51.5 inches high, picked up the crate again, carried it at waist level for twenty feet (90° angle between upper and lower arm), and safely set it back on the floor at the original starting point. A stopwatch was started on the subject’s first movement and was stopped when the weighted crate was set safely on the floor following the fifth repetition. The time required to complete the task was recorded and used as the research variable by which the subject’s ability to lift and carry an object was evaluated. Subjects were monitored to insure that proper lifting technique was utilized (bend at the knees, spine in neutral position; feet shoulder width apart, maintenance of balance). Subjects were spotted by a member of the research team throughout the test to ensure that the chance of an accidental injury was minimized. This lift and carry task has earned a reliability rating of 0.92 (Rejeski et al., 1995).
**Data analysis procedures**

Means and standard deviations were calculated for all variables for both groups. The investigation utilized independent t-tests in order to determine if statistically significant differences exist between the study group mean values on all variables. Pearson correlation was done to determine the correlation of balance performance with ADL performance and quality of life. Alpha level was set at .05.
CHAPTER 3

RESULTS

As stated earlier, C and H were well-matched for age, C (M = 57, SD = 6) and H (M = 54, SD = 4), p = .321. Both groups were also well-matched at physical activity level, C (M = 36.2, SD = 2) and H (M = 38.1, SD = 4), p = .456. C demonstrated statistically significantly greater center of pressure area (A; cm$^2$), C (M = 1.2, SD = .4) vs. H (M=.8, SD = .2), p = .046. While not statistically significant, C demonstrated greater center of pressure average velocity (V; cm/s$^2$), C (M = .93, SD = .3) vs. H (M= .72, SD = .1), p = .078. H showed significantly higher quality of life than C, H (M = 5.3, SD = 0.32) vs. C (M = 4.8, SD = .55), p = .01). C showed reduced activities of daily living performance (varying level of significance) as indicated by 1) Slower timed stair climb and descent test performance as compared to H, C (M = 43.2, SD = 3.3 vs. H (M = 32.9, SD = 4.5), p = .025.  2) Slower timed sit to stand test performance in C as compared to H, C (M = 32.7, SD = 8.1) vs. H (M = 25.3, SD = 2.2), p = .048.  3) Slower timed lift and carry performance as compared to H, C (M = 76.4, SD = 16.5) vs. H (M = 72.9, SD = 11.3), p = .153. A strong correlation (Rubin, 2009; Sheskin, 2004) existed between A and stair climb/descent (r = .79), while moderate correlations (Rubin, 2009; Sheskin, 2004) existed between: A and sit to stand time (r = .59); V and stair/climb descent time (r = .52). Moderate correlations existed between A and QOL (r = .42), as well as lift and carry and QOL (.39). See Table 1 and Table 2 for a visual depiction of the results.
Table 1

*Tests’ Results With p-values*

<table>
<thead>
<tr>
<th>TESTS</th>
<th>C</th>
<th>H</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDING BALANCE (Accusway Balance Platform®)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eyes open closed base - V; cm/s²</td>
<td>.93±.3</td>
<td>.72±.1</td>
<td>.078</td>
</tr>
<tr>
<td>Eyes open closed base -A; cm²</td>
<td>1.2±.4</td>
<td>.8±.2</td>
<td>.046</td>
</tr>
<tr>
<td>QUALITY OF LIFE (Ferrans and Powers – Likert Scale)</td>
<td></td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>QUALITY OF LIFE (Ferrans and Powers – Likert Scale)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QUALITY OF LIFE (Ferrans and Powers – Likert Scale)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACTIVITIES OF DAILY LIVING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sit to stand (Seconds to complete 10 cycles)</td>
<td>32.7±8.1</td>
<td>25.3±2.2</td>
<td>.048</td>
</tr>
<tr>
<td>Stair climb/descent (Seconds to complete 3 cycles)</td>
<td>43.2±3.3</td>
<td>32.9±4.5</td>
<td>.025</td>
</tr>
<tr>
<td>Lift and carry (Seconds to complete 5 cycles)</td>
<td>76.4±16.5</td>
<td>72.9±11.3</td>
<td>.153</td>
</tr>
</tbody>
</table>
Table 2

Cross-tabulation of Pearson Correlation Coefficients of A, V, ADL, and QOL

<table>
<thead>
<tr>
<th></th>
<th>Sit to stand</th>
<th>Stair climb/descent</th>
<th>Lift and carry</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.59</td>
<td>.79</td>
<td>--</td>
</tr>
<tr>
<td>V</td>
<td>--</td>
<td>.52</td>
<td>--</td>
</tr>
<tr>
<td>QOL</td>
<td>--</td>
<td>--</td>
<td>.39</td>
</tr>
</tbody>
</table>
CHAPTER 4

DISCUSSION

The ability to sustain balance is involved in the performance of most ADL (Judge, 2003; Kolbe-Alexander, Lambert, & Charlton, 2006; Powell, Carnegie, & Burke, 2006) and decreases in ADL performance can be a major component of an overall decrement in quality of life for the cancer survivor (Courneya & Friedenreich, 1999; Dimeo, 2001; Ferrell, Grant, Dean, Funk, & Ly, 1996; Lehman et al., 1978). The results of this study show that QOL was reduced along with ADL and balance performance in participants who had undergone chemotherapy. Although the results for center of pressure average velocity and the lift and carry test did not have statistically significant p-values, the results still indicate a trend toward better balance and activities of daily living performance in the healthy group based on group means. This study suggests a link between cancer treatment, balance, activities of daily living performance, and overall quality of life. The results are consistent with the hypotheses, cancer survivors showed significantly poorer balance performance when compared to age-matched apparently healthy controls. In addition, Balance performance correlated with ADL performance and QOL correlated with balance and ADL performance in cancer survivors.

There were some potential limitations in this study. First, the mean age of group C was slightly higher than the mean age of Group H and this might have affected the results. A recent study suggests that aging affects the balance performance year by year (Aslan, Cavlak, Yagci, & Akdag, 2008). Another study has shown that balance, strength, gait and activity performance measures declined significantly with increasing age (Haber, Erbas, Hill, & Wark, 2008). With aging, a lower capacity for neuromuscular response in
controlling postural sway leads to impaired balance with a decrease in speed of postural adjustments and event detection (Izquierdo, Aguado, Gonzalez, Lopez, Hakkinen, 1999). The slight age difference may have exacerbated the group differences beyond the effect of chemotherapy.

Second, the male female ratio was different in both groups, with more female participants in group C as compared to group H. Studies have shown that women experience greater disability than men of the same age across a wide range of functional measures, including both basic ADL such as bathing and dressing, and instrumental ADL, such as housework and shopping (Newman, & Brach, 2001; Leveille, Resnick, & Balfour, 2000). Another study confirms gender differences in functional limitation onset and that males have better balance performance in comparison to females (Aslan, Cavlak, Yagci, & Akdag, 2007). A study conducted by Lee, Simmonds, Wang, & Novy (2003) showed that men outperformed women on all the activities measured in the study (i.e., repeated reach-ups, forward reach, 50-ft walk, and distance walked in 6 minutes). The reasons for these differences are not fully understood; however, the fact that group C contained a slightly higher percentage of females may have contributed to the fact that group C performance was diminished compared to group H.

Third, all the participants in group C were involved on at least a limited basis in an aerobic and strength training exercise program either during or after the treatment and therefore, does not likely represent the typical cancer survivor who is more sedentary. Previous studies have shown that participating in exercise program can improve balance in older people (Barnett, Smith, Lord, Williams, & Baumand, 2003; Liu-Ambrose, Khan, Eng, Lord, & McKay, 2004). Despite the fact that there were no significant differences in
measured physical activity level between the groups, the fact that group C was likely more active than the typically cancer survivor may have diminished the potential for differences between the groups.

Finally, the small sample size in the study limits the ability to generalize the results to the entire population of cancer survivors. The larger the sample size, the more a sample will represent the entire population. Future studies that examine this topic should target greater participant numbers.

This study underscores the need for exercise programs that target the functional needs of cancer survivors. Oncologists are often unsure of the appropriate recommendations for exercise when their patients inquire. Although future investigations are needed to further evaluate the effect of exercise on balance performance in individuals receiving chemotherapy, the findings of this research can improve the knowledge base of oncologists in this area and increases the frequency and urgency of recommendations to their patients to participate in regular exercise before, during, and after treatment. Involving cancer survivors in structured exercise prior to, during, and after their treatment can help them maintain a higher level of quality of life throughout their cancer experience. This could translate not only to an improvement in balance and ADL performance, but may also translate to higher levels of self esteem and self efficacy, reductions in depression and anxiety, and reduction in physician visits, home-nurse support, and overall health-care costs.
REFERENCES


APPENDIX A

Date: __________        Subject #: __________

Ferrans and Powers
QUALITY OF LIFE INDEX®
CANCER VERSION – III

Part 1. For each of the following, please choose the answer that best describes how satisfied you are with that area of your life. Please mark your answer by circling the number. There are no right or wrong answers.

<table>
<thead>
<tr>
<th>How satisfied are you with:</th>
<th>Very Dissatisfied</th>
<th>Moderately Dissatisfied</th>
<th>Slightly Dissatisfied</th>
<th>Slightly Satisfied</th>
<th>Moderately Satisfied</th>
<th>Very Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Your health?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>2. Your health care?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>3. The amount of pain that you have?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>4. The amount of energy you have for everyday activities?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>5. Your ability to take care of yourself without help?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>6. The amount of control you have over your life?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7. Your chances of living as long as you would like?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>8. Your family’s health?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>9. Your children?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>10. Your family’s happiness?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>11. Your sex life?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>12. Your spouse, lover, or partner?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>13. Your friends?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>14. The emotional support you get from your family?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>15. The emotional support you get from people other family?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>16. Your ability to take care of family responsibilities?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>17. How useful are you to others?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>18. The amount of worries in your life?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<td>19. Your neighborhood?</td>
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<td>22. Not having a job (If unemployed, retired, or disabled)?</td>
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<td>23. Your education?</td>
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<td>24. How well you can take care of your financial needs?</td>
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<td>25. The things you do for fun?</td>
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<td>26. Your chances for a happy future?</td>
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<tr>
<td>27. Your peace of mind?</td>
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<td>28. Your faith in your religion?</td>
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<td>29. Your achievement of personal goals?</td>
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<td>30. Your happiness in general?</td>
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<td>31. Your life in general?</td>
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<td>32. Your personal appearance?</td>
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<td>33. Yourself in general?</td>
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</table>
Part 2. For each of the following, please choose the answer that best describes how important that area of your life is to you. Please mark your answer by circling the number. There are no right or wrong answers.

<table>
<thead>
<tr>
<th>How important to you is:</th>
<th>Very Unimportant</th>
<th>Moderately Unimportant</th>
<th>Slightly Unimportant</th>
<th>Slightly Important</th>
<th>Moderately Important</th>
<th>Very Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Your health?</td>
<td>1</td>
<td>2</td>
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<td>2. Your health care?</td>
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<td>3. Having no pain?</td>
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<td>4. Having enough energy for everyday activities?</td>
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<td>5. Taking care of yourself without help?</td>
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<td>6. Having control over your life?</td>
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<td>7. Living as long as you would like?</td>
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<td>8. Your family’s health?</td>
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<td>9. Your children?</td>
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<td>10. Your friends’ health?</td>
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<td>11. Your sex life?</td>
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<td>12. Your spouse, lover, or partner?</td>
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<td>13. Your friends?</td>
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<td>14. The emotional support you get from your family?</td>
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<td>15. The emotional support you get from people other than family?</td>
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<td>16. Taking care of family responsibilities?</td>
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<td>17. Being useful to others?</td>
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<td>18. Having no worries?</td>
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<td>31. Being satisfied with life?</td>
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<td>33. Yourself as a member of society?</td>
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APPENDIX B

Baecke Self-Administered Habitual Physical Activity Questionnaire:

For each item, circle the response that best pertains to your physical activity level over the course of the past few weeks. If you are retired, answer the “work-related” questions based on any time in your daily routine that you would not consider “leisure time” (yardwork, gardening, housework, volunteer work, babysitting, etc.)

A) At work, I sit
   1) Always     2) Often         3) Sometimes        4) Seldom           5) Never

B) At work, I stand
   1) Never                 2) Seldom        3) Sometimes        4) Often            5) Always

C) At work, I walk
   1) Never                 2) Seldom        3) Sometimes        4) Often            5) Always

D) At work, I lift heavy loads
   1) Never                 2) Seldom        3) Sometimes        4) Often            5) Always

E) After working, I am tired
   1) Never                 2) Seldom        3) Sometimes        4) Often            5) Always

F) At work, I sweat
   1) Never                 2) Seldom        3) Sometimes        4) Often            5) Always

G) In comparison with others my own age, I think that my work is physically
   1) Much lighter          2) Lighter            3) As heavy         4) Heavier              5) Much heavier

H) How many hours per week do you participate in any sports?
   1) Less than 1              2) 1-2             3) 2-3                 4) 3-4           5) Greater than 4

I) In comparison to others my own age, I think that the amount of time I spend doing physical activity is
   1) Much less          2) Less            3) The same        4) More            5) Much more
J) During my leisure time, I sweat
1) Never  2) Seldom  3) Sometimes  4) Often  5) Always

K) During my leisure time, I watch television
1) Always  2) Often  3) Sometimes  4) Seldom  5) Never

L) During my leisure time, I walk
1) Never  2) Seldom  3) Sometimes  4) Often  5) Always

M) During my leisure time, I cycle
1) Never  2) Seldom  3) Sometimes  4) Often  5) Always

N) How many minutes per day do you walk and/or cycle?
1) < 5  2) 5-15  3) 15-30  4) 30-45  5) > 45
APPENDIX C

Medical History Questionnaire
Navitas Cancer Rehabilitation Centers, LLC

Please complete each section of this medical history questionnaire as thoroughly as possible. If you are unsure of the answer to any question, please consult your physician.

Name: ______________________ ID#: ______________ Date: ___/___/____

I. Present Medical History
Check all spaces that apply to you. Include an explanation and the date of occurrence for checked items.

<table>
<thead>
<tr>
<th>Problem List</th>
<th>Explanation/Date</th>
</tr>
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<tbody>
<tr>
<td>☐ Abnormal EKG</td>
<td></td>
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<tr>
<td>☐ Anemia</td>
<td></td>
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<tr>
<td>☐ Arthritis</td>
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<tr>
<td>☐ Asthma</td>
<td></td>
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<tr>
<td>☐ Back/Neck pain/injury</td>
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<tr>
<td>☐ Chest discomfort</td>
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<tr>
<td>☐ Chronic/Recurring cough</td>
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<tr>
<td>☐ Connective tissue disease</td>
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<tr>
<td>☐ Coughing up blood</td>
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<tr>
<td>☐ Dementia</td>
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<tr>
<td>☐ Depression</td>
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<tr>
<td>☐ Diabetes</td>
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<tr>
<td>☐ Disease of arteries</td>
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<tr>
<td>☐ Dizziness/Fainting</td>
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<tr>
<td>☐ Epilepsy</td>
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<td>☐ Foot/Ankle problems</td>
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<td>☐ Heart problems</td>
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<td>☐ High cholesterol</td>
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<td>☐ High blood pressure</td>
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<td>☐ HIV/AIDS</td>
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<td>☐ Increased anxiety</td>
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<td>☐ Knee/Hip problems</td>
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<td>☐ Leg pain after walking</td>
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<tr>
<td>☐ Liver disease (mild, mod., severe)</td>
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<td>☐ Lung disease</td>
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<td>☐ Lymphedema</td>
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<td>☐ Migraine/recurrent headaches</td>
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<tr>
<td>☐ Moderate or severe renal disease</td>
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<tr>
<td>☐ Recurrent fatigue</td>
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<tr>
<td>☐ Respiratory problems</td>
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<tr>
<td>☐ Rheumatic fever</td>
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<tr>
<td>☐ Sleeping problems</td>
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</tbody>
</table>
Stroke
☐ Stomach/Intestinal problems
☐ Swollen/stiff/painful joints
☐ Thyroid problems
☐ Ulcer disease
☐ Varicose veins
☐ Deep Vein Thrombosis
☐ Vision/hearing problems

Females Only
Current Menstrual Status: ☐ In menarche ☐ Menopausal
☐ Pre-menopausal ☐ Post-menopausal
☐ Currently pregnant
☐ Menstrual irregularities

Surgeries
Date: __________________________ Type: __________________________
Date: __________________________ Type: __________________________
Date: __________________________ Type: __________________________
Date: __________________________ Type: __________________________

II. Family Medical History
Please check the boxes that apply to family members that are genetically related to you (grandparents, mother, father, brothers, and sisters)

Problem List
☐ Diabetes
☐ Early death
☐ Heart disease
☐ High blood pressure
☐ High cholesterol
☐ Obesity
☐ Stroke
☐ Cancer(s)
  Type: __________________________ Family Member(s): __________________________
  Type: __________________________ Family Member(s): __________________________
  Type: __________________________ Family Member(s): __________________________
III. Medications List
Please list ALL medications that you presently take. Medications include prescription drugs, non-prescription drugs, vitamins, herbal supplements and hormone replacement therapy drugs. (If you need more space, bring in a written or typed list on a separate page)

Medication: ________________________ Dosage/Frequency: _____________________
Medication: ________________________ Dosage/Frequency: _____________________
Medication: ________________________ Dosage/Frequency: _____________________
Medication: ________________________ Dosage/Frequency: _____________________
Medication: ________________________ Dosage/Frequency: _____________________

IV. Drug/Food/Environmental Allergies
Please list any known substances that may cause you to have an allergic reaction.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

V. Other Medical Concerns
If you know of any other medical concerns that we should be made aware prior to your participation in this research study, please identify them below.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
APPENDIX D

Cancer Treatment History Questionnaire
Navitas Cancer Rehabilitation Centers, LLC

Name: ___________________________  ID#: _______  Date: ___/___/_____ 

I. Cancer Information
Cancer Type/Location: ___________________________  Date of Diagnosis: ________________  Stage/Grade at Diagnosis: ________________

Cancer Type/Location: ___________________________  Date of Diagnosis: ________________  Stage/Grade at Diagnosis: ________________

II. Treatment Information
Surgery: □ Yes  Date: __________ Type: ___________________________
□ No  Date: __________ Type: ___________________________

Chemotherapy:

- Are you currently receiving chemotherapy?
  □ YES
  Do you have a chemotherapy port in place presently?  ◯ Yes  ◯ No
  What chemotherapy drug(s) are you receiving?
  _____________________________________________________________
  ______________________________
  Start date: ____________  Next treatment: ________
  How many more treatments will you have? ________
  List any complications from treatment you are experiencing.
  _____________________________________________________________

□ NO
  Did you receive chemotherapy in the past?  ◯ Yes  ◯ No
  Did you have a chemotherapy port?  ◯ Yes  ◯ No
  What chemotherapy drug(s) did you receive?
  _____________________________________________________________
  ______________________________
  Start date: ____________  Final treatment: ____________
  How many treatments did you have? ________
  List any complications from treatment you have experienced.
  _____________________________________________________________
  Will you be receiving chemo in the next 6 months?  ◯ Yes  ◯ No

Radiation:

- Are you currently receiving radiation?
  □ YES
  Start date: ____________  Next treatment: ____________
  How many more treatments will you have? ____________
  List any complications from treatment you are experiencing.
  _____________________________________________________________

□ NO
Did you receive radiation in the past?  ○ Yes  ○ No
Start date:  ____________  Final treatment:  ____________
How many treatments did you have?  ____________
List any complications from treatment you have experienced.

Will you be receiving radiation in the next 6 months?  ○ Yes  ○ No

**Biotherapy (BT):** (Stem cell or bone marrow transplant, gene therapy, etc.)
Are you preparing/ have you begun to undergo any BT treatments?

☐ YES
What type?  __________________
Start date:  ____________  Next treatment:  ____________
How many more treatments will you have?  ____________
List any complications from treatment you are experiencing.

☐ NO
Did you receive BT in the past?  ○ Yes  ○ No
What type?  __________________
Start date:  ____________  Final treatment:  ____________
What type did you receive?  __________________
List any complications from treatment you experienced.

Will you be receiving BT in the next 6 months?  ○ Yes  ○ No

**Hormone Therapy (HT):**
Are you currently receiving HT?

☐ YES
What type?  __________________
Start date:  ____________  Next treatment:  ____________
How many more treatments will you have?  ____________
List any complications from treatment you are experiencing.

☐ NO
Did you receive HT in the past?  ○ Yes  ○ No
Start date:  ____________  Final treatment:  ____________
What type did you receive?  __________________
List any complications from treatment you experienced.

Will you be receiving HT in the next 6 months?  ○ Yes  ○ No

**Alternative/Complimentary Therapy (ATC):**
Are you currently using any ATC? (Vitamins, herbs, supplements, etc.)

☐ YES
Start date:  ____________  Final treatment:  ____________
What type are you receiving?  __________________
List any complications from treatment you have experienced.

☐ NO
Did you use ATC in the past?  ○ Yes  ○ No
Start date:  ____________  Final treatment:  ____________
What type did you receive?  __________________
List any complications from treatment you experienced.

Will you be receiving ATC in the next 6 months?  ○ Yes  ○ No

Currently...
Do you have any medical concerns due to your cancer/ cancer treatment(s)?

○ Yes  ○ No
If yes explain:  __________________
Do you have any physical limitations due to your cancer/cancer treatment(s)?
  ◦ Yes  ◦ No
    If yes explain: ________________________________

Do you use medications/therapies to manage symptoms related to your cancer/treatment(s)?
  ◦ Yes  ◦ No
    If yes explain: ________________________________
Pratibha Garg

Date of Birth: February 8, 1985

4515 Grove Ave, Apt 1. Brookfield, IL- 60513

prati08@siu.edu

Kurukshetra University
Bachelor of Science, Physical Therapy, May 2008

Research Title:
Balance Performance in Cancer Survivors Who Have Undergone Chemotherapy

Major Professor: Dr. Philip M. Anton