

Physical Activity and Posttraumatic Growth in Gynecologic Cancer Survivors

by

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ABSTRACT

Background: Posttraumatic growth (i.e., positive psychological growth following a traumatic event) is a desired outcome of a cancer diagnosis, however, there is limited research examining interventions to foster experiences of growth. The benefits of physical activity for cancer survivors have been well documented and include improved physical functioning, symptom management, overall quality of life, decreased anxiety and depression, and possibly a lower risk of recurrence and longer survival. Few studies to date, however, have examined the potential role of physical activity in facilitating posttraumatic growth. **Purpose:** The purpose of my dissertation was to examine the potential role of physical activity in promoting posttraumatic growth in gynecologic cancer survivors. **Methods:** Study 1 was a population-based, mailed cross-sectional survey of 621 gynecologic cancer survivors diagnosed between 1986 and 2013 identified through the Alberta Cancer Registry. The survey consisted of measures of self-reported aerobic and resistance exercise, “adventure/extreme sport” participation, and posttraumatic growth. Study 2 examined the feasibility and preliminary efficacy of a wall climbing intervention in 35 gynecologic cancer survivors. The primary outcome was feasibility and the primary efficacy outcome was posttraumatic growth as assessed by the Posttraumatic Growth Inventory. **Results:** In paper 1 from Study 1, one third (32.9%) of gynecologic cancer survivors were meeting aerobic exercise guidelines and 19.0% were meeting strength exercise guidelines. Those meeting the combined exercise guidelines reported more favorable scores for the Posttraumatic Growth Inventory ($p=0.014$), the Negative Impact of Cancer Scale ($p<.001$) and several of its subscales compared to those meeting only one or neither guideline. In paper 2 from Study 1, 12.1% of gynecologic cancer survivors reported participating in extreme/adventure activities in the past year but 41.1% were interested in trying extreme/adventure activities. Moreover, neither participation nor

interest in extreme/adventure activities was associated with posttraumatic growth; however, “exercise growth” (i.e., the extent to which GCS changed their physical activity after diagnosis) was significantly associated with all posttraumatic growth indicators ($p < .001$).

For Paper 3 from Study 1, correlates for participation and interest in extreme sport adventure activities were meeting the aerobic exercise guideline, better general health, having cervical or ovarian cancer, being employed, and being healthy weight. In paper 1 from Study 2, the Gynecologic Cancer Survivors Wall Climbing for Total Health (GROWTH) trial was feasible and resulted in significant improvement in objective health-related and functional fitness. Of the 512 GCS recruited to participate, 35 (7%) were randomized. The median adherence to the wall climbing intervention was 13.5/16 (84%) sessions. In paper 2 from Study 2, the GCS in the wall climbing intervention reported significantly higher posttraumatic growth in the areas of new possibilities and personal strength. **Conclusions:** Preliminary evidence suggests that exercise—especially if it is novel, challenging, and/or risky—may promote certain aspects of posttraumatic growth in gynecologic cancer survivors. Preliminary data suggests that wall climbing is feasible for gynecologic cancer survivors and may also lead to improvements in physical functioning and positive psychological health. Larger phase II and III trials are needed to confirm the type, volume, and intensity of exercise that may promote posttraumatic growth in gynecologic cancer survivors. Moreover, additional trials are warranted to determine the potential breadth of benefits that may result from a wall climbing intervention.

Preface

This thesis is an original work by Jennifer J. Crawford. Study 1 received research ethics approval from the Alberta Cancer Research Ethics Committee and the University of Alberta, Project Name “A study of health in gynecologic cancer survivors”, ACREC Project No. 26102, June 11, 2013. Study II received research ethics approval from the Health Research Ethics Board of Alberta Cancer Committee, Project Name “The feasibility and preliminary (exploratory) efficacy of wall climbing on posttraumatic growth in gynecologic cancer survivors”. HREBA.CC-14-0181, March 10, 2015.

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CHAPTER 1-INTRODUCTION

1.1 POSTTRAUMATIC GROWTH

Substantial research has demonstrated that patients diagnosed with cancer experience symptoms of fear, anxiety, depression, and helplessness [1, 2]. These symptoms are generally displayed as constant worry, fears of recurrence, nightmares about the illness or treatments, high sensitivity to physical symptoms, and additional psychological symptoms such as irritability and anger that may negatively affect relationships and role functioning [2-4]. The concept of posttraumatic growth is defined as both an outcome and a process in which individuals have experienced positive psychological change following a significantly challenging, or traumatic life event, and is often characterized by an increased appreciation for life, better interpersonal relationships, personal strength, recognition of new possibilities, and spiritual development [5-8]. Posttraumatic growth describes the experience of individuals whose development has exceeded what was present prior to the trauma, that is, individuals feel that they do not simply return to life as usual but they feel enriched, happier, and stronger following the crisis [9].

The primary factors that are in action as the experience of posttraumatic growth unfolds are summarized in Figure 1 [10]. The posttraumatic growth model commences with the individual's characteristics prior to the occurrence of trauma. For instance, personality characteristics such as extraversion, openness, agreeableness, conscientiousness and coping levels may influence the likelihood of ensuing growth [11]. Furthermore, an individual's gender and age may also influence the possibility of posttraumatic growth, with women and younger people reporting more growth [12]. A critical factor in influencing posttraumatic growth is the individual's assumptive world, the core beliefs an individual has about the world and their place in it [7, 13]. Trauma has the potential to prompt individuals to assess and examine their core beliefs about the world and their place in it. The process of re-evaluating one's fundamental beliefs is a catalyst for prompting posttraumatic growth [14]. The disturbance of one's assumptive world can also be coupled with the disturbance to an individual's life goals or one's life narrative, likely resulting in rumination. Rumination is defined as "several varieties of recurrent thinking, including making sense, problem solving, reminiscence, and anticipation" [15]. At the onset of the trauma it is likely rumination may have intrusive qualities where an individual may unintentionally revisit the trauma and its ramifications when they do not wish to do so.

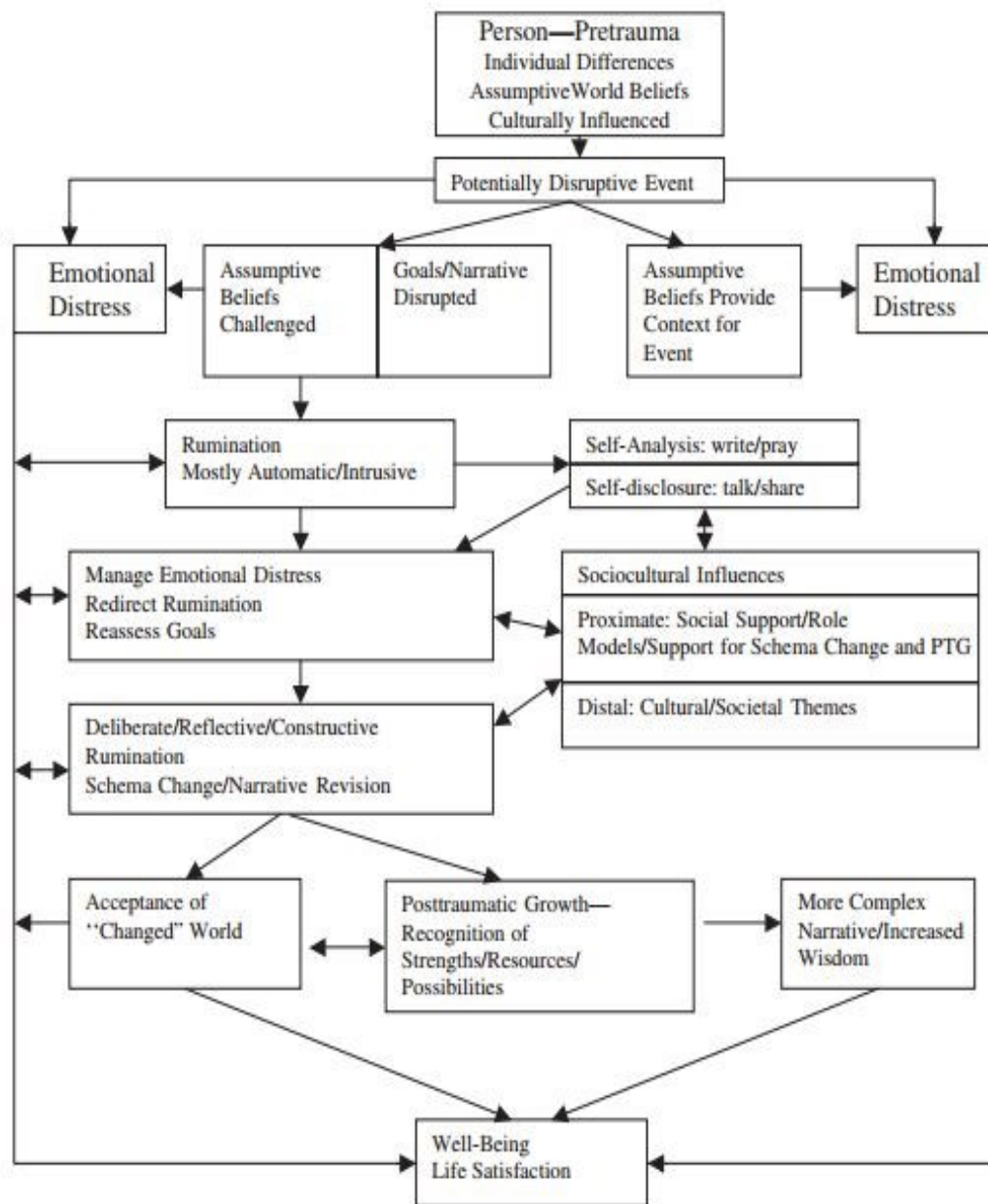


Figure 1-1 A model of posttraumatic growth[10].

However, with the passage of time, intrusive thoughts (such as what happened? How did it happen?) can develop into trying to understand the situation. This manner of rumination that is reflective, deliberate, and focused on making sense of the trauma is key for the potential of

future posttraumatic growth [10, 14, 15]. At the onset of the trauma it is likely the individual may be overcome with emotional distress. However, time and coping may reduce the individuals overwhelming emotional distress and intrusive thought processes, leading to reflective and more deliberate thoughts, making the opportunity for future posttraumatic growth more likely.

It is also critical to understand the individual's socio-cultural context as this plays an important role in the face of trauma and the potential for subsequent posttraumatic growth. A variety of interacting socio-cultural influences may play a role in an individual's world following trauma. Having a strong social support system in both the individuals' proximate and distal cultures, specifically those who maintain support not only in the immediate aftermath of a traumatic event but for as long as it is requested or desired, can play a key role in the individual's process of coping with the traumatic event [16]. A large study of American and Japanese individuals who experienced a variety of traumatic events, found that the way individuals report positive benefits following trauma can vary within the particular cultural setting [17]. Socio-cultural themes and values underlying the potential for posttraumatic growth may vary across cultures. It is important to take into account the cultural and epistemological framework in which individuals live when understanding the posttraumatic growth process.

In conclusion, Tedeschi and Calhoun explain that the process of posttraumatic growth occurs when the impact of an event forces an individual to reconsider the basic assumptions about themselves, the world in which they live and their future [6-8]. Growth involves the rebuilding of views and beliefs through ruminative thought, utilizing social support, and significant cognitive engagement and processing of trauma related elements [8]. It is not the experience of trauma itself that drives posttraumatic growth but rather the individuals struggle in the aftermath of trauma that determines the extent to which positive psychological growth may occur.

1.2 POSTTRAUMATIC GROWTH AND CANCER

To date, there have been no systematic reviews examining posttraumatic growth in cancer survivors; however, there is a review of individuals living with a serious medical condition [18], which included many of the studies on cancer survivors. I therefore highlight

the key conclusions of this review before focusing more specifically on the studies that are most relevant to this dissertation.

Barskova and Oesterreich (2009) completed a systematic review of 68 empirical studies to describe the progress to-date in understanding the experience of posttraumatic growth for individuals living with serious medical conditions [18]. Of those studies, 36 included cancer survivors. Among the author's key conclusions was that "women in comparison with men, as well as younger patients in contrast with the older patients may show different profiles of growth related processes triggered by the onset of illness [18]." Moreover, there was a positive relationship between time elapsed since the diagnosis and posttraumatic growth suggesting that posttraumatic growth takes time to develop after a traumatic event. Several studies also examined whether disease severity (cancer stage or tumor size) was associated with posttraumatic growth. Research into this association revealed mixed results although generally individuals with more severe cancer reported more posttraumatic growth than those whose medical condition was less serious. On the other hand, a curvilinear relationship was also found as cancer patients with stage II were found to have significantly higher posttraumatic growth than those with Stage I and Stage IV disease. Lastly, it was found that few studies examined the relationship between posttraumatic growth and health behaviours [18].

This review provides an excellent summary of the literature on posttraumatic growth in cancer survivors and also provides recommendations for future research, indicating the growing consensus concerning what is known about this research topic and what remains to be studied. Nevertheless, most of the correlates examined in this review are non-modifiable factors (e.g., age, gender, disease severity, time since diagnosis) and do not provide targets for interventions.

1.3 POSTTRAUMATIC GROWTH AND GYNECOLOGIC CANCER

The literature regarding posttraumatic growth in gynecologic cancer survivors is sparse. Polsluszny and colleagues [19] examined levels and predictors of posttraumatic growth over one-year post surgery in women diagnosed with gynecologic cancer or benign conditions necessitating surgical intervention and found that of the four groups (advanced stage cancer, early stage cancer, benign gynecologic disease, and no disease) scores varied significantly on the Posttraumatic Growth Inventory. The three disease groups reported higher

levels of growth in comparison to the no disease group. Additionally, higher Posttraumatic Stress Disorder scores presurgery and greater disease severity was positively related to posttraumatic growth and higher income level was negatively related to posttraumatic growth [19]. Although prospective, longitudinal studies have examined posttraumatic growth in a variety of cancer types including breast cancer, colorectal cancer, and hematological cancer there has been scant literature examining posttraumatic growth in gynecologic cancer survivors [19-23]. Additional research is warranted to gain a comprehensive understanding of the impact of disease and treatments on various aspects of growth. For an overview of gynecologic cancer, its risk factors, and treatments, see Appendix A.

1.4 STUDIES OF INTERVENTIONS FOR POSTTRAUMATIC GROWTH IN CANCER SURVIVORS

Few interventions have been conducted that focus on posttraumatic growth in cancer survivors. Interventions to enhance posttraumatic growth in cancer survivors have been primarily cognitive behavioural stress management interventions and mindfulness-based stress reduction interventions [24]. Observational research has found that emotionally and physically demanding activities may provide a vehicle for physical and psychological growth in cancer survivors [20, 25-27]. Dunn and colleagues undertook an exploratory qualitative study of women with breast cancer who were participating in a 7-day motorcycle ride across two Australian states to investigate women's experiences of self-transformation and peer support [25]. Researchers concluded that a positive peer support experience resulted in feelings of inner peace, accomplishment, self-learning, a positive perspective, and improved social support. From the themes Dunn and colleagues identified, it can be concluded that a physical challenge in a novel social setting created peer support that was a potential catalyst for posttraumatic growth [25]. This finding regarding these factors is particularly crucial when designing a posttraumatic growth intervention as it can have a profound effect on the level of growth that may be experienced.

1.5 STUDIES OF PHYSICAL ACTIVITY AND POSTTRAUMATIC GROWTH FOR CANCER SURVIVORS

The benefits of physical activity for cancer survivors have been well documented and include improved physical functioning, symptom management, overall quality of life,

decreased anxiety and depression, and possibly a lower risk of recurrence and longer survival [28-30]. Research has primarily examined the role of physical activity in mitigating negative psychological outcomes such as depression, negative affect and distress [31]. Recently, however, there has been a focus on the relationship between physical activity and positive emotional outcomes such as posttraumatic growth, benefit finding, adversarial growth and thriving [31]. To date there is no systematic review of physical activity and posttraumatic growth in any population. There are a limited number of physical activity interventions that have been aimed at long-term cancer survivors designed to facilitate posttraumatic growth [20, 26, 27].

Hefferon and colleagues (2007) engaged in an explorative phenomenological study documenting the experience of posttraumatic growth among breast cancer patients, and the role that a group based physical activity intervention had on the attainment of posttraumatic growth [26]. Following a 12-week exercise class intervention period, there were six resultant themes that were important to all ten participants: exercise as a saviour, safe environment, positive support system, somatopsychic influence, transference of skills and new health behaviours. The success of the exercise class intervention in facilitating posttraumatic growth could be viewed as superior to other group based therapies in providing participants with a non-pressurized supportive environment and the freedom with which to self-disclose without the pressure that a variety of other group therapies may induce [26]. However, for participants who report posttraumatic growth, the extents to which the physical, psychological, and emotional benefits of a physical activity intervention contribute to this process is unknown. Furthermore, this study was limited because it was observational in nature and drew inferences about the potential relationship between physical activity and posttraumatic growth from qualitative data in a sample of breast cancer survivors.

More recently, Chandwani and colleagues (2010) conducted a randomized controlled trial examining the effects of yoga on benefit finding in women with breast cancer undergoing radiotherapy [32]. Breast cancer patients completed two 60-minute yoga classes each week during their 6 weeks of radiotherapy. The researchers concluded that the yoga intervention led to significant improvements in benefit finding compared to the waitlist control arm; however, it should be noted that adherence to the intervention was poor [32].

Dragon boat racing teams specific for breast cancer survivors have become popular across the globe and provide a physical and emotional challenge with a competitive goal in a supportive group environment. Sabiston and colleagues engaged in a constructivist grounded theory study exploring the potential link between posttraumatic growth among breast cancer survivors participating in a dragon boat program [23]. In particular, dragon boating was found to facilitate psychological strength, appreciation for life, closer relationships, new possibilities and opportunities.

Several mountain climbing challenges including Mt. McKinley, Mt. Fuji, and Mt. Kilimanjaro have provided physically and emotionally challenging activities, which have led to a better understanding of self-transformation and benefit finding following a cancer diagnosis. A series of case studies reported by Burke and Sabiston explored breast cancer survivors' experiences of climbing Mt. Kilimanjaro from a posttraumatic growth perspective [20]. Their work represented three case studies of participants who participated in interviews and observations during a nine-day climb on the mountain and conveyed themes around nurturing priorities, fostering self-belief, and cultivating connections [20]. The nature of case study research makes it difficult to draw generalizations from the data and limits the ability to conclude a causal relationship. To date, no study has quantified this possible relationship or identified which aspects of physical activity are associated with which dimensions of posttraumatic growth. As there have been limited randomized controlled trials to examine the effects of physical activity on positive growth, information on temporal and causal relationships is limited. As well, all research examining physical activity and posttraumatic growth has utilized breast cancer survivors that limit the generalizability to other cancer survivor groups.

In summary, there is preliminary evidence that a positive relationship exists between physical activity and posttraumatic growth but most studies are qualitative or single group designs. There are no randomized controlled trials to demonstrate a cause-effect relationship between physical activity and posttraumatic growth in gynecologic cancer survivors. Moreover, research indicates that posttraumatic growth might be best facilitated by involvement in a novel activity that is physically and emotionally challenging.

1.6 OVERVIEW OF DISSERTATION

The purpose of my dissertation is to examine the potential role of physical activity in facilitating posttraumatic growth in gynecologic cancer survivors. This dissertation is presented in 7 chapters. The first section of the dissertation (Chapter 1) provided an overview of posttraumatic growth, studies of interventions for posttraumatic growth in cancer survivors and studies of physical activity and posttraumatic growth for cancer survivors. An additional literature review on gynecologic cancer is provided in Appendix A, which includes overviews of ovarian, endometrial and cervical cancer, signs and symptoms of the diseases, risk factors, medical treatments, and side effects. The main body of the dissertation is presented in a series of three papers based on a cross-sectional population based survey study of 621 gynecologic cancer survivors, which is Study 1 of the dissertation. Paper 1 (Chapter 2), examined the associations between exercise and posttraumatic growth in gynecologic cancer survivors. This paper has been published in *Supportive Care in Cancer*. Paper 2 (Chapter 3) examined the prevalence and interest in extreme/adventure sport and its associations with posttraumatic growth. This paper has been published in *Mental Health and Physical Activity*. Paper 3 (Chapter 4), examined the demographic, medical, and behavioural correlates of participation and interest in extreme/adventure activities. This paper has been published in the *American Journal of Health Behaviour*. Study 2 of the dissertation was informed by the results generated from Study 1. Study 2 assessed the feasibility and preliminary efficacy of a wall climbing intervention in 35 gynecologic cancer survivors and is presented in two papers. Paper 1 (Chapter 5) reports the feasibility and preliminary efficacy of a wall climbing intervention on objective health-related and functional fitness. This paper has been accepted for publication in *Oncology Nursing Forum*. Paper 2 (Chapter 6) reports the preliminary efficacy of a wall climbing intervention on posttraumatic growth and quality of life in gynecologic cancer survivors. Lastly, a general discussion (Chapter 7) summarizes the overall findings, discusses practical implications and future research directions, and provides conclusions for this dissertation.

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CHAPTER 2-Study 1-Paper 1

Associations Between Exercise and Posttraumatic Growth in Gynecologic Cancer Survivors

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2.1 INTRODUCTION

A cancer diagnosis is associated with symptoms of posttraumatic stress as it can evoke a profound sense of fear, devastation, and lack of control [1]. Paradoxically, a cancer diagnosis may also provide an opportunity for growth and adaptation [2-4]. Posttraumatic growth is defined as a positive psychological change that emerges following a significantly challenging or traumatic life event and is often characterized by an increased appreciation for life, better interpersonal relationships, personal strength, recognition of new possibilities, and spiritual development [5, 6]. Posttraumatic growth is theorized to occur when a traumatic event is sufficiently challenging that it prompts intense cognitive processing of the event and its aftermath. This cognitive processing includes rumination and self-disclosure that can lead to fundamental schema changes, altered life goals, and reduced emotional distress; all of which may be facilitated by increased social support [7]. To date, few interventions have been developed to facilitate posttraumatic growth.

The benefits of exercise for cancer survivors include improved physical functioning, fatigue, sleep quality, quality of life, anxiety and depression, and possibly even lower risk of recurrence and longer survival [8-10]. Few studies to date, however, have examined whether exercise is associated with posttraumatic growth [11]. Previous research has suggested that peer support programs that included a physical activity component may promote posttraumatic growth through increases in social support [12-16] and decreases in distress [15, 16]; however, the majority of these studies are qualitative with small sample sizes. Moreover, none of these studies examined whether meeting the standard exercise guidelines might be associated with posttraumatic growth. Social support and reduced stress may be mechanisms by which exercise may improve posttraumatic growth however, there may be other mechanisms such as improved fitness, weight loss, sense of accomplishment, change in self-schema, or personal meaning in the activity.

Here, we report one of the first studies to quantify the association between exercise and posttraumatic growth in cancer survivors. The primary objective of this study was to examine the association between exercise and various indicators of posttraumatic growth in gynecologic cancer survivors (GCS). We selected gynecologic cancers because they are among the most common types of cancer diagnosed in women [17]. Moreover, the 5-year survival rates are quite varied with rates of 75 % for cervical cancer, 85% for endometrial

cancer, and 42% for ovarian cancer [17]. The life threat and invasive treatments make GCS an ideal population to examine the association of exercise and posttraumatic growth [18, 19]

Based on previous research [12-14, 20], and posttraumatic growth theory [5-7], we hypothesized that GCS who were meeting the exercise guidelines would be more likely to report posttraumatic growth than those not meeting the guidelines. We explored the associations separately for aerobic and strength exercise. Moreover, we compared GCS who were meeting both exercise guidelines to those meeting only one or neither guideline to determine if a combined exercise program might have additional benefit. Finally, we explored important demographic and clinical variables as potential moderators of the associations between exercise and posttraumatic growth including cancer type, previous treatments, and time since diagnosis.

2.2 METHODS

Study population

Ethical approval for this study was granted by the Alberta Cancer Research Ethics Board and the University of Alberta Health Research Ethics Board. This study utilized a cross-sectional design with a mailed, self-administered survey. Eligibility for the study included: (a) 18 years of age or older, (b) histologically confirmed gynecologic (cervical, endometrial, or ovarian) cancer diagnosed between 1986 and 2013, and (c) ability and willingness to complete all questionnaires in English.

Study Procedure

The Alberta Cancer Registry generated a random sample of 2,064 GCS stratified by cancer type (688 from each survivor group) who were then contacted by the registry on behalf of the researchers. The survey was conducted between July and November 2013 and followed a modified version of the Total Design Method [21]. Our team of researchers has successfully utilized the Alberta Cancer Registry to contact survivors and request participation in survey based studies [9, 22, 23]. Eligible GCS were mailed a study package containing: (a) a letter of invitation from the Registry explaining the purpose of the Registry and its role in this specific study, (b) a letter from the researchers explaining the study, (c) the survey booklet, and (d) a postage paid return envelope. A postcard reminder was mailed 3-4 weeks later, and a second survey was mailed 3-4 weeks after that to nonresponders. GCS were instructed that they could decline the study either by not responding or by returning the initial survey blank.

Measures

Demographic and medical information.

Demographic variables were assessed by self-report and included age, marital status, education, annual income, employment status, ethnicity, and height and weight to calculate body mass index (BMI). Medical variables were also assessed by self-report and included date of diagnosis, type of gynecologic cancer (cervical, endometrial, ovarian), disease stage (localized, metastasized, unsure), previous and current treatments (surgery, radiation, chemotherapy/drugs), previous recurrence (no or yes), and current disease status (“cancer is gone” vs. “still have cancer”). Comorbidities were assessed by asking participants to check all conditions that applied to them from a list of comorbidities including high blood pressure, heart attack, emphysema, diabetes, angina, high cholesterol, stroke, chronic bronchitis, other cancer, and arthritis.

Exercise

Aerobic exercise was measured using a modified version of the validated Leisure Score Index from the Godin Leisure Time Exercise Questionnaire [24, 25]. Participants were asked to recall the average weekly frequency and duration of any vigorous (heart beats rapidly, sweating), moderate (not exhausting, light perspiration), and light (minimal effort, no perspiration) intensity aerobic exercise they engaged in over the past month. We calculated the percentage of participants meeting the 2008 Physical Activity Guidelines for Americans [26] which have been endorsed for cancer survivors by the American Cancer Society [27] and the American College of Sports Medicine [28]. The guidelines state that cancer survivors should perform either 75 minutes of vigorous aerobic exercise per week, 150 minutes of moderate aerobic exercise per week, or an equivalent combination that double weights the vigorous minutes. Thus, we calculated aerobic “exercise minutes” as moderate minutes plus 2 times the vigorous minutes and dichotomized the minutes into: (a) not meeting aerobic exercise guidelines (0-149 exercise minutes/week) or (b) meeting aerobic guidelines (≥ 150 exercise minutes/week).

Strength exercise was assessed using items from a previous survey of strength exercise in colorectal cancer survivors [29]. Participants were asked to recall if they had participated in any strength exercises in the past month with response options of yes or no. Examples of strength exercises were provided to participants including weight lifting, sit-ups,

and push-ups. If yes, they were asked the frequency (days/week). We dichotomized strength exercise into: (a) not meeting strength exercise guidelines (< 2 days per week) or (b) meeting strength exercise guidelines (≥ 2 days per week). We also created a 'combined exercise' variable from the aerobic and strength exercise guidelines that categorized GCS as meeting both exercise guidelines, either exercise guideline, or neither exercise guideline.

Posttraumatic Growth

Given that this was the first study to examine the association between meeting the exercise guidelines and posttraumatic growth in cancer survivors, we felt it was important to utilize a broad range of indicators of posttraumatic growth. Our primary posttraumatic growth scale was the well-validated Posttraumatic Growth Inventory (PTGI) [5]. The PTGI is a 21-item questionnaire which yields a total growth score and five subscale scores: new possibilities (5 items), relating to others (7 items), personal strength (4 items), spiritual change (2 items), and appreciation of life (3 items). Items were rated on a six-point Likert scale, ranging from 0 (I did not experience this change as a result of my crisis) to 5 (I experienced this change to a very great degree as a result of my crisis). For this study, the stem statement was modified to refer to the trauma of a gynecologic cancer diagnosis. Items were summed for a total score with higher scores indicating greater posttraumatic growth. Internal consistency for the original scale development was $\alpha=0.90$, and in the present study was $\alpha=0.96$.

A secondary posttraumatic growth scale was the Impact of Cancer Scale (IOC) which consists of 41 items comprising 5 positive subscales (health awareness, positive self-evaluation, positive outlook, value of relationships, meaning of cancer) and 5 negative subscales (body changes, negative self-evaluation, negative outlook, life interferences, health worry) [30]. The higher order positive impact of cancer scale (PIOC) and negative impact of cancer scale (NIOC) are scored as the mean of the subscale scores. Respondents indicated the extent to which they agreed or disagreed with each of the 41 items along a five-point Likert scale. Higher scores on the PIOC and its associated subscales indicate a more positive impact of cancer whereas higher scores on the NIOC and its associated subscales indicate a more negative impact. Internal consistencies for the original IOC development ranged from $\alpha=0.62$ to $\alpha=0.91$. In the present study, internal consistency was $\alpha=0.93$ for the NIOC scale and $\alpha=0.94$ for the PIOC.

A third posttraumatic growth scale was the 14-item Benefit Finding Scale (BFS) which was used to assess the ways gynecologic cancer could have a positive impact [31]. Participants rated the extent to which their attitudes and behaviours had changed as a result of having gynecologic cancer on a scale ranging from 1 (not at all) to 4 (very much). Items were summed with higher scores indicating more benefits from having cancer. The original BFS reported a high internal consistency ($\alpha=0.92$) which was replicated in our study ($\alpha=0.94$).

Statistical analysis

As no clinically meaningful difference has been reported for any of the PTG scales, our planned sample size of over 600 provided 80% power to detect a small standardized effect size d difference of 0.20 between meeting and not meeting exercise guidelines with an alpha of $p=0.05$. In subgroup analyses with approximately 150 GCS per group, we still had 80% power to detect standardized effect size d differences of 0.33 between meeting and not meeting exercise guidelines with an alpha of $p=0.05$.

Multivariate analyses of covariance (MANCOVA) were used to test differences in posttraumatic growth across the four total scales (i.e. PTGI, PIOC, NIOC, BFS) for each of the exercise guidelines. If significant, follow-up univariate analyses of covariance (ANCOVAs) were used for the total scales and subscales. Our primary analyses were adjusted for important demographic and medical variables determined a priori including age, type of cancer, BMI, months since diagnosis, radiation treatment, and chemotherapy treatment. We used the same analyses for our combined exercise guideline variable comparing those meeting both, either, or neither exercise guideline and followed up significant ANCOVAs with least significant difference (LSD) post hoc tests.

Finally, we explored several demographic and medical variables as potential moderators of the association between our combined exercise guideline variable and the total scores of the PTGI, PIOC, NIOC, and BFS. Interactions were tested using ANCOVAs adjusting for the same variables as in our main analyses with potential moderators identified a priori as age (<60 vs. ≥ 60), BMI (healthy weight vs. overweight vs. obese), marital status (married vs. not married), months since diagnosis (<24 vs. 24-59 vs. ≥ 60), type of gynecologic cancer (cervical vs. endometrial vs. ovarian), chemotherapy (yes vs. no), radiation (yes vs. no), and general health rating (fair/poor vs. good vs. excellent/very good).

2.3 RESULTS

Figure 1 reports the participant flow through the study. Of the 2,064 mailed surveys, 438 were returned due to wrong address (n=432), no history of gynecologic cancer (n=4), and deceased (n=2). Of the remaining 1,626 surveys, the most common reasons for not participating were no response (n=819), questionnaire returned blank (n=109), contacted us to decline participation (n=69), returned questionnaire incomplete (n=4), and returned questionnaire too late (n=2). In total, 621 surveys were returned completed resulting in a completion rate of 30% (621/2,064) and a response rate of 38% (621/1,626) excluding those that were returned to sender or not eligible.

To examine the representativeness of our sample, we compared responders (n=621) to nonresponders (n=1,443) on the limited demographic and medical information available from the registry. We found our sample of responders was similar to nonresponders in age (60.8±12.2 vs. 60.9±13.9 years; p=0.84), radiation treatment (30% vs. 28%; p=0.36) and surgical treatment (91% vs. 89%; p=0.10). Our sample of responders was different from nonresponders in that they were more likely to have received chemotherapy (36% vs. 22%; p<0.001); more likely to have ovarian cancer (40% vs 31%) as compared to endometrial (27% vs. 30%) or cervical cancer (32% vs. 39%; p=0.001); and closer to their date of diagnosis (118±77 vs. 156±83 months; p<0.001).

Sample characteristics

Demographic and medical characteristics are presented in Tables 1 and 2. The mean age of participants was 60.8±12.2 years and 71.5% were married. The mean BMI was 28.2 ± 6.6 with 64.4% of participants being classified as overweight or obese. For type of cancer, 40.3% had ovarian cancer, 27.4% had endometrial cancer, and 32.4% had cervical cancer. Descriptive statistics for the exercise and posttraumatic growth variables are displayed in Table 3. Based on the exercise guidelines, 204 (32.9%) were meeting aerobic exercise guidelines and 118 (19.0%) were meeting strength exercise guidelines. In terms of the combined exercise guidelines, 135 (21.7%) were meeting only the aerobic guideline, 49 (7.9%) were meeting only the strength exercise guideline, and 69 (11.1%) were meeting both guidelines.

Associations between exercise and posttraumatic growth

The overall MANCOVA was significant for aerobic exercise guidelines [Wilks' $\lambda=0.05$, $F(4,609)=7.958$, $p<0.001$]. Follow-up univariate ANCOVAs (Table 4) indicated significant differences in favor of the exercisers for the NIOC ($M_{diff}=-0.3$, $p<0.001$, $d=0.43$) and its subscales of negative body changes ($M_{diff}=-0.3$, $p<0.001$, $d=0.30$), negative self-evaluation ($M_{diff}=-0.3$, $p<0.001$, $d=0.34$), life interferences ($M_{diff}=-0.5$, $p<0.001$, $d=0.56$), and health worry ($M_{diff}=-0.2$, $p=0.017$, $d=0.13$), as well as the PIOC subscale of health awareness ($M_{diff}=0.1$, $p=0.040$, $d=0.15$). The overall MANCOVA for strength exercise was not significant [Wilks' $\lambda=0.01$, $F(4,609)=1.627$, $p=0.17$].

The overall MANCOVA for combined exercise was significant [Wilks' $\lambda=0.07$, $F(12,1827)=3.648$, $p<0.001$]. Follow-up univariate ANCOVAs (Table 5) indicated differences for the PTGI Scale ($p=0.014$), the NIOC Scale ($p<0.001$), the BFS ($p=0.05$), and several of their subscales. Post hoc tests showed that GCS meeting both exercise guidelines had higher PTGI scores than those meeting either guideline ($M_{diff}=10.1$, $p<0.05$, $d=0.42$) or neither guideline ($M_{diff}=7.1$, $p<0.05$, $d=0.33$); and higher BFS scores than those meeting either guideline ($M_{diff}=3.3$, $p=0.021$, $d=0.32$). Moreover, those meeting either guideline reported lower NIOC scores than those meeting neither guideline ($M_{diff}=-0.3$, $p<0.05$, $d=0.37$).

Moderators of the associations between exercise and posttraumatic growth

The only consistent moderator of the association between the combined exercise guidelines and posttraumatic growth was marital status. Marital status significantly moderated the association of the combined exercise guidelines with the PTGI (p for interaction = 0.002; Figure 2a), the PIOC (p for interaction = 0.024; Figure 2b), and the BFS (p for interaction = 0.024; Figure 2c). The general pattern was that the association between the combined exercise guidelines and posttraumatic growth was strong and dose-dependent for unmarried GCS whereas it was essentially non-existent for married GCS. The only other significant interaction was between general health rating and the combined exercise guidelines for NIOC (p for interaction = 0.024 Fig. 2d). The association was strong and dose-dependent for GCS with poor/fair health whereas there was no clear association for GCS in good health or very good/excellent health.

2.4 DISCUSSION

Our results showed that aerobic exercise is associated with shielding the negative impact of cancer in GCS including negative body changes, negative self-evaluation, life interferences, and health worry. One possible explanation for this finding is that the NIOC captures primarily the negative physical impact of a cancer diagnosis with items related to physical functioning, symptom management, body image, and fatigue [30]. Aerobic exercise has clearly been shown to ameliorate these negative physical impacts of cancer and its treatments [32].

Aerobic exercise was not associated with the PTGI or the PIOC, which are measures of positive adaptation and personal growth [30]. Previous research has reported that exercise classes [13], mountaineering [12], and dragon boating [14] are linked to posttraumatic growth and these data are generally interpreted as suggesting that social support is a key element of the activity intervention success. It is also possible, however, that the nature of the activity in these interventions (e.g., mountaineering, dragon boating) may have further contributed to posttraumatic growth. That is, activity interventions that are physically challenging, novel, or incur some risk may be more likely to promote growth. Based on previous surveys of endometrial [33] and ovarian [34] cancer survivors, it is likely that the majority of aerobic exercise in our study was walking which is unlikely to be viewed as physically challenging, novel, or risky. Future research should examine the nature of the activity and how it may be related to posttraumatic growth.

There was no association between achieving the strength exercise guidelines and posttraumatic growth in GCS. This result is inconsistent with recent systematic reviews and meta-analyses that have clearly shown that strength exercise is associated with improved physical functioning and health outcomes in cancer survivors [32, 35]. It is possible that our smaller sample size of GCS meeting the strength exercise guidelines or the self-report measure of strength exercise may have limited our ability to find an association. Given that this is the first study examining strength exercise and posttraumatic growth, further research is warranted.

Our study is one of the few to examine the association between meeting the combined exercise guidelines and health outcomes in cancer survivors. Consistent with our hypothesis, GCS meeting both exercise guidelines reported significantly higher levels of posttraumatic

growth including the subscales of new possibilities, personal strength, spiritual change, and appreciation for life. Similarly, meeting both guidelines and either guideline was significantly associated with less negative impact on negative body changes and life interference. Based on previous research, combined exercise has been found to manage declines in physical function and worsening symptoms compared to aerobic exercise alone [36]. Moreover, participants may be challenged both physically and emotionally to meet both aerobic and strength guidelines which may foster a sense of accomplishment and psychological growth. These results are compatible with observational studies of breast cancer survivors that found emotionally and physically demanding activity may provide a vehicle for physical and psychological growth [12-16].

Interestingly, we found that marital status consistently moderated the association between exercise and posttraumatic growth. The general pattern was a strong and dose-dependent association for unmarried GCS whereas it was absent for married GCS. This finding is consistent with previous randomized controlled trials showing that unmarried breast cancer patients [37] and lymphoma patients [38] experienced a greater quality of life benefit from an exercise intervention than married patients. One potential explanation for this finding is that unmarried survivors may have less social support and, therefore, benefit more from the social aspects of exercise [39, 40].

General health was also a statistically significant moderator of the association between the combined exercise guidelines and the NIOC. The association was strong and dose-dependent for GCS with poor/fair health whereas there was no clear association for GCS in good health or very good/excellent health. This finding is consistent with a recent randomized controlled trial that showed that general health moderated the effects of aerobic exercise training on quality of life with greater benefits for lymphoma patients in poor/fair health [38]. It is possible that GCS with poor/fair health may have had more difficult treatments and/or more advanced disease stage allowing them to benefit more from the combined exercise

To our knowledge, our study is the first to examine the association between meeting exercise guidelines and posttraumatic growth in cancer survivors. Moreover, we obtained a large population-based sample of GCS stratified by cancer site and we were able to compare responders to nonresponders. Other strengths include the use of well-validated measures of exercise and posttraumatic growth. Our study is limited by the cross-sectional design, which

precludes any inferences about causality; and the modest response rate which resulted in some selection biases. Additionally, our study used self-reported exercise measures, which may be less reliable and valid, compared to objective measures. Finally, our study did not assess social support or psychological functioning, which may have helped in the interpretation of our data. Future exercise studies may consider assessment of these variables now that an association between exercise and posttraumatic growth has been established.

In conclusion, we examined the associations between exercise and posttraumatic growth in a population-based sample of 621 GCS. We found that aerobic exercise was associated with a lower negative impact of cancer whereas strength exercise was not associated with any aspects of posttraumatic growth. Meeting both the aerobic and strength exercise guidelines, however, was strongly associated with positive aspects of growth. Additional research examining the nature of the physical activity and how it may be related to posttraumatic growth is warranted. Ultimately, randomized controlled trials are needed to determine if there is a causal relationship between exercise interventions and posttraumatic growth. If these observations are validated in randomized controlled trials, exercise may be an important strategy for promoting posttraumatic growth in cancer survivors.

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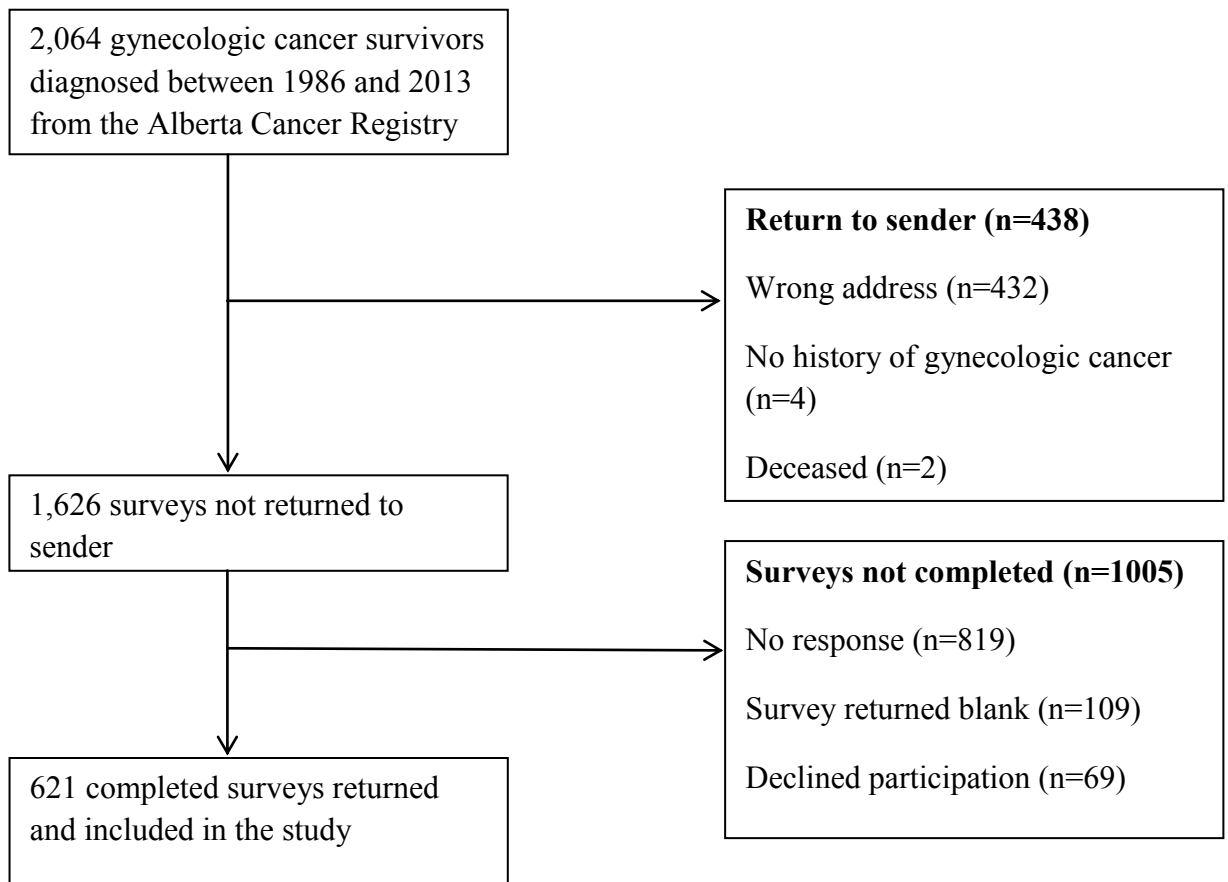
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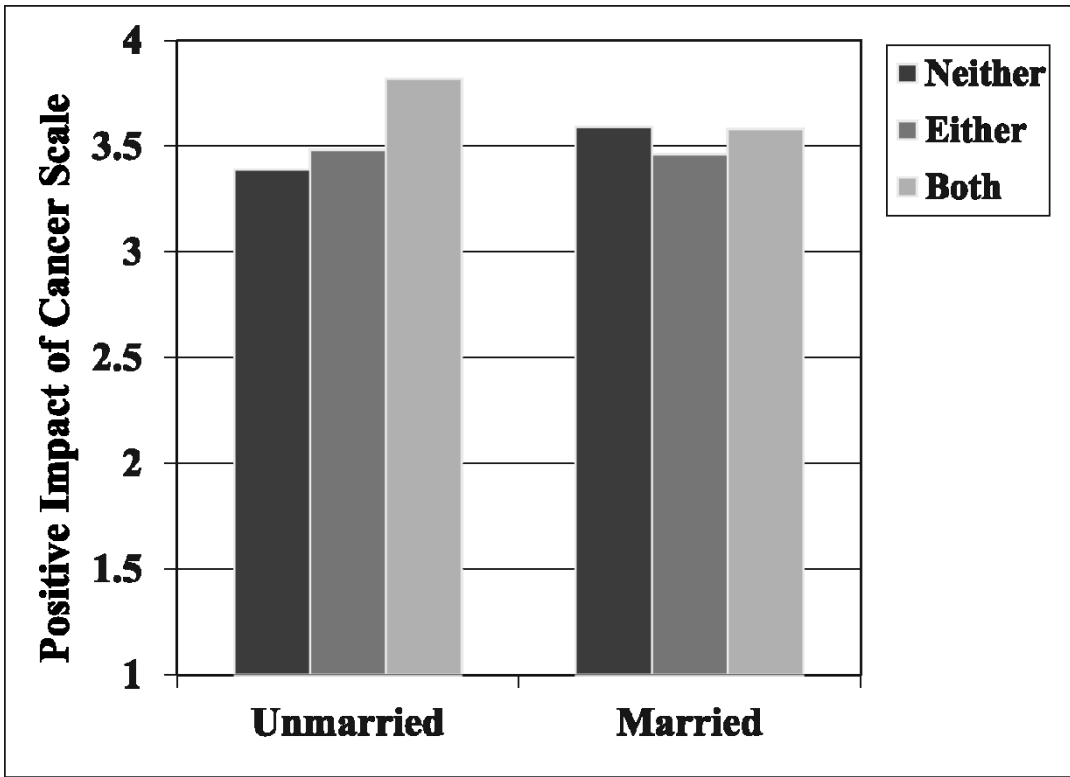
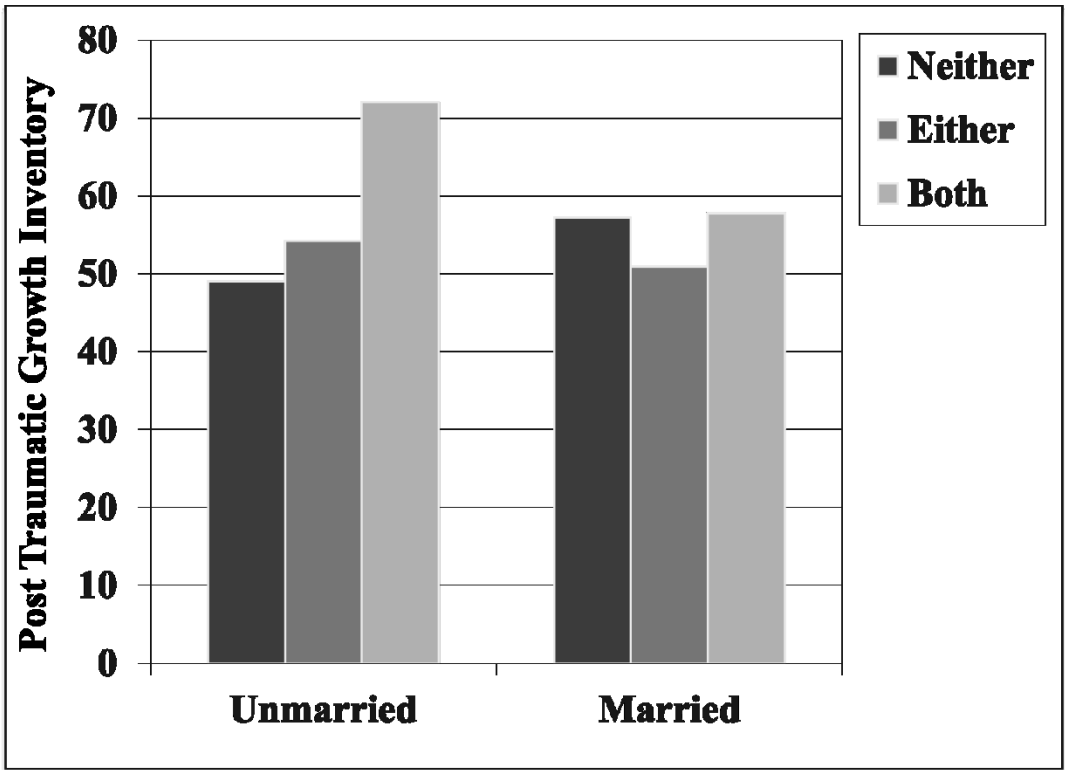
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Figure Captions

Figure 2-1. Flow of participants through the study.

Figure Panel 2-2. Significant interactions between the combined exercise guidelines and (A) marital status for the PTGI, (B) marital status for the PIOC, (C) marital status for the BFS, and (D) general health rating for the NIOC.





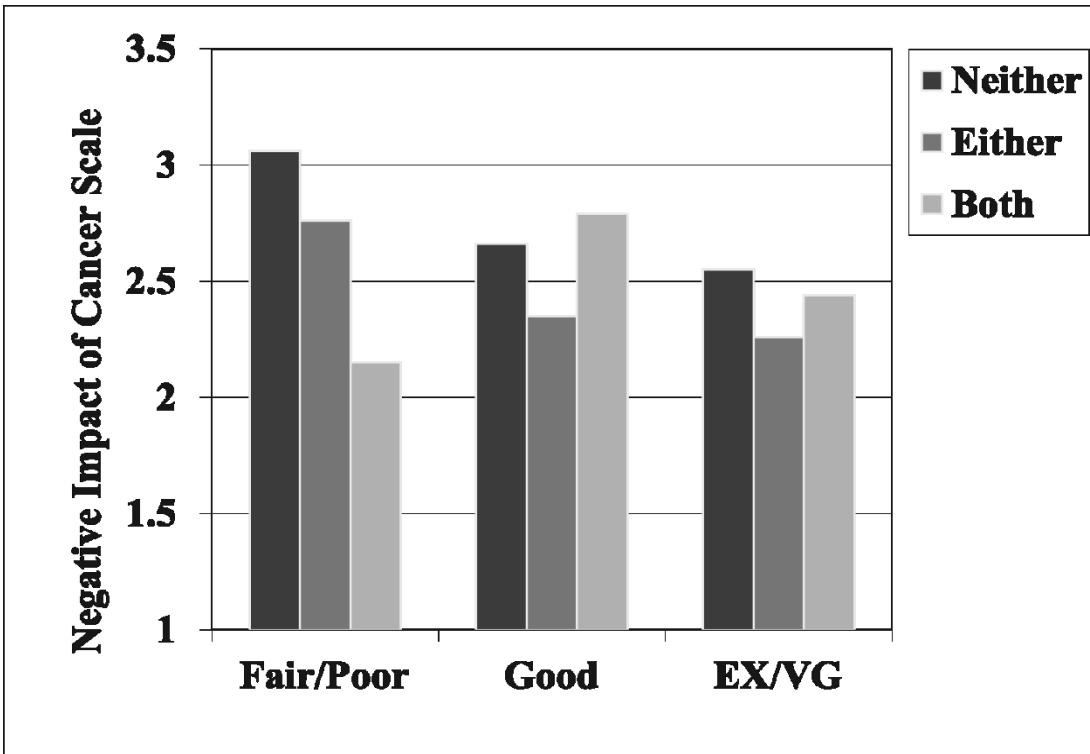
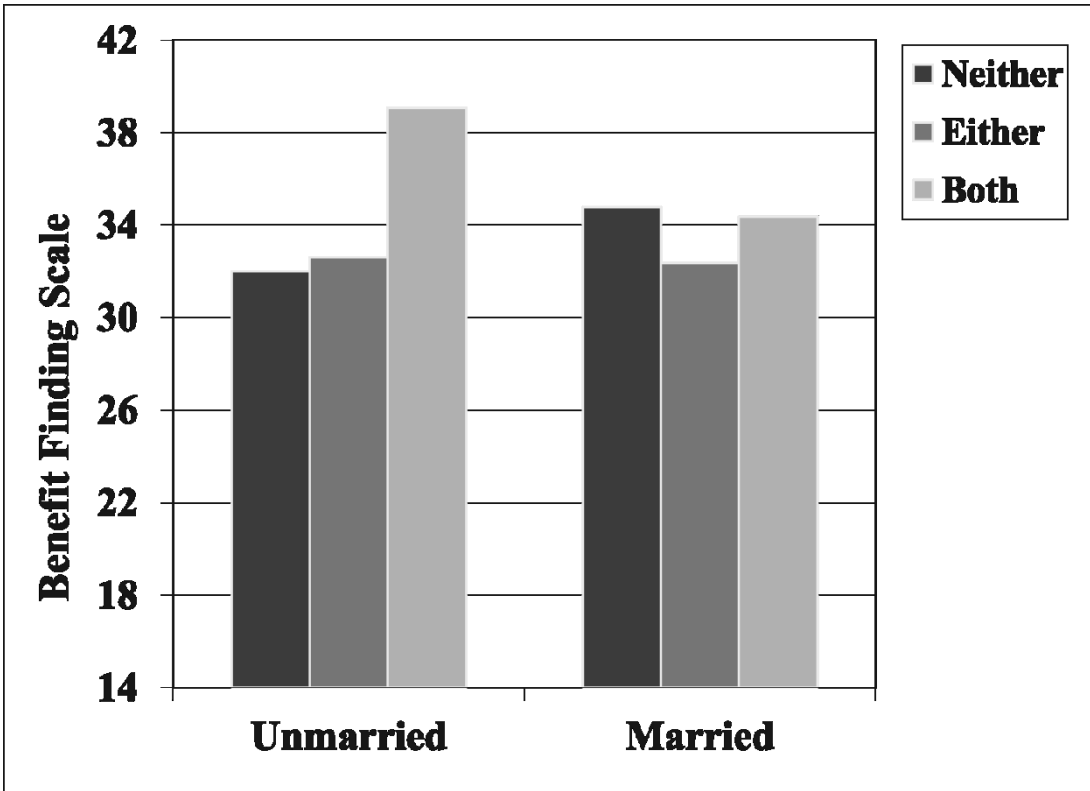


Table 2-1 Demographic and medical characteristics of gynecologic cancer survivors in Alberta, Canada, July-November, 2013 (N=621).

Variable	n (%)
Age (Mean±SD=60.8±12.2)	
<60	265 (42.7%)
≥60	356 (57.3%)
Marital Status	
Not married	177 (28.5%)
Married/common law	444 (71.5%)
Education	
Did not complete university/college	327 (52.7%)
Completed university/college	294 (47.3%)
Annual Family Income	
<\$60,000	237 (38.2%)
≥\$60 000	278 (44.8%)
Missing data	106 (17.0%)
Employment status	
Not employed	356 (57.3%)
Employed full-/part-time	265 (42.7%)
Ethnicity	
White	549 (88.4%)
Other	72 (11.6%)
Body mass index (Mean ± SD=28.2±6.6)	
Healthy weight (<25)	221 (35.6%)
Overweight (25.0-29.9)	213 (34.3%)
Obese (≥30.0)	187 (30.1%)
Number of comorbidities	
0	172 (27.7%)
≥1	449 (72.3%)
Most common comorbidities	
High blood pressure	262 (42.2%)
Arthritis	258 (41.5%)
High cholesterol	185 (29.8%)
Other cancer	83 (13.4%)
Diabetes	84 (13.5%)
Smoking status	
Non-smoker	558 (89.9%)
Smoker	63 (10.1%)
Drinking status	
Non-drinker	200 (32.2%)
Regular/social drinker	421 (67.8%)

Table 2-2 Cancer and treatment characteristics of gynecologic cancer survivors in Alberta, Canada, July-November, 2013 (N=621).

Variable	n (%)
Months since diagnosis (Mean±SD=118±77)	
<60	171 (27.6%)
≥60	450 (72.5%)
Type of gynecologic cancer	
Ovarian	250 (40.3%)
Endometrial	170 (27.4%)
Cervical	201 (32.4%)
Disease stage	
Localized	539 (86.8%)
Metastatic	49 (7.9%)
Don't know	33 (5.3%)
Surgery treatment	
No	56 (9.0%)
Yes	565 (91.0%)
Radiation treatment	
No	437 (70.4%)
Yes	184 (29.6%)
Chemotherapy treatment	
No	397 (63.9%)
Yes	224 (36.1%)
Current treatment status	
Receiving treatment	15 (2.4%)
Completed treatment	606 (97.6%)
Recurrence	
No	569 (91.6%)
Yes	52 (8.4%)
Current disease status	
Disease-free	590 (95.0%)
Existing disease	31 (5.0%)
General health rating	
Excellent/Very good	266 (42.8%)
Good	235 (37.8%)
Fair/Poor	105 (16.9%)

Table 2-3 Descriptive statistics for exercise and posttraumatic growth in gynecologic cancer survivors in Alberta, Canada, July-November, 2013 (N=621).

Variable	M ± SD or n (%)
Average weekly aerobic physical activity	
Moderate minutes	72 ± 111
Vigorous minutes	29 ± 73
Exercise minutes ¹	130 ± 194
Aerobic exercise guidelines	
Not meeting guidelines	417 (67.1%)
Meeting guidelines	204 (32.9%)
Strength exercise guidelines	
Not meeting guidelines	503 (81.0%)
Meeting guidelines	118 (19.0%)
Combined exercise guidelines	
Neither	368 (59.3%)
Aerobic only	135 (21.7%)
Strength only	49 (7.9%)
Both	69 (11.1%)
Posttraumatic growth (0-105)	54.7 ± 25.1
Relating to others (0-35)	19.1 ± 8.9
New possibilities (0-25)	10.7 ± 6.7
Personal strength (0-20)	11.3 ± 5.3
Spiritual change (0-10)	4.4 ± 3.4
Appreciation for life (0-15)	9.4 ± 4.0
Negative Impact of Cancer (0-5)	2.6 ± 0.7
Negative body changes (0-5)	2.5 ± 1.0
Negative self-evaluation (0-5)	2.2 ± 0.9
Negative outlook (0-5)	2.8 ± 1.3
Life interferences (0-5)	2.2 ± 0.9
Health worry (0-5)	3.2 ± 1.1
Positive Impact of Cancer (0-5)	3.5 ± 0.6
Health awareness (0-5)	3.7 ± 0.7
Positive self-evaluation (0-5)	3.5 ± 0.7
Positive outlook (0-5)	3.7 ± 0.8
Value of relationships (0-5)	3.6 ± 0.8
Meaning of cancer (0-5)	3.2 ± 0.8
Benefit Finding Scale (0-56)	33.7 ± 10.2

Note. ¹Exercise minutes are calculated as moderate minutes plus two times vigorous minutes.

Table 2-4 Differences in posttraumatic growth based on meeting aerobic exercise guidelines in gynecologic cancer survivors in Alberta, Canada, July-November, 2013 (N=621).

	Not Meeting Guidelines Mean (SE)	Meeting Guidelines Mean (SE)	Mean Difference (95%CI)	p
Posttraumatic growth	54.5 (1.24)	55.0 (1.81)	+0.4 (-4.0 to +4.8)	0.85
Relating to others	19.0 (0.44)	19.2 (0.65)	+0.2 (-1.3 to +1.8)	0.77
New possibilities	10.7 (0.33)	10.8 (0.48)	+0.1 (-1.0 to +1.3)	0.81
Personal strength	11.3 (0.26)	11.1 (0.38)	-0.2 (-1.2 to +0.7)	0.61
Spiritual change	4.5 (0.17)	4.2 (0.25)	-0.3 (-0.9 to +0.4)	0.42
Appreciation for life	9.2 (0.20)	9.6 (0.29)	+0.4 (-1.1 to +0.3)	0.27
Negative Impact of Cancer	2.7 (0.03)	2.4 (0.05)	-0.3 (-0.4 to -0.1)	<0.001
Negative body changes	2.6 (0.05)	2.3 (0.07)	-0.3 (-0.5 to -0.2)	<0.001
Negative self-evaluation	2.3 (0.04)	2.0 (0.06)	-0.3 (-0.4 to -0.1)	<0.001
Negative outlook	2.8 (0.06)	2.8 (0.09)	+0.0 (-0.2 to +0.2)	0.88
Life interferences	2.3 (0.05)	1.9 (0.07)	-0.5 (-0.6 to -0.3)	<0.001
Health worry	3.2 (0.05)	3.0 (0.07)	-0.2 (-0.4 to -0.0)	0.017
Positive Impact of Cancer	3.5 (0.03)	3.5 (0.04)	+0.0 (-0.1 to +0.1)	0.98
Health awareness	3.6 (0.03)	3.7 (0.05)	+0.1 (+0.0 to +0.3)	0.040
Positive self-evaluation	3.6 (0.03)	3.5 (0.05)	-0.2 (-0.2 to +0.1)	0.79
Positive outlook	3.6 (0.04)	3.7 (0.06)	+0.1 (-0.1 to +0.2)	0.33
Value of relationships	3.5 (0.04)	3.5 (0.06)	+0.0 (-0.1 to +0.2)	0.56
Meaning of cancer	3.2 (0.04)	3.1 (0.06)	-0.1 (-0.3 to +0.0)	0.08
Benefit Finding Scale	33.8 (0.51)	33.4 (0.73)	-0.4 (-2.2 to +1.4)	0.63

Note. Mean (SE) and Mean (95% CI) are adjusted for age, type of cancer, BMI, months since diagnosis, radiation, and chemotherapy; CI= confidence interval, SE= standard error.

Table 2-5 Differences in posttraumatic growth based on meeting neither, either, or both exercise guidelines in gynecologic cancer survivors in Alberta, Canada, July-November, 2013 (n=621).

	Meeting neither Guideline (N) Mean (SE)	Meeting either guideline (E) Mean (SE)	Meeting both guidelines (B) Mean (SE)	ANCOVA p value	Post-hoc comparisons
Posttraumatic growth	54.8 (1.31)	51.8 (1.86)	61.9 (3.00)	0.014	B>N, E
Relating to others	19.1 (0.47)	18.4 (0.67)	20.7 (1.08)	0.17	
New possibilities	10.6 (0.35)	10.0 (0.50)	12.9 (0.79)	0.008	B>N, E
Personal strength	11.3 (0.28)	10.7 (0.39)	12.5 (0.63)	0.050	B>E
Spiritual change	4.5 (0.18)	3.9 (0.26)	5.0 (0.41)	0.030	B, N>E
Appreciation for life	9.2 (0.21)	9.0 (0.29)	10.8 (0.47)	0.004	B>N, E
Negative Impact of Cancer	2.7 (0.04)	2.4 (0.05)	2.5 (0.08)	<0.001	E<N
Negative body changes	2.7 (0.05)	2.2 (0.07)	2.4 (0.12)	<0.001	B, E<N
Negative self-evaluation	2.3 (0.05)	2.0 (0.07)	2.1 (0.11)	0.002	E<N
Negative outlook	2.8 (0.07)	2.7 (0.10)	3.2 (0.16)	0.014	E, N<B
Life interferences	2.4 (0.05)	2.0 (0.07)	1.9 (0.11)	<0.001	B, E<N
Health worry	3.3 (0.05)	3.0 (0.80)	3.1 (0.12)	0.020	E<N
Positive Impact of Cancer	3.5 (0.03)	3.5 (0.05)	3.7 (0.07)	0.10	
Health awareness	3.6 (0.04)	3.7 (0.05)	3.8 (0.08)	0.06	
Positive self-evaluation	3.6 (0.04)	3.5 (0.05)	3.7 (0.08)	0.06	
Positive outlook	3.7 (0.04)	3.6 (0.06)	3.9 (0.10)	0.07	
Value of relationships	3.6 (0.04)	3.5 (0.06)	3.6 (0.10)	0.47	
Meaning of cancer	3.2 (0.04)	3.1 (0.06)	3.2 (0.10)	0.13	
Benefit Finding Scale	34.0 (0.54)	32.4 (0.76)	35.7 (1.23)	0.05	B>E

Note. Mean (SE) adjusted for age, type of cancer, BMI, months since diagnosis, radiation, and chemotherapy; SE=standard error, N=not meeting either guideline; E=meeting either guideline (aerobic or strength); B=meeting both guidelines (aerobic and strength).

CHAPTER 3-Study 1-Paper 2

Prevalence and Interest in Extreme/Adventure Activities Among Gynecologic Cancer Survivors: Associations with Posttraumatic Growth

A version of this chapter has been published. Crawford, J. J., Holt, N. L., Vallance, J. K., & Courneya, K. S. (2015). Prevalence and interest in extreme/adventure activities among gynecologic cancer survivors: Associations with posttraumatic growth. *Mental Health and Physical Activity*, 9, 35-40, by permission of publisher. doi: 10.1016/j.mhpa.2015.09.001

3.1 INTRODUCTION

Although a cancer diagnosis can be extremely stressful and traumatic, it may also provide an opportunity for positive growth and adaptation (Linley & Joseph, 2004; Love & Sabiston, 2011; Morris, Shakespeare-Finch, & Scott, 2007). Posttraumatic growth is defined as a positive psychological change that emerges following a significantly challenging or traumatic life event and is often characterized by an increased appreciation for life, better interpersonal relationships, personal strength, recognition of new possibilities, and spiritual development (Tedeschi & Calhoun, 1996; Tedeschi, Park, & Calhoun, 1998). Posttraumatic growth is theorized to occur when a life crisis or traumatic event is challenging enough that it prompts cognitive processing of the event and its aftermath. Posttraumatic growth theory suggests that individual styles of managing distress, social support, and disclosure regarding emotions and perspectives on the traumatic event, as well as cognitive processing of the traumatic event, can lead to schema changes, change in life goals, and reduced psychological distress (Tedeschi & Calhoun, 1996; Tedeschi et al., 1998).

Posttraumatic growth is a desired outcome of a cancer diagnosis; however, few interventions have been developed to promote experiences of growth. We previously reported that meeting exercise guidelines was associated with some aspects of posttraumatic growth in gynecologic cancer survivors (GCS) (Crawford, Vallance, Holt, & Courneya, 2014). Nevertheless, it is unknown whether the nature of the exercise itself (i.e., the exercise modality and context) may also be important for fostering posttraumatic growth. Previous research has found that emotionally and physically demanding activities (e.g., mountaineering, dragon boating, and group motorcycling) may prompt psychological growth in cancer survivors (Burke & Sabiston, 2012; Dunn, Campbell, Penn, Dwyer, & Chambers, 2009; Hefferon, Greal, & Mutrie, 2008; McDonough, Sabiston, & Ullrich-French, 2011; Sabiston, McDonough, & Crocker, 2007).

Based on posttraumatic growth theory and preliminary research, we propose that activities that push cancer survivors beyond their current capacity and provide a sense of accomplishment may be most likely to foster positive growth. Accordingly, we propose that the optimal physical activities for stimulating posttraumatic growth would be physically challenging (i.e., a high physiological demand), novel (i.e., not common or everyday activities), and contain some element of physical risk (i.e., potentially serious injury if a

mistake is made). The term “extreme/adventure activities” has become a general descriptor for these types of activities (Brymer & Schweitzer, 2013). Moreover, we propose that posttraumatic growth is most likely to occur when the cancer diagnosis itself prompts the cancer survivor to participate in extreme/adventure activities.

The primary objective of this study was to examine the prevalence and interest in extreme/adventure activities in GCS and determine any associations with posttraumatic growth. Based on posttraumatic growth theory and previous research (Burke & Sabiston, 2012; Dunn, Campbell, Penn, Dwyer, & Chambers, 2009; Hefferon, Greal, & Mutrie, 2008; McDonough, Sabiston, & Ullrich-French, 2011; Sabiston, McDonough, & Crocker, 2007), we hypothesized that few GCS would be participating in extreme/adventure activities but that those GCS who were participating would report higher posttraumatic growth. Based on previous research (Blanchard et al., 2003), we also hypothesized that few GCS would report their cancer diagnosis prompted them to substantially change the amount, type, or nature of their exercise (i.e., reported exercise growth) but those who did report exercise growth would also report higher posttraumatic growth.

3.2 METHODS

Study population

The design and methods of this cross-sectional, population-based study have been reported elsewhere (Crawford et al., 2014). Ethical approval was granted by the Alberta Cancer Research Ethics Board. Eligibility criteria included: (a) ≥ 18 years of age and (b) histologically confirmed gynecologic (cervical, endometrial, or ovarian) cancer diagnosed between 1986 and 2013. The Alberta Cancer Registry generated a random sample of 2,064 GCS stratified by cancer type (688 from each survivor group) who were then contacted by the registry on behalf of the researchers. The survey was conducted between July and November 2013. Eligible GCS were mailed a study package containing: (a) a letter of invitation from the Registry explaining the purpose of the Registry and its role in this specific study, (b) a letter from the researchers explaining the study, (c) the survey booklet, and (d) a postage paid return envelope. The survey protocol followed a modified version of the Total Design Method (Dillman, 2007) where participants were mailed (a) the initial study package, (b) a postcard reminder 3-4 weeks later to nonresponders, and (c) a second survey 3-4 weeks after that to nonresponders to the initial survey and postcard reminder.

Measures

Demographic and medical information

Medical and demographic variables were assessed by self-report and included age, marital status, education, annual income, employment status, ethnicity, height and weight to calculate body mass index (BMI), date of diagnosis, type of gynecologic cancer (cervical, endometrial, ovarian), disease stage (localized, metastasized), previous and current treatments (surgery, radiation, chemotherapy/drugs), previous recurrence (no or yes), and current disease status (“cancer is gone” versus “still have cancer”).

Participation and interest in extreme/adventure activity

We were unaware of any published scales that have been validated for the assessment of extreme/adventure activities. Based on definitions of extreme sport (Brymer & Schweitzer, 2013) and adventure therapy (Epstein, 2004), we defined extreme/adventure activities for participants as *physically challenging activities involving speed, height and/or a high level of physical exertion such as mountaineering, white water rafting, triathlon, marathon, scuba diving, rock climbing, dragon boating and downhill skiing*. Extreme/adventure activity participation was assessed using one item (i.e., have you participated in any extreme/adventure activity in the past year) with a yes or no response; and one open-ended question (i.e., if yes, what type of extreme/adventure activity(ies) did you do).

For participants interested in participating in a future exercise study, we asked “would you be interested in trying any extreme/adventure type activities” with a yes or no response. If participants selected yes, they were asked to choose which extreme/adventure activities they were most interested in trying from a list of options that included wall/rock climbing, mountaineering (hiking), triathlon, waterskiing/wakeboarding, river rafting, kayaking, scuba diving, mountain biking, cross country skiing, downhill skiing, horseback riding and other.

Posttraumatic growth

Given the exploratory nature of this study, posttraumatic growth was assessed by three scales. The primary posttraumatic growth scale was the Posttraumatic Growth Inventory (PTGI) (Tedeschi & Calhoun, 1996). The PTGI is a 21-item questionnaire with a six-point Likert Scale ranging from 0 (I did not experience this change as a result of my crisis) to 5 (I experienced this change as a result of my crisis). The PTGI is scored by the sum of the 21 items where higher scores indicated greater posttraumatic growth. The Impact of Cancer

Scale (IOC) was a second measure of posttraumatic growth (Zebrack, Yi, Petersen, & Ganz, 2008). The IOC consists of 41 items comprising 5 positive subscales (health awareness, positive self-evaluation, positive outlook, value of relationships, meaning of cancer) and 5 negative subscales (body changes, negative self-evaluation, negative outlook, life interferences, health worry). Respondents indicated the extent to which they agree from 1 (strongly disagree) to 5 (strongly agree). The Benefit Finding Scale (BFS) was used to assess the ways gynecologic cancer may have had a positive impact (Tomich & Helgeson, 2006). The BFS is a 14-item questionnaire with a 4-point scale ranging from 1 (not at all) to 4 (very much). The BFS is scored by summing the 14-items, with higher scores indicating more benefits from cancer.

Exercise growth

We were interested in the extent to which a diagnosis and treatment of gynecologic cancer may have prompted participation in extreme/adventure activities but we were unaware of any validated scales assessing such a construct. Consequently, we embedded six “exercise growth” items in the PTGI scale. As noted earlier, the PTGI scale asks “how your diagnosis and treatment for gynecologic cancer (ovarian, endometrial, or cervical) may have changed your life” with responses ranging from 0 (I did not experience this change as a result of my crisis) to 5 (I experienced this change as a result of my crisis). The six exercise growth items focused on changes in the amount, type, and nature of exercise in order to tap aspects related to physically challenging, novel, and high risk extreme/adventure activities. The specific items were: “I have significantly increased the amount of exercise I do”, “I have tried new exercises I have never done before”, “I have taken up a mind-body exercise such as yoga or tai chi”, “I have taken up a new sport that I never played before such as tennis or golf”, “I have taken up a physically challenging activity such as marathon running or triathlon”, and “I have taken up a high risk sport or activity such as rock climbing or white water rafting.”

Statistical analysis

All analyses were conducted using SPSS version 21.0 (SPSS Inc, Chicago, IL). We conducted analyses of covariance (ANCOVAs) comparing those participating versus not participating and those interested versus not interested in extreme/adventure activities on the PTGI, PIOC, NIOC, and BFS. Our analyses adjusted for age, type of cancer, BMI, months since diagnosis, radiation treatment, and chemotherapy treatment. We also conducted

ANCOVAs to examine differences in posttraumatic growth based on the six exercise growth items by creating four categories of exercise growth: (1) no change (0=did not experience this change), (2) very small/small change (1-2= changed to a very small/small degree), (3) moderate change (3=changed to a moderate degree), and (4) great/very great change (4-5= changed to a great/very great degree). Finally, we performed forced entry multiple regression analyses to determine the independent associations of each of the six exercise growth variables with PTGI, PIOC, NIOC, and BFS, adjusting for the same variables as in our main analyses.

3.3 RESULTS

Flow of participants through the study has been reported elsewhere (Crawford et al., 2014). Briefly, of the 2,064 mailed surveys, 621 surveys were completed resulting in a completion rate of 30% (621/2,064) and a response rate of 38% (621/1,626) excluding those that were returned to sender or not eligible. Demographic and medical data have been reported elsewhere (Crawford et al., 2014). In summary, the mean age of participants was 60.8 ± 12.2 years, 71.5% were married, and 47.3% had completed university/college. The mean BMI was 28.2 ± 6.6 with 64.4% of participants being classified as overweight or obese. For type of cancer, 40.3% had ovarian cancer, 27.4% had endometrial cancer, and 32.4% had cervical cancer. Based on the limited data available in the Alberta Cancer Registry, we found our sample was similar to nonresponders in age, radiation treatment, and surgery treatment but slightly over-represented ovarian cancer survivors, chemotherapy treatment, and were closer to their date of diagnosis (Crawford et al., 2014).

Participation and interest in extreme/adventure activities

Overall, 12.1% (n=75) of GCS reported that they had participated in an extreme/adventure activity over the past year (Table 1). Downhill skiing was the most frequently reported activity (29.4%) followed by mountaineering (17.5%) and cross-country skiing (8.7%). Of the 309 (49.8%) GCS interested in a future exercise study, 41.1% (127 out of 309) indicated they would be interested in trying an extreme/adventure activity. The most preferred type of extreme/adventure activity was cross-country skiing (56.9%) followed by horseback riding (51.5%) and river rafting (41.5%).

Exercise growth

Descriptive statistics for the exercise growth variables are displayed in Table 2. Results indicated that GCS reported the largest change for increasing the amount of exercise (38.8%) followed by trying new exercises (32.4%), taking up mind body exercises (16.3%), taking up a new sport (10.7%), taking up a physically challenging activity (5.5%), and taking up a higher risk sport or activity (2.8%).

Associations between extreme/adventure activities and posttraumatic growth

ANCOVAs indicated no significant differences for participation or interest in extreme/adventure activities for the PTGI, PIOC, NIOC, and BFS (Table 3).

Associations between exercise growth and posttraumatic growth

Table 4 reports the differences in posttraumatic growth based on the exercise growth items. All exercise growth items were significantly associated with all posttraumatic growth scales ($P_s < 0.05$). In forced entry multivariate regression analyses, the exercise growth items explained 37.2 % ($p < 0.001$) of the variance in PTGI, 7.2% ($p < 0.001$) of the variance in the NIOC, 19.9% ($p < 0.001$) of the variance in the PIOC, and 23.0% of the variance in BFS. For the PTGI, the significant independent correlates were increasing the amount of exercise ($\beta = 0.36$; $p < 0.001$), trying new exercises ($\beta = 0.24$; $p < 0.001$) and taking up a new sport ($\beta = 0.09$; $p = 0.023$). For the NIOC, the only significant correlate was trying new exercises ($\beta = 0.13$; $p = 0.031$). For the PIOC, the significant independent correlates were increasing the amount of exercise ($\beta = 0.31$; $p < 0.001$) and taking up mind-body exercises ($\beta = 0.09$; $p = 0.039$). Finally, for the BFS, the independent correlates were increasing the amount of exercise ($\beta = 0.31$; $p < 0.001$), taking up a new sport ($\beta = 0.09$; $p = 0.042$), and taking up a high risk sport ($\beta = 0.10$; $p = 0.020$).

3.4 DISCUSSION

Our results showed that only 12.1% ($n = 75$) of GCS reported participating in extreme/adventure activities in the past year with the most popular activities being downhill skiing, mountaineering, and cross-country skiing. There are no published studies that have examined extreme/adventure activity participation in cancer survivors with which to compare our results. This rate of participation is higher than the 5% reported in the general adult population (Tomlinson, Ravenscroft, Wheaton, & Gilchrist, 2005) although participation rates have continued to grow (Brymer & Schweitzer, 2013). Interestingly, about 40% of GCS interested in participating in a future exercise study were interested in trying

extreme/adventure activities with the strongest interest in cross country skiing (56.9%), horseback riding (51.5%), and river rafting (41.5%). These findings suggest that extreme/adventure activity interventions may be of interest to GCS despite limited current participation.

GCS also reported modest exercise growth as a result of their diagnosis. About one-third of GCS reported that their diagnosis and treatments prompted them to increase the amount of exercise and try new exercises; however, fewer than 10% reported that it prompted them to take up a new sport, take up a physically challenging activity, or take up a high-risk sport or activity. The proportion of GCS that increased the amount of exercise is about double that reported for breast and other cancer survivors (Blanchard et al., 2003). The reasons for the low rate of exercise change in terms of trying a new sport, a physically challenging activity, or a high risk activity are unclear. It is possible that the low rate of exercise change in these variables may be due to the age range of participants in the present study. Previously, extreme/adventure activities tended to be popular among younger people; however, the demographics of participants in extreme/adventure sports are broadening to include people of all ages including women (Celsi, Rose, & Leigh, 1993; Willig, 2008).

Contrary to our hypothesis, our data indicated that extreme/adventure activity participation and interest was not associated with posttraumatic growth. Observational research has indicated that those who push their boundaries and overcome physical and psychological challenges by taking up a new or physically challenging activities such as mountaineering, dragon boating, or motorcycling, have reported improved posttraumatic growth (Burke & Sabiston, 2012; Dunn et al., 2009; McDonough et al., 2011; Sabiston et al., 2007). One potential explanation for our finding is that a single participation in an extreme/adventure activity in the past year may not be sufficient to change posttraumatic growth. Unfortunately, we did not ask about the frequency of participation in our survey. A second possible explanation is that the low numbers of GCS who had participated in any extreme/adventure activity may have limited our ability to find an association. Finally, it is also possible that the GCS who participated in extreme/adventure activities in the past year were the same ones who had participated prediagnosis, thereby, not experiencing any change in activities which may be the critical factor in prompting posttraumatic growth.

This last explanation is bolstered by our results showing that all exercise growth items were significantly associated with all posttraumatic growth scales. These data suggest that GCS who changed the amount, type, or nature of their exercise experienced higher posttraumatic growth. These results are consistent with observational studies with breast cancer survivors that found emotionally and physically taxing activities may provide a medium for physical and psychological growth (Burke & Sabiston, 2010, 2012; Dunn et al., 2009; Sabiston et al., 2007). Moreover, it was not only an increase in the amount of exercise that was associated with posttraumatic growth but also trying new activities and high risk activities. These data are consistent with our hypothesis that activities that are physically challenging, novel, and contain some risk may be more likely to prompt posttraumatic growth in GCS. Future research examining whether exercise growth is associated with posttraumatic growth in other cancer survivor populations is warranted.

Our study has several strengths and limitations that need to be recognized. The strengths of our study include being the first to examine extreme/adventure activities and posttraumatic growth in GCS. Moreover, we obtained a large population-based sample of GCS that was fairly representative of the GCS population of Alberta and used validated measures of posttraumatic growth. One limitation of this study is the use of researcher-developed scales for extreme/adventure activity participation as well as exercise growth. The cross-sectional design is also a limitation. Moreover, our research should be replicated in different climates and countries, as different opportunities for extreme/adventure activities may exist.

In summary, we examined the associations between extreme/adventure activities and posttraumatic growth in a population-based sample of 621 GCS. We found that neither participation nor interest in extreme/adventure activities was associated with posttraumatic growth; however, exercise growth (i.e., changes in the amount, type, and nature of exercise prompted by the cancer diagnosis) was strongly associated with posttraumatic growth. Future research examining the outcomes and determinants of adventure/extreme activities in GCS and other cancer survivor populations are warranted.

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Table 3-1. Participation and interest in extreme/adventure activities in gynecologic cancer survivors in Alberta, Canada, July-November, 2013 (N=621).

Extreme/adventure activity variable	N (%)
Have you participated in any “extreme/adventure” activities in the past year?	
Yes	75 (12.1)
No	546 (87.9)
If yes, what type of extreme/adventure activities did you do? (n=75) ^a	
Downhill skiing	37 (29.4)
Mountaineering	22 (17.5)
Cross country skiing	11 (8.7)
White water rafting	10 (7.9)
Scuba diving	7 (5.6)
Mountain biking	6 (4.8)
Rock climbing	4 (3.2)
Sea kayaking	3 (2.4)
Zip lining	3 (2.4)
Horseback riding	3 (2.4)
Long distance running	2 (1.6)
Waterskiing	2 (1.6)
Rope course	2 (1.6)
Triathlon	2 (1.6)
Surfing	2 (1.6)
Other	6 (6.4)
Would you be interested in participating in a future exercise study?	
Yes	309 (49.8)
No	312 (50.2)
If yes, would you be interested in trying any “extreme/adventure” activities? (n=309)	
Yes	127 (41.1)
No	182 (58.9)
If yes, what type of “extreme/adventure” activities would you like to try? (n=127) ^a	
Cross country skiing	74 (56.9)
Horseback riding	67 (51.5)
River rafting	54 (41.5)
Mountaineering (hiking)	48 (36.9)
Kayaking	47 (36.2)
Wall/rock climbing	40 (30.8)
Downhill skiing	38 (29.2)
Scuba diving	31 (23.8)
Waterskiing/Wakeboarding	25 (19.2)
Mountain biking	23 (17.7)
Other	17 (13.1)
Triathlon	8 (6.2)

Note.^a Participants could list more than one type of extreme/adventure activity.

Table 3-2. Descriptive statistics for exercise growth variables in gynecologic cancer survivors in Alberta, Canada, July-November, 2013 (N=621).

Exercise growth variable	M ± SD	No Change ^a	Small Change ^b	Moderate Change ^c	GreatChange ^d
		n (%)	n (%)	n (%)	n (%)
Increased amount of exercise	1.3 ± 1.0	147 (23.7)	233 (37.5)	141 (22.7)	100 (16.1)
Tried new exercises	1.1 ± 1.1	234 (37.7)	186 (30.0)	103 (16.6)	98 (15.8)
Taken up mind-body exercises	0.6 ± 1.0	418 (67.3)	102 (16.4)	46 (7.4)	55 (8.9)
Taken up a new sport	0.4 ± 0.8	467 (75.2)	88 (14.2)	32 (5.2)	34 (5.5)
Taken up physically challenging activity	0.2 ± 0.6	531 (85.5)	56 (9.0)	20 (3.2)	14 (2.3)
Taken up “high risk” sport or activity	0.1 ± 0.5	560 (90.2)	44 (7.1)	11 (1.8)	6 (1.0)

Note. Exercise growth was rated on a six-point scale from 0=I did not experience this change to 5=I experienced this change to a very great degree. ^aDid not experience this change=0. ^bChanged to a very small/small degree=1-2. ^cChanged to moderate degree=3. ^dChanged to a great/very great degree=4-5.

Table 3-3. Differences in posttraumatic growth based on participation and interest in extreme/adventure activities in gynecologic cancer survivors in Alberta, Canada, July-November, 2013.

Variable	No	Yes	Mean Difference	p
	Mean (SE)	Mean (SE)	(95% CI)	
<u>Participation</u> (n=621)	(n=546)	(n=75)		
Posttraumatic Growth Inventory	54.7 (1.07)	54.9 (2.97)	+0.2 (-6.0 to +6.5)	0.95
Negative Impact of Cancer Scale	2.6 (0.03)	2.5 (0.08)	- 0.1 (-0.3 to +0.1)	0.29
Positive Impact of Cancer Scale	3.5 (0.03)	3.5 (0.07)	- 0.0 (-0.2 to +0.1)	0.78
Benefit Finding Scale	33.7 (0.03)	33.9 (1.21)	+0.2 (-2.3 to +2.8)	0.87
<u>Interest</u> (n=309)	(n=182)	(n=127)		
Posttraumatic Growth Inventory	55.9 (1.92)	52.6 (2.33)	-3.3 (-0.49 to +2.85)	0.29
Negative Impact of Cancer Scale	2.6 (0.06)	2.5 (0.07)	-0.1 (-0.23 to +0.12)	0.55
Positive Impact of Cancer Scale	3.5 (0.05)	3.5 (0.06)	+0.0 (-0.14 to +0.18)	0.81
Benefit Finding Scale	34.2 (0.77)	33.0 (0.94)	-1.2 (-3.66 to +1.30)	0.35

Note. Mean (SE) and Mean (95% CI) are adjusted for age, type of cancer, body mass index, months since diagnosis, radiation, and chemotherapy; CI= confidence interval, SE= standard error.

Table 3-4. Differences in posttraumatic growth based on exercise growth in gynecologic cancer survivors in Alberta, Canada, July-November, 2013 (N=621).

Variable	No Change ^a	Small Change ^b	Moderate Change ^c	Great Change ^d	p
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	
Increased amount of exercise	(n=147)	(n=233)	(n=141)	(n=100)	
Posttraumatic Growth Inventory	34.8 (1.71)	51.8 (1.36)	65.4 (1.75)	75.5 (2.09)	<0.001
Negative Impact of Cancer Scale	2.3 (0.06)	2.6 (0.05)	2.7 (0.06)	2.8 (0.07)	<0.001
Positive Impact of Cancer Scale	3.1 (0.05)	3.5 (0.04)	3.7 (0.05)	3.9 (0.06)	<0.001
Benefit Finding Scale	27.4 (0.75)	32.7 (0.60)	36.9 (0.77)	40.7 (0.92)	<0.001
Tried new exercises	(n=234)	(n=186)	(n=103)	(n=98)	
Posttraumatic Growth Inventory	38.9 (1.37)	57.8 (1.55)	64.7 (2.07)	75.9 (2.14)	<0.001
Negative Impact of Cancer Scale	2.3 (0.60)	2.7 (0.05)	2.7 (0.07)	2.9 (0.07)	<0.001
Positive Impact of Cancer Scale	3.2 (0.04)	3.6 (0.04)	3.7 (0.06)	3.9 (0.06)	<0.001
Benefit Finding Scale	28.7 (0.60)	35.2 (0.68)	36.3 (0.91)	40.2 (0.94)	<0.001
Taken up mind-body exercises	(n=418)	(n=102)	(n=46)	(n=55)	
Posttraumatic Growth Inventory	49.5 (1.17)	61.5 (2.37)	68.3 (3.54)	69.9 (3.24)	<0.001
Negative Impact of Cancer Scale	2.5 (0.03)	2.8 (0.07)	2.9 (0.10)	2.8 (0.09)	<0.001
Positive Impact of Cancer Scale	3.4 (0.03)	3.7 (0.06)	3.8 (0.09)	3.9 (0.08)	<0.001
Benefit Finding Scale	32.0 (0.48)	36.1 (0.98)	37.6 (1.47)	39.0 (1.34)	<0.001
Taken up a new sport	(n=467)	(n=88)	(n=32)	(n=34)	
Posttraumatic Growth Inventory	49.6 (1.09)	68.2 (2.51)	71.2 (4.14)	73.9 (4.02)	<0.001
Negative Impact of Cancer Scale	2.5 (0.03)	2.9 (0.07)	2.8 (0.12)	2.8 (0.12)	<0.001
Positive Impact of Cancer Scale	3.4 (0.03)	3.8 (0.06)	3.8 (0.11)	3.8 (0.10)	<0.001
Benefit Finding Scale	31.9 (0.45)	39.0 (1.04)	39.5 (1.71)	39.9 (1.66)	<0.001

Table 4. (continued)

Variable	No Change ^a	Small Change ^b	Moderate Change ^c	Great Change ^d	p
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	
Taken up physically challenging activity	(n=531)	(n=56)		(n=34) ^e	
Posttraumatic Growth Inventory	52.3 (1.06)	66.0 (3.26)		72.5 (4.2)	<0.001
Negative Impact of Cancer Scale	2.6 (0.03)	2.7 (0.09)		2.8 (0.12)	0.049
Positive Impact of Cancer Scale	3.5 (0.03)	3.8 (0.08)		3.9 (0.11)	<0.001
Benefit Finding Scale	32.7 (0.43)	39.6 (1.32)		40.2 (1.7)	<0.001
Taken up “high risk” sport or activity	(n=560)	(n=44)		(n=17) ^e	
Posttraumatic Growth Inventory	53.0 (1.03)	65.2 (3.69)		81.8 (6.0)	<0.001
Negative Impact of Cancer Scale	2.6 (0.03)	2.7 (0.11)		2.9 (0.17)	0.028
Positive Impact of Cancer Scale	3.5 (0.03)	3.7 (0.09)		4.0 (0.15)	<0.001
Benefit Finding Scale	33.0 (0.42)	38.7 (1.49)		45.3 (2.42)	<0.001

Note. Exercise growth was rated on a six-point scale from 0=I did not experience this change to 5=I experienced this change to a very great degree. ^aDid not experience this change=0. ^bChanged to a very small/small degree=1-2. ^cChanged to moderate degree=3. ^dChanged to a great/very great degree=4-5. ^eCombined moderate change and great change. Mean (SE) are adjusted for age, type of cancer, body mass index, months since diagnosis, radiation, and chemotherapy; SE= standard error.

CHAPTER 4-Study 1-Paper 3

Extreme Sport/Adventure Activity Correlates in Gynecologic Cancer Survivors

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4.1 INTRODUCTION

The benefits of physical activity for cancer survivors have been well documented and include improved physical and psychosocial functioning, and possibly prolonged survival and a reduced risk of recurrence [1-3]. Notwithstanding the plethora of benefits, physical activity participation rates are relatively low [4-6], suggesting the importance of identifying the correlates of physical activity in this population. Most physical activity and cancer research has focused on traditional exercise programs such as aerobic training (eg, walking) and strength training. More recent research has suggested that cancer survivors participate in other forms of physical activity that might be characterized as extreme sport/adventure activities (ESAAs).

ESAAs include activities that encompass inherent elements of physical, psychological, or emotional challenge such as rock climbing, mountaineering, river rafting, downhill skiing and mountain biking [7-9]. Recent research supports the notion that participation in ESAAs facilitates improvements in physical and psychological outcomes in several groups [8-11]. Most ESAA research has focused on adolescent populations with mental health challenges or at-risk behaviors (ie, behavioral/emotional problems, substance use, academic problems, and delinquency) [12]. More recently, ESAAs have been examined in cancer survivors as a strategy to prompt self-discovery and personal challenge to overcome the obstacles and adversity of a cancer diagnosis [10, 11, 13-15].

Most ESAA research in cancer survivors has focused on breast cancer survivors and has tested various interventions including dragon boating [14], mountain climbing [15], and horseback riding [16]. These studies have revealed that participants benefited from the ESAA interventions, in part, because of the supportive group environment of women who shared a similar diagnosis. The important role of the group context has also been observed in other

adventure therapy programs for cancer survivors that offer physical and emotional challenges in a remote wilderness setting [10,11]. Mastery and performance-based success of outdoor leisure activities with an element of risk have been shown to have a positive physical, psychological, and psychosocial impact on cancer survivors [10, 11, 17]. Specifically, studies have shown that cancer survivors who have participated in ESAAs interventions have experienced improvements in subjective wellbeing, personal growth, posttraumatic growth, quality of life, aerobic fitness, body composition, and muscular strength [13-16].

[ENREF_14](#) [ENREF_16](#)

More recently, Crawford et al. [18] examined the association between ESAA participation and posttraumatic growth in gynecologic cancer survivors. Although no association was found between ESAAs and posttraumatic growth, other important physical and psychosocial outcomes were not measured. Moreover, only 12.1% of gynecologic cancer survivors had participated in ESAAs in the past year suggesting that few, if any, would be experiencing any of the documented benefits. Despite the benefits of ESAA participation in cancer survivors, no study to date has examined the correlates of ESAA participation in cancer survivors.

In the general population, young, white, wealthy men are most likely to participate in ESAAs although this demographic is beginning to shift to include individuals of a wider age range and women [19]. A gynecologic cancer diagnosis and its treatments may influence whether one participates in ESAAs as well as whether an individual would be interested in participating in ESAAs. For instance, endometrial cancer survivors are more likely to be obese, experience other comorbidities, and experience late and chronic side effects from treatment that may affect their participation and interest in ESAAs [20-22]. The purpose of

this study was to examine the demographic, medical and behavioral correlates of participation and interest in ESAAs in gynecologic cancer survivors.

4.2 METHODS

The Alberta Cancer registry generated a random sample of 2,064 gynecologic cancer survivors (688 each from ovarian, endometrial, and cervical) from a total number of 5,134 survivors who matched the inclusion criteria [6,18]. Eligible survivors were: (a) at least 18 years of age or older, (b) diagnosed with gynecologic (cervical, endometrial, or ovarian) cancer between 1986 and 2013, and (c) able to complete questionnaires in English. Ethical approval for this self-administered questionnaire was approved by the Alberta Cancer Research Ethics Board and the University of Alberta Health Research Ethics Board. A modified version of the Total Design Method [23] was used for this study that consisted of: (a) mailing of the initial survey package to 2064 gynecologic cancer survivors (b) mailing of a postcard reminder three weeks after the initial mailout to those who did not respond, and (c) mailing of a second survey three weeks after that to those who had not responded to the initial survey and postcard reminder. Survivors were instructed that they could decline the study either by not responding or by returning the initial survey blank.

Measures

Demographic and medical information. Demographic variables were assessed by self-report and included age (open response), marital status (never married, married, common law, separated, widowed, divorced), education (some high school, completed high school, some university/college, completed university/college, some graduate school, completed graduate school), annual income (<20,000, 20-39,000, 40-59,000, 60-79,000, 80-99,999, >100,000; CA\$), employment status (disability, retired, part-time, homemaker, full-time, temporarily unemployed), and ethnicity (white black, Hispanic, Asian, aboriginal, other). Medical

variables were also assessed by self-report and included date of diagnosis (open ended), type of gynecologic cancer (cervical, endometrial, and ovarian), disease stage (localised, metastasized), previous and current treatments (surgery, radiation, chemotherapy), previous recurrence (yes/no), and current disease status (“cancer is gone” vs “still have cancer”). Similarly, behavioral/health variables were assessed by self-report and included smoking status (never smoked, ex-smoker, occasional, regular smoker), alcohol consumption (never drink, social drinker, regular drinker), general health (excellent, very good, good, fair, poor), and comorbidities (high blood pressure, high cholesterol, heart attack, stroke, emphysema, chronic bronchitis, diabetes, other cancer, angina, arthritis). Lastly, self-reported height and weight was used to calculate body mass index (BMI).

For the purposes of the current paper, demographic and behavioral correlates were grouped as follows: age (<50, 50-59, 60-60, ≥ 70), marital status (not married, married/common law), education (did not complete university/college, completed university/college), annual income (<40,000, 40,000-79,999, $\geq 80,000$), employment status (not employed, employed full-/part-time), ethnicity (white, other), aerobic exercise (not meeting guideline, meeting guidelines) and strength exercise (not meeting guidelines, meeting guidelines). Medical correlates were grouped as follows: months since diagnosis (<60, 60-119, ≥ 120), type of cancer (cervical, endometrial, ovarian), radiation therapy (yes, no), chemotherapy (yes, no), BMI (healthy weight, overweight, obese) general health (poor/fair, good, very good/excellent), and comorbidity (0 comorbidities, ≥ 1 comorbidities).

Physical activity. Our measure of physical activity has been reported elsewhere [6,18]. We used a modified version of the validated Leisure Score Index from the Godin Leisure Time Exercise Questionnaire [24,25]. Participants were asked to indicate the average weekly

frequency and duration of any vigorous (heart beats rapidly, sweating), moderate (not exhausting, light perspiration), and light (minimal effort, no perspiration) intensity aerobic exercise they engaged in a typical week over the past month. We calculated the percentage of participants meeting the physical activity guidelines based on the 2008 Physical Activity Guidelines [26] which have been endorsed for cancer survivors by the American College of Sports Medicine [27] and the American Cancer Society [28]. The guidelines indicate that individuals should achieve 75 minutes of vigorous aerobic exercise per week, 150 minutes of moderate aerobic exercise per week or a combination that double weights the vigorous minutes. Thus, we calculated aerobic exercise minutes as moderate minutes plus 2 times the vigorous minutes and classified them into: (a) not meeting aerobic exercise guidelines (<150 exercise minutes/week) or (b) meeting aerobic exercise guidelines (≥ 150 exercise minutes/week).

To the best of our knowledge there are no validated self-report scales that have been designed to measure strength exercise. Therefore, strength exercise was assessed using items from a previous study on strength exercise in colorectal cancer survivors [29]. We defined strength exercise for participants as physical activity/exercise that increases skeletal muscle strength, power, endurance or mass such as strength training or resistance training.

Participants were asked to recall if they had participated in any strength exercises in the past month with response options of yes or no. Examples of strength exercises were listed for participants including weight lifting, sit-ups, push-ups and resistance band exercises. If the respondent indicated yes, they were asked the frequency (days/week) of their strength exercise. Based on the American College of Sports Medicine recommendations for cancer

survivors [27], we dichotomized strength exercise into: (a) not meeting strength exercise guidelines (<2 days per week) or (b) meeting strength exercise guidelines (≥ 2 days per week).

Extreme sport/adventure activity participation and interest. Based on previous definitions of extreme sport [9] and adventure therapy [10], we defined ESAA for participants as physically challenging activities involving speed, height and/or a high level of physical exertion such as mountaineering, white water rafting, triathlon, marathon, scuba diving, rock climbing, dragon boating and downhill skiing [18] ESAA participation was assessed using one item (ie, have you participated in any extreme/adventure activity in the past year) with a yes or no response; followed by one open-ended question (ie, if yes, what type of extreme/adventure activity (ies) did you do). For participants who indicated that they would be interested in participating in a future exercise study, we asked “would you be interested in trying any extreme/adventure type activities” with a yes or no response. If yes, participants were asked to choose which ESAA they were most keen on trying from a list of options that included river rafting, kayaking, scuba diving, mountain biking, wall/rock climbing, mountaineering, triathlon, waterskiing/wakeboarding, cross country skiing, downhill skiing, horseback riding and other.

Statistical Analysis

All analyses were conducted using SPSS version 22 (SPSS Inc, Chicago, IL). Chi-square tests were used to examine the associations between the categorical demographic, medical and behavioral variables and the yes/no ESAA participation question and the yes/no ESAA interest question. All variables that had a statistically significant or borderline significant ($p < 0.10$) univariate association with ESAA participation or interest were entered into a multivariate logistic regression model to predict the probability that a respondent would

participate or be interested in participating in ESAA. Medical and demographic variables with more than 2 categories that were associated with ESAA participation or interest were dichotomized using dummy variables for the multivariate logistic regression analyses based on the optimal comparison. The significance level was set at an alpha of 0.05, and all tests were 2-sided.

4.3 RESULTS

Flow of participants through the study has been described elsewhere [6,18]. [ENREF_28](#) Of the 2,064 mailed surveys, 438 were returned due to wrong address, no history of gynecologic cancer, and decreased. Of the remaining 1,626 questionnaires, 621 gynecologic cancer survivors returned completed self-report questionnaires, resulting in a completion rate of 30% (621/2,064) and a response rate of 38% (621/1,626). Similarly, demographic and medical descriptives have been reported elsewhere [6]. [ENREF_28](#) The final sample had a mean age of 60.8 ± 12.2 years and were predominantly married (71.5%). The most common type of cancer was ovarian (40.3%) followed by cervical (32.4%) and endometrial (27.4%). At the time of the survey, 32.9% of participants were meeting aerobic exercise guidelines and 19% were meeting strength exercise guidelines. Previously, we compared responders (N = 621) and nonresponders (N = 1443) and found that our sample was similar to nonresponders in age, radiation treatment, and surgical treatment but slightly overrepresented ovarian cancer and those who received chemotherapy treatment.

Participation And Interest In Extreme Sport/Adventure Activity

Participation and interest in ESAA participation has been reported elsewhere [18]. Of the 621 gynecologic cancer survivors, 12.1% reported participating in ESAA in the past year. The most frequently reported ESAA was downhill skiing (29.4%) followed by mountaineering (17.5%) and cross-country skiing (8.7%). Of the 309 participants interested in

a future exercise study, 41.1% were interested in trying ESAs. The most preferred types of ESAs were cross country skiing (56.9%), horseback riding (51.5%), river rafting (41.5%), mountaineering (36.9%), kayaking (36.2%) and wall/rock climbing (30.8%).

Correlates Of Extreme Sport/Adventure Activity Participation

Table 1 presents the demographic and behavioral correlates of ESAA participation in the past year in gynecologic cancer survivors. Gynecologic cancer survivors were more likely to participate in ESAs if they were younger ($p < .001$), wealthier ($p < .001$), employed ($p < .001$), and meeting aerobic exercise guidelines ($p < .001$). Table 2 presents the cancer and medical correlates of ESAA participation in the past year in gynecologic cancer survivors. Gynecologic cancer survivors were less likely to participate in ESAs if they had endometrial cancer ($p = .013$), poor/fair health ($p = .023$), and were overweight or obese ($p = .005$); and were borderline significantly less likely to participate if they had been treated with radiation therapy ($p = .093$) and had comorbidities ($p = .087$).

The eight significant or borderline significant correlates of ESAA participation were included in a logistic regression analysis. Medical and demographic variables with more than two categories were dichotomized as follows: age ($<60, \geq 60$), type of cancer (cervical/ovarian cancer, endometrial cancer), general health (excellent/very good, good and fair/poor), and BMI (healthy weight, overweight and obese). The logistic regression was significant [$\chi^2 = 39.85, p < .001$] and explained 12% of the variance in ESAA participation (Table 3). The results indicated that gynecologic cancer survivors were significantly more likely to participate in ESAs if they were meeting aerobic exercise guidelines (OR = 1.75 [95% CI: 1.02 to 2.99]) and were in better general health (OR = 1.71 [95% CI: 1.01 to 2.90]). Gynecologic cancer survivors were borderline significantly more likely to participate in ESAs if they had cervical or ovarian cancer (OR = 1.95 [95% CI: 0.97 to 3.93]), were

employed (OR = 1.71 [95% CI: 0.95 to 3.08]), and were healthy weight (OR = 1.58 [95% CI: 0.93 to 2.68]).

Correlates Of Extreme Sport/Adventure Activity Interest

Table 4 presents the demographic and behavioral correlates of interest in ESAAs in gynecologic cancer survivors. Gynecologic cancer survivors were borderline significantly more likely to be interested in ESAAs if they were younger ($p = .063$) and meeting strength exercise guidelines ($p = .060$). Table 5 presents the cancer and medical correlates of interest in ESAAs in gynecologic cancer survivors. Gynecologic cancer survivors were less likely to be interested in ESAAs if they had endometrial cancer ($p = .026$); and more likely to be interested in ESAAs if they had been treated with chemotherapy ($p = .043$) and had no comorbidities ($p = .055$).

The five significant or borderline significant predictors were included in the logistic regression analysis. Medical and demographic variables with more than 2 categories were dichotomized as follows: age ($<60, \geq 60$) and type of cancer (cervical/ovarian cancer, endometrial cancer). The logistic regression model including the significant and borderline significant variables was significant [$\chi^2 = 15.58, p = .008$] and explained 7% of the variance in ESAA interest (Table 6). The results indicated that gynecologic cancer survivors were borderline significantly more likely to be interested in ESAA participation if they had cervical or ovarian cancer (OR = 1.76 [95% CI: 0.94 to 3.27]) and were meeting the strength exercise guidelines (OR = 1.68 [95% CI: 0.95 to 2.98]).

4.4 DISCUSSION

The purpose of this study was to examine the demographic, medical and behavioral correlates of participation and interest in ESAAs in gynecologic cancer survivors. The univariate results of this study suggest that gynecologic cancer survivors were more likely to

participate in ESAs if they were younger, wealthier, employed, and meeting aerobic exercise guidelines; and less likely to participate in ESAs if they had endometrial cancer, were in poor/fair health, were overweight or obese, had been treated with radiation therapy, and had comorbidities. In multivariate analyses, gynecologic cancer survivors were more likely to participate in ESAs if they were meeting the aerobic exercise guidelines, were in better general health, had cervical or ovarian cancer, were employed, and were healthy weight. In terms of interest in ESAs, univariate analyses showed that gynecologic cancer survivors were more likely to be interested in ESAs if they were younger, meeting strength exercise guidelines, had been treated with chemotherapy, had no comorbidities, and had ovarian or cervical cancer. In multivariate analyses, gynecologic cancer survivors were more likely to be interested in ESAs if they had cervical or ovarian cancer and were meeting the strength exercise guidelines. No study to date has examined the correlates of ESAA participation or interest in any cancer survivor group.

In our view, these correlates of ESAA participation and interest can be organized into 2 higher order themes: (1) correlates relating to physical capability and (2) correlates relating to financial resources. The first theme (physical capability) is represented by correlates such as younger age, healthy body weight, no comorbidities, excellent general health, not having endometrial cancer, and currently exercising. Although these correlates are associated with traditional exercise participation such as walking [30], they may be particularly important for ESAs and for gynecologic cancer survivors. Many ESAs—such as white water rafting, rock climbing, mountain climbing, and dragon boat racing—require significant physical abilities including flexibility, balance, muscular strength, and cardiovascular fitness that could be major barriers to participation. Moreover, many of these physical abilities are

compromised in gynecologic cancer survivors because they are often older women who have received extensive medical treatments [31]. Nevertheless, there are several possibilities for addressing these barriers to increase the number of gynecologic cancer survivors who may be interested and able to participate in ESSAs.

First, it is important to educate gynecologic cancer survivors about the varying degrees of difficulty of different types of ESAs. While gynecologic cancer survivors may perceive ESAs to be physically demanding and highly technical, programs are often designed to provide progressive ESA opportunities for individuals with functional limitations. It may be beneficial to inform gynecologic cancer survivors that ESAs are modifiable and can be delivered to individuals of all ages and abilities. For example, in downhill skiing, participants can progress from beginner (ie, a green run that has very easy and gentle terrain) to expert terrain (ie, a black diamond that has a difficult slope) over time [32]. Similarly, in wall climbing [33] and mountaineering [34] participants are able to choose their route/course from a range of difficulty levels. Second, there is the possibility of improving the physical abilities of gynecologic cancer survivors prior to participating in ESAs. For example, gynecologic cancer survivors could participate in aerobic and strength exercise training programs as a means of improving their physical and functional abilities prior to engaging in ESAs. Taking the physical and functional abilities of gynecologic cancer survivors into account when determining ESA programming options may lead to increased rates of participation and interest.

The second theme identified was the “financial resources” to participate in ESAs. In our sample, gynecologic cancer survivors who were wealthier and employed were more likely to participate in ESA, which is true for ESA participation in the general population [35].

To participate in some ESAs requires a significant amount of money and access to specialized environments or equipment, potentially deterring individuals with limited financial resources [35]. It may be effective to encourage participation in ESAs that are less costly such as hiking and long distance running or encourage group based ESA interventions or programming in lieu of individual based activities. Moreover, if the benefits of ESAs can be established in cancer survivors it may be advantageous to consider having cancer centers and cancer support groups subsidize or cover the costs of ESA interventions or programming through philanthropy or other fundraising. By taking the financial implications into account when determining ESA programming options, it may lead to increased interest and participation by gynecologic cancer survivors.

The present study has a number of strengths and limitations. To our knowledge, this is the first study to examine the correlates of ESA participation and interest in any cancer survivor group. Other strengths of this study include a broad range of demographic, medical, and behavioral variables and the large population based sample of gynecologic cancer survivors stratified by cancer type. Our study was limited by the cross-sectional design which precludes inferences about causality, the modest response rate which limits the generalizability, the researcher-developed measure of ESA participation and interest, and the lack of a theoretical model to understand ESA participation. Despite these limitations, this study provides useful data to assist in the development of future research studies and, ultimately, ESA intervention programs for gynecologic and other cancer survivors.

The lack of a theoretical model in our study is a particularly important limitation because it may be useful for understanding ESA behaviour and informing interventions to promote ESA participation. For instance, the Theory of Planned Behavior may be a

particularly relevant framework for understanding ESAA behaviour [36]. Moreover, randomized controlled trials of ESAs in gynecologic cancer survivors are needed to evaluate the safety and efficacy of ESAA participation as a strategy to increase physical activity and improve physical and psychological health in gynecologic cancer survivors. Building on this literature could assist clinicians in making recommendations on ESAA participation in gynecologic cancer survivors.

In conclusion, this study examined the demographic, medical, and behavioral correlates of ESAA participation in gynecologic cancer survivors. Our study reports a low rate of participation in ESAs by gynecologic cancer survivors but a fairly strong interest in ESAA participation. Moreover, our study identified 2 higher order themes of correlates of ESAs in gynecologic cancer survivors: physical capability and financial resources. Our study provides the first contribution to the evidence base on the correlates of ESAA participation and interest in cancer survivors. Future research should examine a broader range of correlates (eg, medical, demographic, behavioral, social cognitive, environment) that are associated with each individual type of ESAA in a variety of cancer survivor groups.

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Table 4-1 Demographic and Behavioral Correlates of Extreme Sport/Adventure Activity Participation in the Past Year in Gynecologic Cancer Survivors in Alberta, Canada, July-November, 2013 (N=621).

Demographic/Behavioral Variables	Extreme/Adventure Participation (12.1%)	No Extreme/Adventure Participation (87.9%)	p(χ^2)
Age			
<50 (n=105)	20 (19.0%)	85 (81.0%)	
50-59 (n=160)	28 (17.5%)	132 (82.5%)	
60-69 (n=211)	15 (7.1%)	196 (92.9%)	
≥70 (n=145)	12 (8.3%)	133 (91.7%)	< .001
Marital status			
Not married (n=177)	25 (14.1%)	152 (85.9%)	
Married/common law (n=444)	50 (11.3%)	394 (88.7%)	.32
Education			
Did not complete university/college (n=327)	34 (10.4%)	293 (89.6%)	
Completed university/college (n=294)	41 (13.9%)	253 (86.1%)	.18
Annual Family Income			
<40, 000 (n=141)	8 (5.7%)	133 (94.3%)	
40,000-79,999 (n=168)	15 (8.9%)	153 (91.1%)	
≥80,000 (n=206)	44 (21.4%)	162 (78.6%)	< .001
Employment status			
Not employed (n=356)	28 (7.9%)	328 (92.1%)	
Employed full-/part-time (n=265)	47 (17.7%)	218 (82.3%)	< .001
Ethnicity			
White (n=549)	66 (12.0%)	483 (88.0%)	
Other (n=72)	9 (12.5%)	63 (87.5%)	.91
Aerobic exercise guidelines			
Not meeting guidelines (n=417)	37 (8.9%)	380 (91.1%)	
Meeting guidelines (n=204)	38 (18.6%)	166 (81.4%)	< .001
Strength exercise guidelines			
Not meeting guidelines (n=503)	56 (11.1%)	447 (88.9%)	
Meeting guidelines (n=118)	19 (16.1%)	99 (83.9%)	.14
<i>Note.</i> p(χ^2)=chi square			

Table 4- 2. Cancer and Medical Correlates of Extreme Sport/Adventure Activity Participation in the Past Year in Gynecologic Cancer Survivors in Alberta, Canada, July-November, 2013 (N=621).

Cancer/Medical Variables	Extreme/Adventure Participation (12.1%)	No Extreme/Adventure Participation (87.9%)	p(χ^2)
Months since diagnosis			
<60 (n=172)	19 (11.0%)	153 (89.0%)	
60-119 (n=191)	23 (12.0%)	168 (88.0%)	
≥ 120 (n=258)	33 (12.8%)	225 (87.2%)	.86
Type of gynecologic cancer			
Ovarian (n=250)	31 (12.4%)	291 (87.6%)	
Endometrial (n=170)	11 (6.5%)	159 (93.5%)	
Cervical (n=201)	33 (16.4%)	168 (83.6%)	.013
Radiation treatment			
No (n=437)	59 (13.5%)	378 (86.5%)	
Yes (n=184)	16 (8.7%)	168 (91.3%)	.093
Chemotherapy treatment			
No (n=397)	42 (10.6%)	355 (89.4%)	
Yes (n=224)	33 (14.7%)	191 (85.3%)	.13
Body mass index			
Healthy weight (n=221)	39 (17.6%)	182 (82.4%)	
Overweight (n=213)	17 (8.0%)	196 (92.0%)	
Obese (n=187)	19 (10.2%)	168 (89.8%)	.005
General health			
Excellent/very good (n=281)	45 (16.0%)	221 (83.1%)	
Good (n=235)	20 (8.5%)	215 (91.5)	
Fair/poor (n=105)	10 (9.5%)	95 (90.5%)	.023
Number of comorbidities			
0 (n=172)	27 (15.7%)	145 (84.3%)	
≥ 1 (n=449)	48 (10.7%)	401 (89.3%)	.087
<i>Note.</i> p(χ^2)=chi square			

Table 4-3. Logistic Regression Table for Participation in Extreme Sport/Adventure Activities from Demographic, Behavioral, and Medical Variables in Gynecologic Cancer Survivors in Alberta, Canada, July-November, 2013 (N=621).

Predictor	B	Wald χ^2	Odds Ratio	95% CI
Younger	.52	2.62	1.68	0.90 to 3.15
Employed	.54	3.19	1.71	0.95 to 3.08
Meeting aerobic exercise guidelines	.56	4.19	1.75	1.02 to 2.99
Had cervical or ovarian cancer	.67	3.48	1.95	0.97 to 3.93
Received radiation therapy	-.23	0.55	0.80	0.43 to 1.46
Healthy weight	.46	2.90	1.58	0.93 to 2.68
Better general health	.54	3.91	1.71	1.01 to 2.90
Comorbidities	.35	1.35	1.01	0.79 to 5.66

Table 4-4. Demographic and Behavioral Correlates of Interest in Extreme Sport/Adventure Activity as Part of a Study in Gynecologic Cancer Survivors in Alberta, Canada, July-November, 2013 (N=309).

Demographic/ Behavioral Variables	Extreme/Adventure Interest (41.1%)	No Extreme/Adventure Interest (58.9%)	p(χ^2)
Age			
<50 (n=62)	33 (53.2%)	29 (46.8%)	
50-59 (n=85)	36 (42.4%)	49 (57.6%)	
60-69 (n=101)	40 (39.6%)	61 (60.4%)	
≥ 70 (n=61)	18 (29.5%)	43 (70.5%)	.063
Marital status			
Not married (n=92)	39 (42.4%)	53 (57.6%)	
Married/common law (n=217)	88 (40.6%)	129 (59.4%)	.76
Education			
Did not complete university/college (n=152)	58 (38.2%)	94 (61.8%)	
Completed university/college (n=157)	69 (43.9%)	88 (56.1%)	.30
Annual Family Income			
<40,000 (n=64)	26 (40.6%)	38 (59.4%)	
40,000- 79,999 (n=80)	28 (35.0%)	52 (65.0%)	
$\geq 80,000$ (n=118)	57 (48.3%)	61 (51.7%)	.17
Employment status			
Not employed (n=165)	62 (37.6%)	103 (62.4%)	
Employed full-/part-time (n=144)	65 (45.1%)	79 (54.9%)	.18
Ethnicity			
White (n=276)	114 (41.3%)	162 (58.7%)	
Other (n=33)	13 (39.4%)	20 (60.6%)	.83
Aerobic exercise guidelines			
Not meeting guidelines (n=203)	78 (38.4%)	125 (61.6%)	
Meeting guidelines (n=106)	49 (46.2%)	57 (53.8%)	.19
Strength exercise guidelines			
Not meeting guidelines (n=247)	95 (38.5%)	152 (61.5%)	
Meeting guidelines (n=62)	32 (51.6%)	30 (48.4%)	.060

Note. p(χ^2)=chi square

Table 4-5. Cancer and Medical Correlates of Interest in Extreme Sport/Adventure Activity as Part of a Study in Gynecologic Cancer Survivors in Alberta, Canada, July-November, 2013 (N=309).

Cancer/Treatment Variables	Extreme/Adventure Interest (41.1%)	No Extreme/Adventure Interest (58.9%)	p(χ^2)
Months since diagnosis			
<60 (n=92)	36 (39.1%)	56 (60.9%)	
60-119 (n=92)	40 (43.5%)	52 (56.5%)	
≥120 (n=125)	51 (40.8%)	74(59.2%)	.89
Type of gynecologic cancer			
Ovarian (n=128)	58 (45.3%)	70 (54.7%)	
Endometrial (n=70)	19 (27.1%)	51 (72.9%)	
Cervical (n=111)	50 (45.0%)	61 (55.0%)	.026
Radiation treatment			
No (n=226)	98 (43.4%)	128 (56.6%)	
Yes (n=83)	29(34.9%)	54 (65.1%)	.18
Chemotherapy treatment			
No (n=198)	73 (36.9%)	125 (63.1%)	
Yes (n=111)	54 (48.6%)	57 (51.4%)	.043
Body mass index			
Healthy weight (n=123)	57 (46.3%)	66 (53.7%)	
Overweight (n=101)	38 (37.6%)	63 (62.4%)	
Obese (n=85)	32 (37.6%)	53 (62.4%)	.31
General health			
Excellent/very good (n=140)	60 (42.9%)	80 (57.1%)	
Good (n=116)	49 (42.2%)	67(57.8%)	
Fair/poor (n=53)	18 (34.0%)	35 (66.0%)	.51
Number of comorbidities			
0 (n=98)	48 (49.0%)	50 (51.0)	
≥1 (n=211)	79 (37.4%)	132 (62.6%)	.055

Note. $p(\chi^2)$ =chi square

Table 4- 6. Logistic Regression Table for Interest in Extreme Sport/Adventure Activities from Demographic, Behavioral, and Medical Variables in Gynecologic Cancer Survivors in Alberta, Canada, July-November, 2013 (N=309).

Predictor	B	Wald χ^2	Odds Ratio	95% CI
Younger	.29	1.26	1.34	0.80 to 2.24
Meeting strength exercise guidelines	.52	3.16	1.68	0.95 to 2.98
Had cervical or ovarian cancer	.56	3.14	1.76	0.94 to 3.27
Received chemotherapy	.31	1.51	1.37	0.83 to 2.25
Comorbidities	-.25	0.83	0.78	0.45 to 1.34

CHAPTER 5 -Study 2-Paper 1

Feasibility and preliminary efficacy of an 8-week supervised wall climbing intervention in gynecologic cancer survivors: A pilot randomized controlled trial

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5.1 INTRODUCTION

Gynecologic cancers are the 4th most common cancer in women with approximately 10,000 new cases diagnosed per year and over 100,000 survivors in Canada (Canadian Cancer Society, 2015). Gynecologic cancer survivors (GCS) experience negative physical and psychological side effects following diagnosis and treatment such as psychological distress, fatigue, menopausal symptoms, sexual dysfunction, pain, cognitive dysfunction, and sleep disturbances (Grover et al., 2012; Salani, 2013). Moreover, GCS have lower physical fitness than matched controls based on a cross-sectional comparison using the Cooper Center Longitudinal Study database (Peel et al., 2015). Systematic reviews and meta-analyses have confirmed the importance of physical activity for the physical and psychological health benefits of cancer survivors (Courneya & Friedenreich, 2007; Fong et al., 2012; Mishra et al., 2015) but few studies have focused on GCS (Peel et al., 2015).

Similar to physical activity interventions in other cancer survivors, most physical activity interventions in GCS have focused on walking (Peel et al., 2015), likely because it is the most feasible and safe activity for older adults. Walking has demonstrated health benefits in many groups; however, it does not improve upper body muscular strength or flexibility, does not usually engage the mind, is not novel, is not physically challenging for most healthy adults, and does not result in a heightened emotional state (e.g., arousal, fear). Consequently, walking may be less likely to improve outcomes important to GCS such as cognitive dysfunction, peripheral neuropathy, fatigue, psychosocial distress, and posttraumatic growth (Salani, 2013).

Therapeutic wall climbing is a newer rehabilitation approach adapted from rock climbing where artificial indoor climbing walls are used to mimic rock climbing in a controlled environment (Buechter & Fechtelpeter, 2011). Therapeutic wall climbing is becoming increasingly popular in rehabilitation settings and has been shown to have physical and psychological benefits in various clinical populations including geriatric patients (Fleissner et al., 2010), patients with multiple sclerosis (Velikonja, Curic, Ozura, & Jazbec, 2010), chronic low-back pain (Engbert & Weber, 2011; Kim & Seo, 2015), children with disabilities (Böhm, Rammelmayer, & Döderlein, 2015), and adults diagnosed with depression (Luttenberger et al., 2015). These studies are limited, however, by small sample sizes and rarely report recruitment rates, adherence rates, descriptions of the contents of the

intervention, the setting, and by whom and how the intervention was delivered. Moreover, no studies to date have examined therapeutic wall climbing in any cancer survivor group.

The primary purpose of the Gynecologic Cancer Survivors Wall Climbing for Total Health (GROWTH) trial was to assess the feasibility and preliminary efficacy of an 8-week supervised wall climbing intervention (WCI) in improving physical functioning, quality of life, psychosocial outcomes, and symptom management in GCS. Here, we report the feasibility and physical functioning outcomes. Feasibility was assessed by evaluating the recruitment rate, adherence rate, skill performance, and safety of the intervention. Preliminary efficacy was assessed by evaluating the changes in objective health-related and functional fitness outcomes. We hypothesized that adherence to the WCI would be high (>70%), the majority of GCS would become proficient at most climbing skills (>70%), and there would be no serious adverse events. Moreover, we hypothesized that the completion of the 8-week WCI would result in greater improvements in objective health-related and functional fitness parameters compared to usual care (UC).

5.2 METHODS

Setting and Participants

The GROWTH Trial was conducted at the University of Alberta in Edmonton, Alberta, Canada from June 2015-November 2015. The study received ethics approval from the Health Research Ethics Board of Alberta Cancer Committee and the Health Research Ethics Board at the University of Alberta. All participants provided informed consent prior to participating in this study. Inclusion criteria included (a) histologically confirmed diagnosis of cervical, endometrial or ovarian cancer that was cured or in remission, (b) between 18 to 70 years of age, (c) living in Edmonton or surrounding area, and (d) willing to attend the supervised WCI. Exclusion criteria included (a) any absolute contraindication to exercise testing or participating in the WCI, (b) any uncontrolled medical condition or psychiatric illness that would prevent completion of the WCI or interfere with the study assessments, (c) not cleared to participate in exercise as determined by Physical Activity Readiness Questionnaire Plus (PAR-Q+) or Physical Activity Readiness Examination form (PARmed-X), and (d) unable to understand and provide informed consent in English.

Design and Procedures

The study was a pilot randomized controlled trial with assessments completed before and after an 8-week supervised WCI. Participants were recruited in two ways: (a) from a previous survey in which they expressed interest in future research (Crawford, Holt, Valiance, & Courneya, 2015) or (b) from the Alberta Cancer Registry using a mailed invitation. Participants were instructed to contact the research coordinator if they were interested in participating in this study. All individuals that were interested in participating were screened and scheduled for their baseline assessment if eligible.

Randomization and Blinding

The wall climbing program was offered in a group-based format on set days and times and could accommodate up to 6 participants per group. There were 4 classes (days and times) available and prospective participants were asked to indicate their required or preferred class schedule at the time of recruitment. To facilitate intervention delivery, participants were stratified by their required/preferred class schedule before being randomized to the WCI or UC. To fill the necessary class size of 6 participants, the randomization within each strata was blocked so that 6 participants were randomized to the WCI regardless of the total strata size available for that schedule. For example, nine women preferred to climb on Tuesday and Friday from 4:00-6:00pm, therefore, the block randomization was set so that six participants were randomized to the supervised WCI and three were randomized to UC. This process was repeated for all 4 stratas (classes). A research assistant, not otherwise involved in the trial, generated the randomization sequence. Participants were randomized following baseline measurements using a computer-generated allocation sequence. Outcome assessors (i.e., fitness testers and wall climbing instructors) were not blinded to group allocation; however, assessors were trained on the importance of following standardized assessment procedures and intervention delivery to enhance intervention fidelity.

Wall Climbing Intervention

The 8-week intervention took place at the Wilson Climbing Center located on the University of Alberta campus. The Wilson Climbing Center contains several versatile, modular climbing structures with climbing routes to a maximum of 48 feet (Figure 1a and 1b). The standardized intervention consisted of twice-weekly, two-hour wall climbing sessions designed to provide a comprehensive introduction to wall climbing. All wall climbing sessions were delivered in the same order and with the same content. In these

classes, participants learned basic safety considerations, essential movement skills, rope management techniques, communication and terminology, bouldering and top rope climbing strategies, how to safely fall, and other essential instructions. The WCI was individualized based on baseline fitness assessments immediately prior to beginning the WCI. The rate of progression was adjusted based on the individual's response to the WCI by varying the difficulty of the route, the time set to complete the route, or the height to be achieved while climbing. All wall climbing sessions were supervised by certified wall climbing staff and a certified personal trainer. Table 1 outlines the order and content of the 8-week supervised WCI. Participants in the WCI group were instructed to continue their previous physical activity routine as normal during the 8-week intervention period.

Usual Care

Participants assigned to UC were asked not to participate in any WCI during the 8-week intervention period and were informed they would receive 4 supervised wall climbing sessions after the post intervention assessments. Participants in the UC group were instructed to continue their previous physical activity routine as normal during the 8-week intervention period.

Demographic, Behavioural, and Medical Characteristics

Demographic and behavioural variables were assessed by self-report and included age, marital status, education, annual family income, employment status, ethnicity, height and weight to calculate body mass index (BMI; $\text{kg}\times\text{m}^{-2}$), and drinking and smoking status. Medical variables were also assessed by self-report and included date of diagnosis, type of cancer, disease stage, treatment type, recurrence, general health, and comorbidities. Baseline aerobic exercise was assessed by using a modified version of the Leisure Score Index from the Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1997). Strength exercise was measured using items developed from a previous survey in colorectal cancer survivors (Speed-Andrews et al., 2013). These items have previously been used in a study of exercise in GCS (Crawford, Vallance, Holt, & Courneya, 2015). We calculated the percentage of participants meeting the 2008 Physical Activity Guidelines for Americans (United States Department of Health and Human Services, 2008) which have been endorsed for gynecologic cancer survivors by the American Cancer Society (Doyle et al., 2006) and the American College of Sports Medicine (Schmitz et al., 2010)

Feasibility Outcomes

Eligibility rate was determined by dividing the number of GCS considered to be eligible for the study by the number who met the inclusion criteria. Recruitment rate was calculated by dividing the number of GCS randomized in the study from those considered eligible. Adherence was measured by the total number of wall climbing sessions attended (out of 16). Skill assessments examined the proficiency of essential movement skills, use of safety commands and belaying, and top rope ascents of varying difficulties. Essential movement skills included spotting (i.e., assisting a climber control a fall by directing to a safe landing spot), straight arms (i.e., climbing with straight arms and bent legs), balanced triangle (i.e., flagging or stretching out a leg to act as either a counter balance, or as a third point of contact when moving to a new holds), push with legs (i.e., extending both legs at the same time in order to reach handholds which are higher), smearing (pressing the sole of the climbing shoe directly on the wall and using friction to gain vertical ground), back step (i.e., rolling the hip inwards towards the wall and placing a foot behind the body), hip lock (i.e., rotating hips from a frontal to a sideways position and bringing the hip closer to the wall) and sit-start (i.e., beginning a climb while sitting on the ground). Participants completed the climbing skills assessment at 2 weeks, 4 weeks, 6 weeks, and 8 weeks and were assessed by the certified wall climbing instructor on a 5-point scale from 1 (unable) to 5 (exemplary). Strategies for achieving standardization across multiple skills assessors included training for skills assessment delivery in which (a) the philosophy and goals of the wall climbing skills assessment were discussed, (b) objectives and procedures of the wall climbing skills assessment were covered in details, and (c) all outcome assessors had the opportunity to practice the necessary skills needed for delivering the wall climbing skills assessment. The safety of study assessments and wall climbing were tracked throughout the study by the wall climbing instructors and personal trainers who attended all wall climbing sessions.

Health-Related and Functional Fitness Outcomes

Functional fitness was assessed by the Seniors' Fitness Test (Rikli & Jones, 1999). The validity and reliability of the Seniors' Fitness Test battery have been well established in a variety of populations (Rikli & Jones, 2013). The Senior Fitness Test consists of a sequence of six items that measure basic mobility-related parameters associated with functional abilities in the everyday living of older adults (Jones & Rikli, 2002; Rikli & Jones, 1999). The

30-second chair stand test examined lower body strength. The arm curl test examined upper body strength. The chair sit-and-reach test examined lower body flexibility. The back scratch test examined upper body flexibility. The 8-foot up-and-go test examined agility and dynamic balance. Lastly, the 6-minute walk test examined aerobic endurance.

In addition, muscular strength (kg) was assessed using a Jamar hydraulic hand dynamometer to examine hand and forearm strength (American College of Sports Medicine, 2013). Body composition was examined by height, weight, and waist circumference measurements (American College of Sports Medicine, 2013). Standing height (cm) was measured using a stadiometer (North Bend, WA), body mass (kg) was measured on a Heath Carter balance beam scale and waist circumference (cm) was determined using the National Institutes of Health protocol (Gledhill & Jamnik, 2003).

Statistical Analysis

This pilot study was designed to estimate the recruitment rate, adherence rate, and preliminary effect sizes for efficacy outcomes to inform larger phase II and III trials. Consequently, an a priori sample size calculation was not performed. For all efficacy analyses, the intention-to-treat principle was used to include all participants in their randomized condition regardless of adherence and who provided 8-week data. Paired t-tests were undertaken to examine the change in the outcome of interest between baseline and post intervention assessments. Analyses of covariance (ANCOVAs) were performed to compare the WCI and UC groups at post intervention on outcomes of interest with adjustments for baseline value of the outcome, age, months since diagnosis, and type of gynecologic cancer. As this was a pilot study with a small sample size, health-related and functional fitness outcome results were interpreted for statistical trends as well as for potential clinical significance. A statistical trend was defined as a two-tailed $\alpha < 0.10$ and clinical significance was defined as a minimum standardized effect size of $d \geq 0.33$. All statistical analyses were conducted using SPSS 23 (SPSS, Chicago, IL, USA).

5.4 RESULTS

Feasibility Outcomes

Figure 2 reports the participant flow through the study. Of the 512 GCS contacted by mail to take part in the study, 13 recruitment packages were returned due to wrong address (n=11) and deceased (n=2). Of the remaining 499, the most common reasons for not

participating were no response (n=419), contacted research coordinator to decline participation (n=16), medical contraindication (n=12), and a planned absence > 2 weeks (n=17). In total, 35 of the 470 eligible GCS were randomized (7%). Of the 24 participants randomized to the supervised wall climbing arm, the median attendance was 13.5 of the 16 sessions (range 1-16 sessions), representing an 84% adherence rate. The most common reasons for a missed supervised wall climbing session were previous work commitment, unable to find childcare, illness and vacation. No serious adverse events were experienced during the supervised wall climbing sessions. One adverse event was observed when a participant fell off a wall while top rope climbing and scratched her leg. The participant did not require medical care and continued with the intervention.

Sample Characteristics and Representativeness

The baseline demographic and medical profiles of the participants are reported in Table 2. Overall, participants had a mean age of 53.0 ± 11.9 , 57.1% were married, 62.9% were employed, and the mean BMI was $26.5 \pm 5.0 \text{ kg/m}^2$. The mean number of months since diagnosis was 63.9 ± 71.2 , 28.6% had cervical cancer, 40.0% had endometrial cancer, 31.4% had ovarian cancer, and 97.1% had received surgery. Overall, 51.4% were meeting public health aerobic exercise guidelines and 22.9% were meeting public health strength exercise guidelines. None reported previous experience with wall climbing.

Wall Climbing Skills Assessment

Descriptive results of the wall climbing skills assessments are summarized in Table 4. For assessment # 1 (week 2), over 75% of participants were proficient at spotting (95.2%), balanced triangle (85.7%), and hip lock (76.2%) while bouldering. For assessment #2 (week 4), over 75% of participants were proficient at tying knots (90.5%), putting the harness on correctly (100%), belaying (100%), communicating with their fellow climber (95.2%), and performing the required safety checks (100%). For assessment #3 (week 6), over 75% of participants were proficient at use of legs (100%), application of movement skills (82.4%), demonstrating safety checks and commands (100%), and overall quality of belay (100%) while ascending a top rope route of 5.6-5.8. Lastly, for assessment #4 (week 8), over 75% of participants were proficient at use of legs (80%), applying movement skills (80%), demonstrating safety checks and commands (100%), and overall quality of belay (93.3%) while ascending a 5.9 top rope route.

Health-Related and Functional Fitness Outcomes

Table 3 provides the change in objective measures of fitness from baseline to post intervention for the WCI group versus UC. A statistically significant large effect favoring the WCI group was noted for the 30-second chair stand ($p < 0.001$) and 30-second arm curl ($p < 0.001$). A statistically significant medium effect size favoring the WCI group was noted for the 6-minute walk ($p < 0.001$), 8-foot up & go ($p = 0.039$), grip strength-right ($p = 0.013$), and grip strength-left ($p = 0.024$). A statistically significant small effect favoring the WCI group was noted in the sit and reach ($p = 0.016$).

5.5 DISCUSSION

To our knowledge, the GROWTH Trial is the first study to assess the feasibility and preliminary efficacy of a WCI in cancer survivors. Overall, the GROWTH Trial demonstrated that a WCI in GCS is not only feasible and safe, but appears to produce substantial improvements in physical fitness. Moreover, many of the participants were older, obese, and had significant comorbidities suggesting that a WCI may be feasible for more than just young, slim, and healthy GCS. Although the recruitment rate was low, the adherence rate was excellent and participants were able to perform most wall climbing skills in a safe and proficient manner. Perhaps most importantly, the large changes in physical fitness may portend improvements in other outcomes important to GCS including symptom management, quality of life, and overall survival.

The recruitment rate of 7% is low but it is comparable to previous physical activity interventions in other cancer survivor groups (Norris, Bell, & Courneya, 2015). Unfortunately, no previous therapeutic WCI studies have reported on the eligibility or recruitment rate so it is unclear if our recruitment rate for a WCI in cancer survivors is worse or better than for other patient populations (Böhm et al., 2015; Engbert & Weber, 2011; Fleissner et al., 2010; Kim & Seo, 2015; Luttenberger et al., 2015). Moreover, it is unclear how many of the 419 non-responders in our study might have been ineligible for the study, thereby potentially further increasing the recruitment rate. Finally, wall climbing is an experimental intervention which has never been tested before in cancer survivors. If results show that wall climbing is safe, feasible, and improves outcomes important to GCS, it may be promoted by cancer centers and the recruitment rate and clinical uptake from GCS may increase substantially. Nevertheless, it must be acknowledged that rural towns and smaller

cities are unlikely to have a climbing wall or certified instructors to deliver such an intervention. While the majority of Canadian cancer survivors reside in an urban area, approximately 20% of the population is considered rural (Statistics Canada, 2011). Ultimately, cancer survivors should be offered an array of physical activity options that cater to their interests, including adventure-based options such as wall climbing.

The GROWTH Trial achieved an excellent median adherence rate of 84% to the WCI. Once again, however, no previous WCI studies have reported the adherence rate so comparisons are not possible. Nevertheless, the adherence rate to the WCI is similar to adherence rates reported for other physical activity interventions among GCS. For example, Von Gruenigen et al. (von Gruenigen et al., 2012) reported an 84% adherence rate to an exercise and healthy diet intervention in endometrial cancer survivors. Kavanagh et al. (Kavanagh et al., 2009) reported a slightly lower adherence rate of 76% to nutrition/physical activity intervention in overweight/obese endometrial cancer survivors. One of the challenges in optimizing adherence to group-based WCIs is the inability to make-up missed sessions. Moreover, two of the primary reasons for missed climbing sessions in our study were lack of childcare and vacation. These barriers are not unexpected due to the mean age of the patient group under study and the time of year the intervention was conducted (summer). Offering childcare, make-up sessions, and interventions during other seasons may improve adherence to WCIs in GCS.

Despite being older, obese women with significant comorbidities and no experience in wall climbing, most GCS were able to improve essential movement skills over the 8 week WCI. Participants were highly proficient at utilizing safety commands and belaying. As might be expected, as the difficulty of the route increased, the quality of the ascent and application of the essential movement skills decreased. Nevertheless, the majority of GCS were proficient at the majority of skills. Future research may wish to examine the frequency of climbing sessions or the length of the WCI as it is likely that participant skills would continue to improve with increasing fitness and practice time.

No serious adverse events related to wall climbing were observed or reported. One adverse event occurred when one participant fell off of the wall and scratched her leg but she did not require medical attention and continued with the intervention. A recent study determined that the incidence of climbing associated injuries was 0.2 injuries per 1,000 hours

of outdoor rock climbing (Neuhof, Hennig, Schoffl, & Schoffl, 2011). The fact that our intervention was closely supervised by highly trained climbing staff in a highly controlled environment may have further reduced the risk of injuries and adverse events.

Consistent with our hypotheses, we found significant differences in favor of the WCI group for a number of objective health-related and functional fitness parameters. Specifically, the WCI group achieved a significant increase of 51 meters in the 6-minute walk compared to those in UC. Research in a number of patient populations indicates that a change in the 6-minute walk of between 43 and 54 meters is clinically meaningful (Perera, Mody, Woodman, & Studenski, 2006; Redelmeier, Bayoumi, Goldstein, & Guyatt, 1997), although no clinically meaningful change has been identified for cancer survivors. Climbing uses anaerobic and aerobic energy systems leading to positive adaptations in aerobic fitness (Rodio, Fattorini, Rosponi, Quattrini, & Marchetti, 2008; Watts, 2004). Moreover, Rodio et al. (Rodio et al., 2008) found that the intensity of climbing is similar to that recommended by the American College of Sports Medicine to sustain good cardiorespiratory fitness, suggesting that climbing may be an effective training modality for cancer survivors. Future research is warranted to confirm these results with heart rate monitoring during climbing and using a maximal cardiorespiratory fitness test. Moreover, based on research in other chronic disease populations (Boxer et al., 2010; Pinto-Plata, Cote, Cabral, Taylor, & Celli, 2004), the 6-minute walk may be a prognostic indicator of survival and other disease outcomes. Therefore, wall climbing may be an effective type of physical activity for cancer survivors based on these valuable health benefits.

Muscular strength improved significantly in the 30-second chair stands, 30-second arm curls, and grip strength favoring the supervised WCI group. No other studies to date have examined the effects of wall climbing on muscular strength in any cancer survivor group. Partly in line with the present study, Jolk et al. (Jolk, Dalgas, Osada, Platen, & Marziniak, 2015) suggested that climbing may be an effective resistance training modality resulting in significant improvement in leg strength performance in patients with multiple sclerosis in a descriptive 5-week interventional climbing study. Similarly, other studies have reported improvements in grip strength, upper limb strength, and endurance induced from climbing compared with no climbing in novice climbers (Lopera, Porcari, Steffen, Doberstein, & Foster, 2007; Rodio et al., 2008; Watts, 2004). Resistance training has been shown to improve

muscular strength, lean body mass, physical functioning, fatigue and quality of life (Strasser, Steindorf, Wiskemann, & Ulrich, 2013) and may be linked to improved long term survival in cancer survivors (Hardee et al., 2014). Wall climbing improved muscular strength in GCS through the movement of body weight vertically and horizontally. While few women do regular strength training in a gym environment, wall climbing may be a safe, novel, and effective form of functional resistance training where women may reap similar benefits.

Our feasibility trial should be interpreted within the context of its important strengths and limitations. To our knowledge, it is the first study to assess a WCI in any cancer survivor group and one of the few in any patient population. Moreover, we closely tracked the recruitment rate, adherence rate, and all reasons for missed climbing sessions. Lastly, we used a randomized controlled trial design, state of the art climbing wall, and reliable and validated measures to examine objective health-related and functional fitness parameters. Limitations include the low recruitment rate which may limit generalizability, small sample size, no long term follow-up, and the failure to blind outcome assessors.

Based on compelling evidence, the American College of Sports Medicine (Schmitz et al., 2010) and the American Cancer Society (Rock et al., 2012) recommend that GCS perform 150 minutes/week of moderate intensity aerobic exercise and 2-3 days per week of resistance training. Our pilot data suggest that wall climbing may be a novel intervention that can substantially improve both cardiovascular fitness and muscular strength in GCS. Larger phase II and III trials are needed to confirm and extend these findings to outcomes important to GCS such as symptom management, quality of life, psychosocial functioning, and overall survival. If improved outcomes are demonstrated in larger trials, these types of wall climbing programs may be offered by cancer centers, cancer supports groups, and other cancer organizations in Canada and beyond.

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Figure Captions

Figure **5-1**. The bouldering wall (A) and top roping wall (B) in the Wilson Climbing Center at the University of Alberta, Edmonton, Canada.

Figure **5-2**. Flow of participants through the study.



1A)



1B)

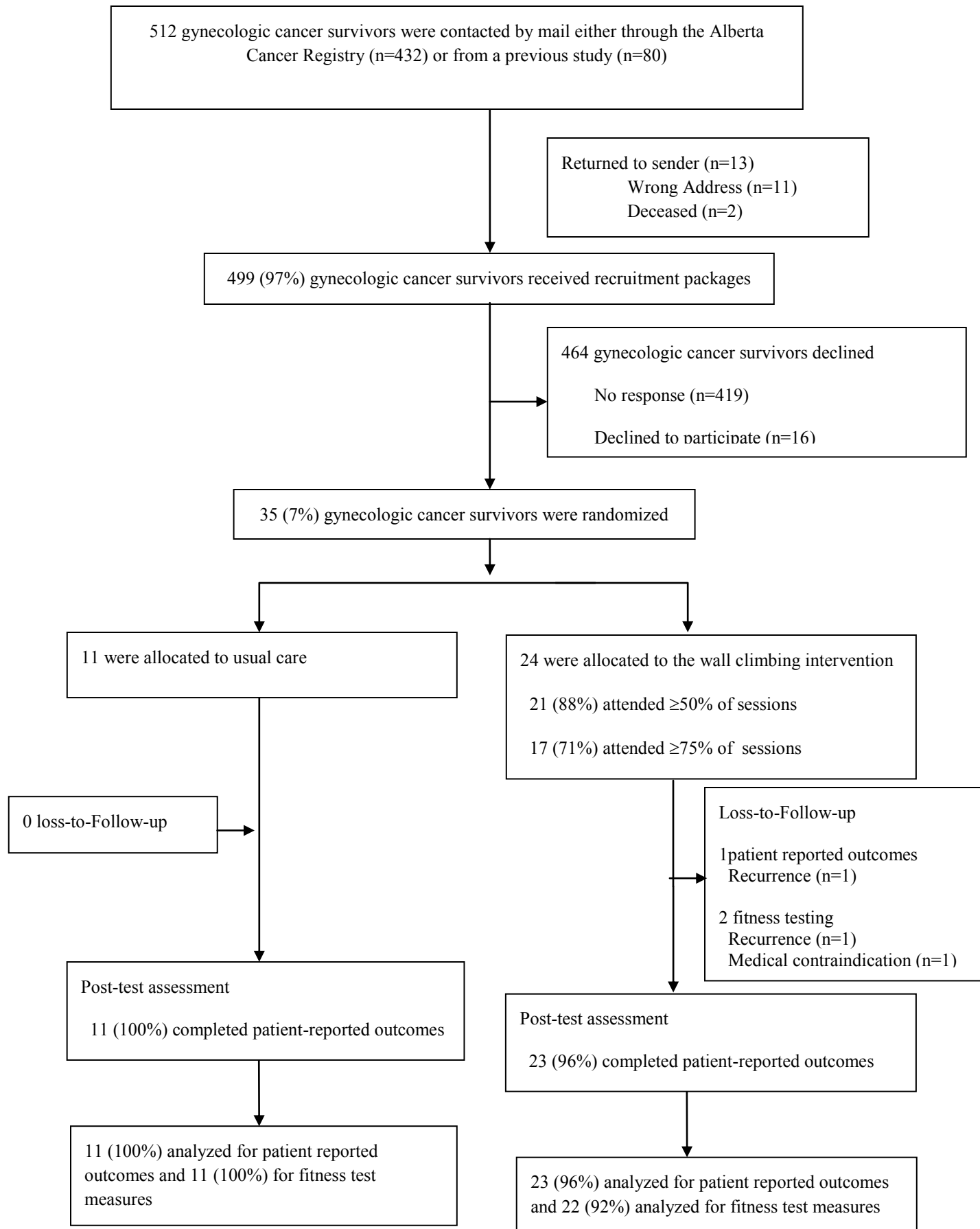


Table 5-1. Order and content of wall climbing sessions in the GROWTH Trial.		
Week	Sessions	Wall Climbing Session Topic
1	1 & 2	Facility Orientation ¹ Equipment Orientation Introduction to essential movement skills Introduction to bouldering Introduction to top roping
2	3 & 4	Assessment #1: Proficiency of essential movement skills while bouldering Review of essential movement skills on bouldering and top rope climbing walls Introduction to belaying
3	5 & 6	Bouldering skill development Top roping skill development Belaying review
4	7 & 8	Assessment # 2: Belaying technique Bouldering skill development (more challenging routes) Top roping skill development (more challenging routes)
5	9 & 10	Bouldering skill development (more challenging routes) Top roping skill development(more challenging routes)
6	11 & 12	Assessment #3: Top rope climbing (ascent of a 5.6-5.8 top rope route) Bouldering skill development (more challenging routes) Top roping skill development(more challenging routes)
7	13 & 14	Bouldering skill development (more challenging routes) Top roping skill development(more challenging routes)
8	15 & 16	Assessment #4: Top rope climbing (ascent of a 5.9 top rope route) Rappelling Bouldering skill development (more challenging routes) Top roping skill development(more challenging routes)
Note: ¹ All climbing sessions begin with a warm-up and dynamic stretch. All climbing sessions end with strength, conditioning, and stretch.		

Table 5-2. Baseline characteristics of gynecologic cancer survivors overall and by group assignment in the GROWTH Trial.			
Variable	Overall (N=35)	Wall Climbing (n=24)	Usual Care (n=11)
Age, mean±SD, y,	53.0±11.9	52.5±12.7	54.1±10.5
<50	11 (31.4)	8 (33.3)	3 (27.3)
≥50	24 (68.6)	16 (66.7)	8 (72.7)
Marital status			
Married/common law	20 (57.1)	14 (58.3)	6 (54.5)
Not Married	15 (42.9)	10 (41.7)	5 (45.5)
Education			
Completed university/college	12 (34.3)	14 (58.3)	9 (81.8)
Did not complete university/college	23 (65.7)	10 (41.7)	2 (18.2)
Annual family income			
<\$100,000	21 (60)	14 (58.3)	4 (63.7)
≥100 000	11 (31.4)	8 (33.3)	3 (27.3)
Missing data	3 (8.6)	2 (8.3)	1 (9.1)
Employment status			
Employed full/part-time	22 (62.9)	16 (66.7)	6 (54.5)
Not employed	13 (37.1)	8 (33.3)	5 (45.5)
Ethnicity			
White	32 (91.4)	22 (91.7)	10 (90.9)
Other	3 (8.6)	2 (8.3)	1 (9.1)
Body mass index, mean±SD, kg/m ²	26.5±5.0	26.1±5.1	27.3±5.0
Healthy weight	17 (48.6)	14 (58.3)	3 (27.3)
Overweight	8 (22.9)	3 (12.5)	5 (45.5)
Obese	10 (28.6)	7 (29.2)	3 (27.3)
% Smoker	4 (11.4)	4 (16.7)	0 (0)
% Meeting aerobic guidelines	18 (51.4)	12 (50)	6 (54.5)
% Meeting strength guidelines	8 (22.9)	4 (16.7)	4 (36.4)
Months since diagnosis, mean±SD	63.9±71.2	53.1±69.4	87.45±72.7
<24	19 (54.3)	16 (66.7)	3 (27.3)
≥24	16 (45.7)	8 (33.3)	8 (72.7)

Type of gynecologic cancer			
Cervical	10 (28.6)	8 (33.3)	2 (18.2)
Endometrial	14 (40.0)	10 (41.7)	4 (36.4)
Ovarian	11 (31.4)	6 (25.0)	5 (45.5)
Disease stage			
Localized	32 (91.4)	23 (95.8)	9 (81.8)
Metastatic	3 (8.6)	1 (4.2)	2 (18.2)
Treatment, no. (%)			
Surgery	34 (97.1)	23 (95.8)	11 (100)
Radiation	4 (11.4)	3 (12.5)	1 (9.1)
Chemotherapy	12 (34.3)	5 (20.8)	7 (63.6)
Recurrence			
No	33 (94.3)	23 (95.8)	10 (90.9)
Yes	2 (5.7)	1 (4.2)	1 (9.1)
General health rating			
Excellent/Very good	22 (62.9)	14 (58.3)	8 (72.7)
Good	11 (31.4)	8 (33.3)	3 (27.3)
Fair/Poor	2 (5.7)	2 (8.3)	0 (0)
Number of comorbidities			
0	14 (42.9)	10 (41.7)	5 (45.5)
≥1	20 (57.1)	14 (58.3)	6 (54.5)
Most common comorbidities			
Arthritis	15 (42.9)	10 (41.7)	5 (45.5)
Other cancer	8 (22.9)	5 (20.8)	3 (27.3)
High cholesterol	7 (20.0)	4 (16.7)	3 (27.3)
High blood pressure	5 (14.3)	2 (8.3)	3 (27.3)

Table 5-3. Wall climbing skills assessment in gynecologic cancer survivors.		
	Mean (SD)	n (%) proficient
Assessment #1: Proficiency of essential movement skills while bouldering (n=21)		
Spotting	4.6 (0.6)	20 (95.2)
Straight arms	3.7 (1.0)	13 (62.9)
Balanced triangle	4.1 (0.7)	18 (85.7)
Push with legs	3.9 (0.8)	14 (66.7)
Smearing	3.9 (1.3)	15 (71.4)
Back-step	3.7 (0.8)	14 (66.7)
Hip lock	4.0 (1.2)	16 (76.2)
Sit-start	2.3 (1.6)	8 (38.1)
Assessment #2: Safety commands and belaying (n=21)		
Knots	4.5 (0.8)	19 (90.5)
Harness	5.0 (0.2)	21 (100)
Belay	4.7 (0.5)	21 (100)
Communication	4.9 (0.4)	20 (95.2)
Safety checks	5.0 (0.0)	21 (100)
Assessment #3: Top rope ascent on a 5.6-5.8 top rope route (n=17)		
Use of legs during ascent	4.7 (0.5)	17 (100)
Application of movement skills ¹	4.2 (0.8)	14 (82.4)
Difficulty of route	3.6 (0.9)	7 (41.2)
Overall quality of ascent	4.1 (1.2)	12 (70.6)
Demonstration of safety checks and commands before/while climbing	4.8 (0.4)	17 (100)
Quality of belay	4.8 (0.4)	17 (100)
Assessment #4: Top rope ascent on a 5.9 top rope route (n=15)		
Use of legs during ascent	4.3 (1.1)	12 (80.0)
Application of movement skills	3.9 (1.3)	12 (80.0)
Overall quality of ascent	3.5 (1.6)	8 (53.3)
Demonstration of safety checks and commands before/while climbing	4.8 (0.4)	15 (100)
Quality of belay	4.6 (0.6)	14 (93.3)
Note. ¹ Application of movement skills involved proficiently straight arms, back step, hip lock, balanced triangle.		

Table 5-4. Effects of wall climbing on health-related fitness outcomes in gynecologic cancer survivors.						
	Baseline	Post Intervention	Mean Change	Adjusted Between-Group Difference in Mean Change ^a		
Health-related Fitness Outcomes	Mean (SD)	Mean (SD)	Mean (95%CI)	Mean (95%CI)	P value	Cohen <i>d</i>
6-minute walk, m						
Wall climbing (n=22)	564 (70)	591 (60)	+28 (+11 to +45)	+51 (+26 to +77)	<0.001	+0.73
Usual care (n=11)	554 (72)	538 (77)	-16 (-34 to +1)			
30-second chair stands, n						
Wall climbing (n=22)	17 (4)	21 (5)	+5 (+3 to +6)	+4 (+2 to +6)	<0.001	+0.99
Usual care (n=11)	18 (5)	18 (5)	+0 (-0 to +1)			
30-second arm curls, n						
Wall climbing (n=22)	19 (4)	23 (4)	+4 (+3 to +6)	+4 (+3 to +6)	<0.001	+0.99
Usual care (n=11)	19 (4)	19 (5)	+0 (-1 to +1)			
Sit and reach, cm						
Wall climbing (n=22)	+9.0 (8.7)	+12.8 (9.2)	+3.8 (+2.2 to +5.3)	+3.1 (+0.6 to +5.5)	0.016	+0.36
Usual care (n=11)	+8.1 (8.7)	+9.2 (8.1)	+1.0 (-0.9 to +3.0)			
Back scratch, cm						
Wall climbing (n=22)	+1.0 (6.8)	+1.8 (7.3)	+0.8 (-0.2 to +1.8)	+0.8 (-0.8 to +2.3)	0.31	+0.16
Usual care (n=11)	+1.0 (7.4)	+1.0 (1.1)	-0.0 (-1.3 to +1.2)			
8-foot up & go, s						
Wall climbing (n=22)	4.3 (0.6)	4.1 (0.6)	-0.2 (-0.4 to -0.0)	-0.4 (-0.7 to -0.0)	0.039	-0.68
Usual care (n=11)	4.4 (0.6)	4.5 (0.9)	+0.1 (-0.2 to +0.4)			
Grip strength-right, kg						
Wall climbing (n=22)	31.8 (5.5)	34.9 (5.2)	+3.1 (1.7 to +4.6)	+2.9 (+0.7 to +5.2)	0.013	+0.51
Usual care (n=11)	31.6 (6.4)	31.0 (6.9)	-0.5 (-2.5 to +1.4)			
Grip strength-left, kg						
Wall climbing (n=22)	30.2 (5.0)	32.7(5.3)	+2.5 (+0.9 to +4.1)	+3.1 (+0.4 to +5.9)	0.024	+0.55
Usual care (n=11)	29.7 (7.0)	28.9 (7.3)	-0.8 (-2.7 to 1.1)			
Waist circumference, cm						
Wall climbing (n=22)	90.3 (12.8)	89.4 (11.8)	-0.9 (-2.8 to +1.0)	-2.0 (-4.8 to +0.9)	0.17	+0.17

Usual care (n=11)	89.7 (10.8)	90.7 (11.5)	+1.0 (-0.9 to +2.9)			
Weight, kg						
Wall climbing (n=22)	72.2 (14.5)	72.5 (14.4)	+0.3 (-0.8 to +1.4)	-0.3 (-2.2 to +1.5)	0.71	-0.02
Usual care (n=11)	73.1 (14.5)	73.7 (15.6)	+0.6 (-0.9 to +2.1)			
<i>Note.</i> <i>SD</i> standard deviation, <i>CI</i> confidence interval, ^a Difference in mean change adjusted for baseline value, age, months since diagnosis, and type of cancer						

CHAPTER 6-Study 2-Paper 2

**A Phase I/II Pilot Study Assessing the Preliminary Efficacy of Wall Climbing for
Improving Posttraumatic Growth and Quality of Life in Gynecologic Cancer Survivors**

6.1 INTRODUCTION

Each year in Canada, approximately 10,000 women are diagnosed with gynecologic cancers including uterine, cervical, and ovarian malignancies (Canadian Cancer Society, 2014). A gynecologic cancer diagnosis is associated with symptoms of posttraumatic stress as it can evoke a sense of fear, devastation, and lack of control (Kwekkeboom & Seng). Paradoxically, a gynecologic cancer diagnosis may also provide an opportunity for growth and adaptation not experienced among healthy adults (Sabiston & Brunet, 2012). Posttraumatic growth is defined as a positive psychological change that emerges following a significantly challenging, or traumatic life event and is often characterized by an increased appreciation for life, better interpersonal relationships, personal strength, recognition of new possibilities and spiritual development (Tedeschi & Calhoun, 1996, 2004; Tedeschi, Park, & Calhoun, 1998). Theoretically, posttraumatic growth occurs when a trauma sufficiently challenges fundamental assumptions about oneself and the world (Tedeschi & Calhoun, 1996, 2004). Based on theoretical models, growth is believed to occur when these assumptions are assimilated into a new coherent worldview, through cognitive processing, self-disclosure and affective engagement (Janoff-Bulman & McPherson Frantz, 1997; Stanton, Bower, & Low, 2006; Tedeschi & Calhoun, 2004).

The benefits of physical activity for cancer survivors have been well documented and include improved physical functioning, symptom management, quality of life, decreased anxiety and depression, and possibly a lower risk of recurrence and longer survival (Ballard-Barbash et al., 2012; Courneya & Friedenreich; Stevinson et al., 2007). Few studies, however, have examined the potential role of physical activity in facilitating experiences of posttraumatic growth in cancer survivors. Preliminary research has suggested that physical activity may increase the level of social support available to cancer survivors, and function as an adaptive coping strategy to decrease levels of distress, thereby facilitating posttraumatic growth (Burke & Sabiston, 2012; Hefferon, Greal, & Mutrie, 2008; Sabiston & Brunet, 2012; Sabiston, McDonough, & Crocker, 2007). In a cross-sectional survey, we previously reported that gynecologic cancer survivors (GCS) who met the combined aerobic and strength exercise guidelines reported higher levels of posttraumatic growth (Crawford, Vallance, Holt, & Courneya, 2014). Furthermore, “exercise growth” (e.g., increasing the amount of exercise, trying new exercises or sports, or taking up a physically challenging or higher risk sport or

activity) was strongly associated with posttraumatic growth in GCS (Crawford, Holt, Vallance, & Courneya, 2015). In addition to social support and coping with stress, we proposed that participating in an activity that is novel, physically and cognitively demanding, and contains some physical risk may be particularly effective for fostering posttraumatic growth. Such “adventure activities” may push cancer survivors beyond their comfort zone and provide a sense of accomplishment that may not occur in standard aerobic-based physical activity programs (e.g., treadmill walking, stationary cycle), thereby, promoting posttraumatic growth (Burke & Sabiston, 2012; Dunn, Campbell, Penn, Dwyer, & Chambers, 2009; Sabiston et al., 2007).

To begin to address this issue, we conducted the Gynecologic Cancer Survivors Wall Climbing for Total Health GROWTH Trial, a pilot randomized controlled trial to examine the safety, feasibility, and preliminary efficacy of supervised wall climbing intervention (WCI)(Crawford et al., in press). In the primary paper, we reported that the WCI was safe, feasible, and resulted in statistically significant and meaningful improvements in objective health-related and functional fitness outcomes. Here, we report the effects of the WCI on posttraumatic growth, its theoretical correlates and quality of life outcomes. We hypothesized that GCS randomized to the WCI would report higher posttraumatic growth compared to GCS allocated to UC. Based on the research literature, we also hypothesized that those in the WCI group would report lower levels of intrinsic rumination (i.e., involuntary thoughts surrounding a gynecologic cancer diagnosis and its treatments that occur unexpectedly) and higher levels of deliberate rumination (i.e., intentional thoughts about a gynecologic cancer diagnosis and its treatments) compared to those in the UC group. Furthermore, we hypothesized that GCS receiving the WCI would report greater improvements in quality of life, fatigue, depression, and endocrine symptoms.

6.2 METHODS

Setting and Participants

The methods of the GROWTH trial have been reported elsewhere (Crawford et al., in press). In brief, the Alberta Cancer Registry identified 512 GCS living within a 75km radius of Edmonton. Women were eligible if they (1) had a histologically confirmed diagnosis of cervical, endometrial or ovarian cancer, (b) were between 18 to 70 years of age, (c) were living in Edmonton or surrounding area, and (d) were willing to attend the supervised WCI.

Ethical approval was granted by the Health Research Ethics Board of Alberta- Cancer Committee and the Health Research Ethics Board at the University of Alberta.

Design and Procedures

The design and procedures of the GROWTH Trial have been reported elsewhere (Crawford et al., in press). Prospective participants were mailed a recruitment package from the Alberta Cancer Registry explaining the nature of the study. Interested participants were instructed to contact the project coordinator for further information. All individuals that were interested in participating were screened and scheduled for their baseline assessment.

Randomization and blinding

The randomization and blinding procedures for the GROWTH trial have been reported elsewhere (Crawford et al., in press). In brief, the WCI was offered in a group-based format on specific days and times and could accommodate 6 participants per climbing group. There were 4 class options (days and times) available and prospective participants were asked to indicate their required or preferred class schedule at the time of recruitment. Participants were stratified by their requested class schedule prior to being randomized to the WCI or UC. To satisfy the required class size of 6 participants, the randomization within each strata was blocked so that 6 participants were randomized to the WCI irrespective of the total strata size. For instance, 10 women preferred to climb on Monday and Wednesday from 9:00-11:00am, therefore, the block randomization was set so that six participants were randomized to the WCI and four were randomized to UC. This procedure was repeated for all 4 stratas (classes). A research assistant not involved in the study generated the random group assignment.

Intervention

The WCI has been described elsewhere (Crawford et al., in press). Wall-climbing classes were held twice per week for 120 minutes for 8 weeks at no cost to the participant. All classes took place at the Wilson Climbing Center located on the University of Alberta campus. The Wilson Climbing Center contains several versatile, modular climbing structures with climbing routes to a maximum of 48 feet. The classes were instructed by a certified climbing instructor and covered bouldering, top roping, rappelling and belaying skills. All classes were adapted based on the individual needs of participants. Participants completed a climbing skills assessment at 2 weeks, 4 weeks, 6 weeks, and 8 weeks to examine skill progression. Individuals who were allocated to UC were asked not to initiate a wall climbing

program for the duration of the study but were offered four free climbing sessions after they completed postintervention assessments. A detailed list of the order and content of the wall climbing sessions has been reported in a previous publication (Crawford et al., in press).

Measures

Our primary measure of posttraumatic growth was the Posttraumatic Growth Inventory (PTGI). The PTGI is a 21-item inventory which measures the extent to which individuals report positive life changes following a traumatic event (Tedeschi & Calhoun, 1996). This inventory assesses five subscale scores (e.g., new possibilities, relating to others, personal strength, spiritual change, and appreciation for life) and a total growth score. Items were measured on a 6-point scale ranging from 0 (I did not experience this change) to 5 (I experienced this change to a great degree). The baseline questionnaire included statements such as “After being diagnosed and treated for gynecologic cancer, I changed my priorities about what is important in life.” The post intervention questionnaire included statements such as “Over the past three months, I changed my priorities about what is important in life.” The total score can range from 0-105, with higher scores indicating higher posttraumatic growth. The Posttraumatic Growth Inventory has strong internal reliability (Cronbach’s alpha= .90) and test-retest reliability ($r = .71$)(Tedeschi & Calhoun, 1996).

As a secondary measure of posttraumatic growth, we directly asked participants in the WCI whether it influenced their posttraumatic growth. Specifically, we asked five posttraumatic growth items on a six-point Likert Scale ranging from 0 (did not experience this change) to 5 (changed to a very great degree). The stem asked, “After participating in the wall climbing program” with the five items focused on the PTGI subscales. The specific items were: “I experienced a greater appreciation for life”, “I experienced better interpersonal relationships with friends and family”, “I experienced an increased sense of personal strength”, “I recognized that there are new possibilities in my life”, and “I experienced increased spiritual development and mindfulness”.

The Event Related Rumination Inventory (ERRI) assessed deliberate and intrinsic rumination. The ERRI, a 20-item inventory, is designed to measure repetitive thinking about a traumatic event (Cann et al., 2011). This measure contains 10 items, which assess deliberate thinking about the event, such as “I thought about whether I could find meaning from my gynecologic cancer diagnosis.” The 10 remaining items measures intrusive thinking about the

event, such as “I thought about my gynecologic cancer when I did not mean to.” Items were measured on a 4-point scale from 0 (Never) to 3 (Often) with higher scores indicating greater rumination. The authors report strong internal reliability for both deliberate (Cronbach’s $\alpha = .88$) and intrusive (Cronbach’s $\alpha = .94$) items (Cann et al., 2011).

The Core Beliefs Inventory (CBI) assessed core beliefs. The CBI is a 9-item inventory which measures the extent to which one’s assumptive world is disrupted as the result of a highly stressful event (i.e., gynecologic cancer diagnosis) (Cann et al., 2010). The Core Beliefs Inventory is additive and yields a total inventory score. Items were measured on a 6-point scale from 0 (not at all) to 5 (to a very great degree), with higher scores indicating a greater degree of examination of core beliefs. The baseline questionnaire included statements such as “After being diagnosed and treated for gynecologic cancer, I seriously examined the degree to which I believe things that happen to people are fair.” The post intervention questionnaire included statements such as “Over the past three months, I seriously examined the degree to which I believe things that happen to people are fair.” The Core Beliefs Inventory has strong internal reliability (Cronbach’s $\alpha = .82$) and test-retest reliability ($r = .69$) (Cann et al., 2010).

Perceived social support was assessed by the 24-item Social Provisions Scale (Cutrona & Russell, 1987). After reversing negatively worded items, responses were summed for a total social provisions score. Items were measured on a 4-point scale ranging from 1 (I strongly disagree) to 4 (strongly agree), with higher scores indicating a great degree of perceived support. The Social Provisions Scale has demonstrated acceptable psychometric properties of high internal consistency (Cronbach’s $\alpha = .70$) and test-retest reliability ($r = .59$) (Russell, Cutrona, Rose, & Yurko, 1984).

General quality of life was assessed by the Short-Form 36 (SF-36) Questionnaire (Ware et al., 2008). The SF-36 questionnaire consisted of 36 items that generate 8 health domain scores: physical functioning, role limitations, bodily pain, vitality, social functioning, mental health and role emotional. The standardized, norm based domain scores were then used to create a physical component and mental component score scores (summary scales). Scores for each health domain ranged from 0 to 100 with higher scores indicating higher function or well-being. The SF-36 has demonstrated strong validity and reliability in clinical and nonclinical populations (Ware et al., 2008).

Fatigue was assessed by the 13-item Fatigue Scale (FS) of the FACT measurement system (Yellen, Cella, Webster, Blendowski, & Kaplan, 1997). The FS was developed specifically for cancer survivors and asks questions concerning fatigue and symptom expression. Scores can range from 0 to 52 with higher scores indicating greater fatigue. Depression was assessed by the Center for Epidemiology Studies Short Depression Scale (CES-D) which is a well-validated 10-item scale that examines the frequency of depressive symptoms over the past week (Andresen, Malmgren, Carter, & Patrick, 1994). Items are scores from 0 (<1 day) to 3 (5-7 days) and summed for a total score of 0-30 with higher scores indicating more depressive symptoms. In a study of cancer patients, the CES-D had a Cronbach's α of 0.89 and a test-retest score of 0.57 (Hann, Winter, & Jacobsen, 1999). Menopausal and sexual symptoms were assessed by the 19-item Endocrine Symptoms Scale (FACT-ES) of the FACT measurement system (Fallowfield, Leaity, Howell, Benson, & Cella, 1999). Participants were asked to indicate the extent of symptoms on a five-point Likert scale ranging from 0 (not at all) to 4 (very much) and summed for a total score of 0-96 with high scores indicating more endocrine symptoms.

Statistical Analysis

Given the primary focus of this pilot study was on safety and feasibility, an a priori sample size calculation was not conducted for the efficacy outcomes. For all analyses of efficacy outcomes, the intention-to-treat principle was used to include all participants in the randomized condition regardless of adherence and who provided 8-week data. ANCOVAs were performed to compare the WCI and UC groups at post-intervention on outcomes of interest with adjustments for the baseline value of the outcome, age, months since diagnosis, and type of cancer. For the PTGI variables, we did not adjust for baseline value because our baseline measure referred to the effects of the cancer diagnosis and treatments on posttraumatic growth. As this was a phase I/II study with a small sample size, outcomes of interest were interpreted for statistical trends as well as for potentially meaningful differences. A statistical trend was defined as a two-tailed $\alpha < 0.10$ and clinical significance was defined as a minimum standardized effect size of $d \geq 0.33$ (Brucker, Yost, Cashy, Webster, & Cella, 2005). All statistical analyses were conducted using SPSS 23 (SPSS, Chicago, IL, USA).

6.3 RESULTS

The flow of participants through the study has been reported elsewhere (Crawford et al., in press). Briefly, of the 35 GCS recruited, 24 were randomized to the WCI and 11 to UC. Median adherence to the WCI was 84% (13.5/16 wall climbing sessions). Post intervention questionnaires were completed by 97% (34/35) of participants. Demographic and medical data have been reported elsewhere (Crawford et al., in press). In summary, the mean age of participants was 53.0 ± 11.9 and the mean number of months since diagnosis was 63.9 ± 71.2 . For type of cancer, 28.6% had cervical cancer, 40.0% had endometrial cancer, 31.4% had ovarian cancer, and 97.1% had received surgery.

Posttraumatic Growth

As shown in Table 1, the WCI had a large and statistically significant positive effect on the PTGI subscale of personal strength compared to UC (adjusted between group difference [ABGD], +4.3; 95% CI, +0.0 to +8.5; $p=0.049$ $d=+0.76$). The WCI group also showed a large and borderline statistically significant positive effect on the subscale of new possibilities (ABGD, +4.5; 95% CI -0.3 to +9.2; $p=0.065$; $d=+0.70$). Non-significant but potentially meaningful effects in favor of the WCI group were also noted for the total PTGI score (ABGD, +12.5; 95% CI, -7.3 to +32.3; $p=0.21$; $d=+0.50$), and relating to others (ABGD, +3.2; 95% CI -3.9 to +10.4; $p=0.36$; $d=+0.40$) subscale. Similarly, a non-significant but potentially meaningful effect in favor of the WCI group were noted for intrusive rumination (ABGD, -3.6; 95% CI -9.9 to +2.6; $p=0.25$; $d=-0.46$).

Descriptive statistics for the direct effects of wall climbing on posttraumatic growth are presented in Table 2. Results indicated that GCS in the WCI reported the highest growth in the areas of personal strength (3.7 ± 1.5) and new possibilities (3.3 ± 1.7). The lowest growth was reported in the area of spiritual change (1.7 ± 1.8) and relating to others (1.8 ± 1.5).

Quality of Life and Symptoms

The generic health related quality of life outcomes are presented in Table 3. There were borderline significant medium-to-large sized effects favoring the WCI for mental health (ABGD, +4.8; 95% CI -0.6 to +10.2; $p=0.077$; $d=+0.61$) and the mental health component score (summary scale; ABGD, +6.9; 95%CI -0.4 to +14.2; $p=0.063$; $d=+0.80$). Conversely, there were borderline significant medium-sized effects favoring the UC group for bodily pain (ABGD, -5.4; 95%CI -11.1 to +0.3; $p=0.063$; $d=-0.50$) and the physical health component

score (summary scale; ABDG, -4.9; 95%CI -9.6 to -0.3; $p=0.038$; $d= -0.58$). The symptom outcomes at baseline and post intervention are summarized in Table 4. A non-significant but potentially meaningful effect in favor of the WCI was noted for depression (ABGD, -2.1; 95%CI -4.9 to +0.8; $p=0.15$; $d= -0.57$).

6.4 DISCUSSION

Consistent with our hypothesis, we found statistical trends and/or meaningful effects in favor of the WCI for the total PTGI and the subscales of new possibilities, personal strength, and relating to others. Contrary to our hypothesis, no meaningful differences emerged for the subscales of spiritual change or appreciation for life. These findings were consistent with the direct reports of growth from those who completed the WCI.

The nature of the activity may have contributed to the positive changes in new possibilities, personal strength, and relating to others, and the lack of changes in spiritual change or appreciation for life. That is, physical activity interventions such as wall climbing that are group-based, physically challenging, novel, incur some risk and result in a heightened emotional state (e.g., fear and arousal) appears to facilitate posttraumatic growth in the domains of new possibilities, personal strength, and relating to others. Wall climbing may facilitate changes in new possibilities as it may prompt participants to recognize new opportunities, interests, and paths in life. Similarly, wall climbing may facilitate changes in personal strength as participants experience feelings of self-reliance and fortitude as they overcome physical and emotional challenges while learning new skills and successfully climb new routes. Relating to others may be facilitated because of the group-based activity that requires reliance on each other for safety and encouragement. It is not surprising that there was no difference in spiritual change as the intervention did not contain any elements of spirituality, religiosity, or mindfulness. We also found no difference in appreciation for life following the WCI, suggesting that it may be the diagnosis itself that prompts one to have an increase regard for life's value and a new sense of vulnerability to death not the activity.

Interestingly, we found no difference between the WCI and UC groups for core beliefs or deliberate rumination. This finding suggests that the WCI did not influence the participants' perceptions of themselves, the world and the purposeful re-examination of the gynecologic cancer diagnosis and its associated treatments. However, we did find non-significant but modest effects for intrusive rumination favoring the WCI, suggesting that our

WCI may have reduced negative intrusive thoughts surrounding diagnosis and treatment. This finding is important given that lower scores on the Intrusive Rumination Scale lead to fewer self-focused negative thoughts surrounding the gynecologic cancer diagnosis that are intrusive, repetitive, cyclical, and uncontrollable. Previously, research has shown that intrusive rumination is related to a range of psychiatric difficulties such as posttraumatic stress disorder (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), depression (Maercker, Michael, Fehm, Becker, & Margraf, 2004), and ongoing distress (Watkins, 2008). Given the informal observation that participants in the WCI group shared and discussed their cancer experiences while climbing, it likely lead participants to engage in cognitive and emotional processes allowing one to better cope with distress and intrusive thoughts. It is possible that wall climbing with other GCS is a therapeutic activity, which encompasses ruminating, clarifying, and working through the thoughts and emotions experienced from a gynecologic cancer diagnosis and its treatments.

Curiously, we did not find a significant difference between the WCI and UC group for social support. This finding contrasts sharply with previous qualitative research in breast cancer survivors in which social support was reported to be a key element of success for an exercise (Hefferon et al., 2008), mountaineering (Burke & Sabiston, 2010), and dragon boating (McDonough, Sabiston, & Ullrich-French, 2011) intervention and was linked to posttraumatic growth. Although speculative, one possible explanation for this finding is that due to the length of time since diagnosis and treatment participants may have previously established a stronger social support network regardless of group randomization. The operationalisation of social support differs across studies (Barskova & Oesterreich, 2009) and it is possible that the measure used to assess social support did not examine instrumental support, emotional support, and the size of one's social network making it difficult to draw conclusions on ones complete supportive social context.

There are no WCIs in GCS or any cancer survivor group with which to compare our results. Moreover, there are no randomized controlled trials to demonstrate a cause-effect relationship between any type of physical activity and posttraumatic growth. Given that this is the first study to examine the effects of any physical activity intervention on posttraumatic growth, further research is warranted. Previous research suggests that there may be opportune time points in which cancer patients should engage in physical activity in an attempt to

facilitate posttraumatic growth (Faulkner, Hefferon, & Mutrie, 2015). Research reports that the relationship between the time since diagnosis and posttraumatic growth may be strongest in the first two years following diagnosis (Stanton et al., 2006). While more longitudinal research is warranted to confirm this temporal relationship, it must be noted that the mean time since diagnosis in the current study was approximately five years.

Consistent with our hypotheses, we found a statistical trend and meaningful group difference of 3 points (Maruish, 2011) in favor of the WCI group for mental health and the mental health component score. Although not statistically significant, our study also noted a medium effect for depressive symptoms in favor of the WCI group. This finding is consistent with an uncontrolled trial of WCI in people with depression. Specifically, Luttenberger et al. (Luttenberger et al., 2015) found that following an 8-week WCI, the intervention group reported significant reductions in depressive symptoms. In contrast to the majority of exercise interventions (e.g., walking, running, or strength training) for individuals with poor mental health (Cooney, Dwan, & Mead, 2014; Mead et al., 2009; Stathopoulou, Powers, Berry, Smits, & Otto, 2006), wall climbing contains a variety of mental facets. Hence, wall climbing may be an effective alternative type of physical activity intervention since individuals who suffer from poor mental health have poorer physical health, less motivation to exercise, and low levels of fitness (Knapen, Vancampfort, Morien, & Marchal, 2015).

Contrary to our hypotheses, we found a statistical trend and meaningful group difference in favor of the UC group for bodily pain and the physical health component score. This finding is inconsistent with our documented improvements in objective functional fitness in the primary paper (Crawford et al., in press). In retrospect, this result is not surprising given that the participants randomized to the WCI participated in a physically demanding type of exercise likely resulting in increased muscle and joint soreness. Moreover, many participants were unfit, overweight, or obese, and none had previous experience with wall climbing. Future clinical trials examining wall climbing in GCS should monitor pain and other physical symptoms closely. Our preliminary data suggest no effects on fatigue or endocrine symptoms.

Our study has strengths and limitations to consider when interpreting the data. Strengths of the current study include being the first study to explore the effects of wall climbing on posttraumatic growth, the randomized controlled trial design, the high rates of

adherence and follow-up, and use of a state of the art climbing wall. The study limitations include the small sample size, no long-term follow-up, and the limitations of the PTGI as an outcome variable in randomized controlled trials. Future studies utilizing the PTGI must provide a stem statement that provides reference to time and the traumatic event to ensure the same construct is being assessed at both time points (i.e., baseline and post intervention).

In conclusion, the GROWTH Trial provides preliminary evidence that a WCI has a positive effect on some aspects of posttraumatic growth and mental health, however, it may induce some bodily pain in unfit and overweight GCS. Additional research is warranted to confirm and extend the benefits and harms of wall climbing on mental and physical health in GCS. Future studies may wish to consider only including participants who are experiencing posttraumatic stress disorder, as they may be most likely to experience the greatest benefit. Lastly, anecdotally some participants in the WCI voluntarily reported improvements in cognitive functioning and peripheral neuropathy that were not assessed in the study. Thus research should confirm whether a WCI has an effect on these important symptoms and the implications for posttraumatic growth and quality of life.

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Table 6-1. Effects of wall climbing on posttraumatic growth in gynecologic cancer survivors.

	Post Intervention	Adjusted Between-Group Difference in Mean Change ^a		
	Mean (SD)	Mean Difference (95%CI)	P value	Cohen <i>d</i>
Total Posttraumatic growth				
Wall climbing (n=23)	40.5 (26.5)	+12.5 (-7.3 to +32.3)	0.21	+0.50
Usual care (n=11)	30.8 (21.2)			
Relating to others				
Wall climbing (n=23)	11.5 (9.3)	+3.2 (-3.9 to +10.4)	0.36	+0.40
Usual care (n=11)	9.0 (7.7)			
New possibilities				
Wall climbing (n=23)	11.7 (6.8)	+4.5 (-0.3 to +9.2)	0.065	+0.70
Usual care (n=11)	8.0 (5.1)			
Personal strength				
Wall climbing (n=23)	9.6 (5.7)	+4.3 (+0.0 to +8.5)	0.049	+0.76
Usual care (n=11)	5.7 (4.7)			
Spiritual growth				
Wall climbing (n=23)	1.9 (2.6)	+0.2 (-1.8 to +2.2)	0.84	+0.08
Usual care (n=11)	2.1 (2.8)			
Appreciation for life				
Wall climbing (n=23)	5.8 (4.1)	+0.4 (-3.0 to +3.8)	0.83	+0.09
Usual care (n=11)	6.0 (4.6)			
Core Beliefs Inventory				
Wall climbing (n=23)	14.5 (10.7)	+2.2 (-6.5 to +11.0)	0.60	+0.20
Usual care (n=11)	12.5 (11.2)			
Intrusive rumination				
Wall climbing (n=23)	7.6 (6.8)	-3.6 (-9.9 to +2.6)	0.25	-0.46
Usual care (n=11)	11.3 (9.5)			
Deliberate rumination				
Wall climbing (n=23)	9.9 (6.8)	-2.4 (-8.3 to +3.5)	0.41	-0.32
Usual care (n=11)	12.1 (9.1)			
Social support				
Wall climbing (n=23)	83.4 (9.4)	+0.1 (-7.4 to +7.6)	0.98	+0.01
Usual care (n=11)	83.3 (9.0)			

Note. SD standard deviation, CI confidence interval, ^a Difference in mean change adjusted for age, months since diagnosis, and type of cancer

Table 6-2. Direct reports of the effects of wall climbing on posttraumatic growth in gynecologic cancer survivors in the wall climbing intervention (n=23).	
	Mean (SD)
Relating to others (0-5)	1.8 (1.5)
New possibilities (0-5)	3.3 (1.7)
Personal strength (0-5)	3.7 (1.5)
Spiritual change (0-5)	1.7 (1.8)
Appreciation for life (0-5)	2.6 (1.6)

Table 6-3. Effects of wall climbing on health-related quality of life in gynecologic cancer survivors.

	Baseline	Post Intervention	Mean Change	Adjusted Between-Group Difference in Mean Change ^a		
	Mean (SD)	Mean (SD)	Mean (95%CI)	Mean difference (95%CI)	P value	Cohen <i>d</i>
Physical functioning						
Wall climbing (n=23)	53.4 (4.4)	53.3 (4.9)	-0.1 (-2.2 to +2.0)	-1.9 (-4.4 to +0.7)	0.15	-0.33
Usual Care (n=11)	51.0 (7.9)	53.0 (5.6)	+1.9 (-0.5 to +4.3)			
Role-physical						
Wall climbing (n=23)	51.7 (7.3)	50.5 (9.4)	-1.3 (-6.6 to +4.0)	-1.4 (-8.5 to +5.7)	0.69	-0.16
Usual Care (n=11)	47.1 (11.4)	48.6 (10.6)	+1.6 (-5.0 to +8.1)			
Bodily pain						
Wall climbing (n=23)	50.2 (10.3)	48.4 (10.6)	-1.8 (-6.8 to +3.1)	-5.4 (-11.1 to +0.3)	0.063	-0.50
Usual Care (n=11)	52.3 (12.0)	53.7 (9.9)	+1.4 (-2.5 to +5.3)			
General health						
Wall climbing (n=23)	50.8 (10.4)	52.2 (8.7)	+1.4 (-1.8 to +4.5)	+1.8 (-3.4 to +7.1)	0.48	+0.19
Usual Care (n=11)	52.7 (7.2)	51.0 (9.9)	-1.6 (-6.0 to +2.7)			
Vitality						
Wall climbing (n=23)	53.4 (8.2)	50.2 (8.5)	-3.3 (-6.2 to -0.3)	-1.4 (-7.1 to +4.2)	0.60	-0.15
Usual Care (n=11)	47.8 (11.1)	47.5 (11.7)	-0.3 (-5.7 to +5.1)			
Social functioning						
Wall climbing (n=23)	52.3 (6.9)	51.40 (8.1)	-0.9 (-4.9 to +3.0)	+4.8 (-2.5 to +12.0)	0.19	+0.65
Usual Care (n=11)	51.4 (8.4)	45.94 (11.2)	-5.5 (-13.3 to +2.4)			
Role-emotional						
Wall climbing (n=23)	52.8 (6.5)	50.3 (7.8)	-2.5 (-6.9 to +1.9)	+6.6 (-1.8 to +15.0)	0.12	+0.69
Usual Care (n=11)	44.6 (12.7)	41.7 (13.2)	-2.8 (-12.6 to +7.0)			
Mental health						
Wall climbing (n=23)	53.9 (6.4)	53.3 (5.8)	-0.6 (-2.9 to +1.7)	+4.8 (-0.6 to +10.2)	0.077	+0.61
Usual Care (n=11)	46.9 (8.8)	44.9 (10.7)	-2.0 (-8.3 to +4.2)			
Physical health component						
Wall climbing (n=23)	51.0 (8.1)	50.8 (7.8)	-0.2 (-4.4 to +4.0)	-4.9 (-9.6 to -0.3)	0.038	-0.58

Usual Care (n=11)	52.5 (9.2)	54.9 (7.5)	+2.4 (-0.5 to 5.3)			
Mental health component						
Wall climbing (n=23)	53.6 (6.4)	51.5 (7.5)	-2.1 (-4.9 to +0.7)	+6.9 (-0.4 to +14.2)	0.063	+0.80
Usual Care (n=11)	45.9 (10.7)	41.4 (12.4)	-4.5 (-13.1 to +4.1)			
<i>Note.</i> <i>SD</i> standard deviation, <i>CI</i> confidence interval, ^a Difference in mean change adjusted for baseline value, age, months since diagnosis, and type of cancer						

Table 6-4. Effects of wall climbing on symptoms in gynecologic cancer survivors.						
Outcomes	Baseline	Post Intervention	Mean Change	Adjusted Between-Group Difference in Mean Change ^a		
	Mean (SD)	Mean (SD)	Mean (95%CI)	Mean difference (95%CI)	P value	Cohen <i>d</i>
Fatigue						
Wall climbing (n=23)	43.0 (5.7)	43.1 (8.1)	0.1 (-3.7 to +3.9)	+0.1 (-6.3 to +6.5)	0.98	+0.01
Usual Care (n=11)	39.3 (10.4)	40.2 (13.0)	0.9 (-5.0 to +6.9)			
Endocrine symptoms						
Wall climbing (n=23)	62.1 (9.0)	62.4 (8.3)	0.3 (-2.2 to +2.7)	-0.5 (-4.7 to +3.6)	0.80	-0.06
Usual Care (n=11)	63.7 (6.4)	64.0 (6.0)	0.3 (-3.3 to +3.8)			
Depressive symptoms						
Wall climbing (n=23)	3.1 (2.8)	3.7 (2.7)	0.5 (-0.7 to +1.7)	-2.1 (-4.9 to +0.8)	0.15	-0.57
Usual Care (n=11)	5.4 (4.8)	7.4 (6.2)	2.0 (-1.5 to +5.5)			

Note. SD standard deviation, CI confidence interval, ^a Difference in mean change adjusted for baseline value, age, months since diagnosis, and type of cancer

CHAPTER 7- Discussion

7.1 OVERVIEW

The purpose of this dissertation was to examine the potential role of physical activity in facilitating posttraumatic growth in gynecologic cancer survivors. While the majority of trauma related research to date has examined the negative psychological and physical sequelae, recent research has found that for some individuals a traumatic experience such as a cancer diagnosis may be transformative and result in changes that are both positive and valued [1-3]. The Gynecologic Cancer Survivors Wall Climbing for Total Health (GROWTH) trial (Study 2), that to the best of my knowledge is the first randomized controlled trial that attempts to facilitate posttraumatic growth in gynecologic cancer survivors. The GROWTH trial was informed by Study 1 findings on exercise growth (Chapter 3) and the correlates of participation and interest in extreme sport/adventure activities (Chapter 4).

7.2 SUMMARY OF FINDINGS

All of the findings have been discussed in detail in this dissertation. The following section will provide a brief overview of the major findings presented in this dissertation. One major finding was that physical activity may be associated with posttraumatic growth (Study 1). Chapter 2 examined the association between exercise and posttraumatic growth in a cross-sectional population based sample, which included 621 gynecologic cancer survivors. Results showed that gynecologic cancer survivors who met the combined exercise guidelines reported significantly higher levels of posttraumatic growth compared to those who met only one guideline or neither guideline [4]. In particular, results showed that exercise that is novel, physically and emotionally challenging, and contains an aspect of risk may be associated with higher posttraumatic growth. As noted in Chapter 3, gynecologic cancer survivors who reported greater exercise growth (e.g., those who substantially changed the amount, type, or nature of their exercise) following their diagnosis and treatment were found to experience significantly higher levels of posttraumatic growth [7]. This finding suggests that it may be the quantity of exercise or the nature of the exercise that is most likely to foster posttraumatic growth. This finding is similar to previous qualitative studies in breast cancer survivors [8-11]. Physical activity that pushes survivors beyond their normal physical and emotional limits may prompt posttraumatic growth.

Another major finding of the dissertation was that exercise that is novel, physically and emotionally challenging, and contains an aspect of risk may facilitate posttraumatic growth. For example, in Chapter 6 (Study 2), I explored the effects of a wall climbing intervention on posttraumatic growth in a sample of gynecologic cancer survivors. As hypothesized, wall climbing improved some aspects of posttraumatic growth (e.g., personal strength and new possibilities) [17]. This improvement in posttraumatic growth may be because gynecologic cancer survivors successfully pushed their physical and mental capabilities prompting feelings of increased strength and an awareness of new possibilities that may not have been available to them prior to their diagnosis and treatment. This finding is in line with previous qualitative studies of breast cancer survivors that found that participating in novel physical activity interventions such as dragon boating [9], mountaineering [8], and group exercise classes [10] led to experiences of posttraumatic growth.

7.3 FUTURE RESEARCH DIRECTIONS

The findings from the cross-sectional survey and the wall climbing intervention that encompass this dissertation provide insight into future directions that warrant further investigation. In Study 1, a variety of measures were utilized to assess posttraumatic growth such as the Benefit Finding Scale [18], Impact of Cancer Scale [19], and the Posttraumatic Growth Inventory [2]. Based on the feedback from participants in Study 1, it was considered that the Posttraumatic Growth Inventory was the best measure to assess Posttraumatic Growth in Study 2 as it specifically refers to a trauma, has been used in a wide variety of cancer patients and cancer survivorship samples, and has very good psychometric properties.

Almost all studies assessing posttraumatic growth in cancer patients utilizing the Posttraumatic Growth Inventory are cross-sectional in design [3]. Consequently, it is envisioned that the Posttraumatic Growth Inventory may require future modification in a few areas. Firstly, it would be beneficial to modify the Posttraumatic Growth Inventory stem statements so that the inventory can be used as an outcome measure in a randomized controlled trial. It became apparent that the Posttraumatic Growth Inventory is more of a measure of Posttraumatic Growth prevalence as it referred only to the trauma with no reference to time. For example, currently the stem statement states “as a result of my gynecologic cancer diagnosis and its treatment I have experienced...”. However, this provides no reference to time making it difficult to apply in a randomized controlled trial design. This measure should be modified by providing a reference to

the trauma (e.g., gynecologic cancer diagnosis and treatment) and time (e.g., length of intervention) and then be validated prior to its use in a future randomized controlled trial.

Secondly, future research should establish cut-off scores identifying “clinically” important levels or changes of posttraumatic growth. This would establish patient posttraumatic growth scores that reflect changes in a clinical intervention that are meaningful to the patient with the potential to change the patient’s management. Determining whether the effects of a wall climbing intervention leads to clinically important changes in posttraumatic growth is paramount for a variety of stakeholders in the cancer survivorship community. These stakeholders include cancer survivorship committees, cancer survivorship centers and organizations, and medical oncologists who need to make informed medical decisions regarding supportive care.

Lastly, future research should consider the addition of a new subscale assessing positive change in health behaviours (e.g., physical activity) following a traumatic event. Many individuals view a cancer diagnosis as a wake-up call that forces them to examine their lives and values [3]. These individuals may place a greater emphasis on improving their personal health by participating in more exercise. These changes may be quite different than those addressed in the Posttraumatic Growth Inventory. Consequently, I think there is potential value added to include an additional subscale that addresses positive health behaviour change following a traumatic event. This could be undertaken by adding a subscale composed of appropriate and psychometrically sound health behaviour change items to the current Posttraumatic Growth Inventory.

Given that the GROWTH Trial is the first trial to examine the feasibility, safety, and preliminary efficacy of a wall climbing intervention, future research should continue building upon the GROWTH Trial by implementing a larger phase II/III trial. Larger phase II/III trials are needed to confirm the efficacy of wall climbing in facilitating improvements in objective health-related and functional fitness outcomes and patient reported outcomes. If these findings are replicated, then it is important to provide gynecologic cancer survivors with the opportunity and access to partake in such activities to maximize their ability to cope and thrive following a cancer diagnosis. If successful, similar interventions designed to foster positive growth may be developed and disseminated to enhance physical and psychological health in gynecologic cancer survivors and other cancer survivor populations.

Future trials should also consider the addition of other health outcomes important to gynecologic cancer survivors. Anecdotally, participants randomized to the wall climbing intervention voluntarily reported improvements in cognitive functioning and peripheral neuropathy (i.e., nerve damage). These outcomes were not assessed in this dissertation. Thus research should confirm whether wall climbing has an effect on these important symptoms and the implications for practice. Enhancing our understanding of the benefits of novel physical activity interventions such as wall climbing could ultimately help to improve our methods of treating patients diagnosed with cancer who suffer from posttraumatic stress symptoms and comorbidities due to treatments.

Given that this is the first study to conduct a wall climbing intervention in cancer survivors, the optimal frequency, climbing style, intensity and duration of climbing is unknown. Future research may wish to examine these important factors and whether they moderate various physical and psychological health benefits. For example, it may be beneficial to compare 2 days/week versus 3 days/week of wall climbing to determine the optimal frequency for the greatest physical and psychological health benefits. The American College of Sports Medicine recommends that cancer survivors engage in 150 minutes of moderate-intensity exercise per week and 2 or 3 days per week of strength training with a focus on all of the major muscle groups [20]. Previous research has noted that wall climbing may be an effective training modality as the intensity of climbing is similar to that recommended by the American College of Sports Medicine to sustain good muscular strength and cardiorespiratory fitness [15, 16]. Climbing 3 days/week may contribute to greater changes in important health outcomes and long-term maintenance of these outcomes compared to those who climb 2 days/week.

Given that nearly all therapeutic climbing research has utilized a bouldering wall to date [21], researchers should rigorously compare the effects of other forms of climbing (e.g., top roping) in order to discover what style of climbing leads to the greatest health benefits for gynecologic cancer survivors. Top roping is a style of climbing where the climber attaches themselves to one end of a rope, which then passes up through an anchor at the top of the wall, and then down to a partner who belays the climber. Alternatively, bouldering is a style of climbing without a rope, generally no higher than 3-5 meters and over a crash pad. As top roping is to a much greater height and requires a belayer (i.e., peer) to control the ropes, it could be more likely to elicit greater changes in social support, posttraumatic growth, and physical

functioning. Alternatively, if bouldering is found to lead to similar health benefits it may be less time intensive to build and less of a financial burden on participants compared to a top rope wall.

Future trials may wish to utilize heart rate monitors while climbing to examine the intensity and duration of climbing bouts. Currently, no research has examined the intensity of wall climbing in any cancer survivor population. Rodeo et al. [15] reported that the intensity of wall climbing is similar to that recommended by the American College of Sports medicine to sustain cardiovascular fitness in a sample of non-competitive rock climbers. Future research is warranted to confirm these findings with heart rate monitoring during climbing and using a maximal cardiorespiratory fitness test.

7.4 PRACTICAL IMPLICATIONS

Although research into the relationship between exercise and posttraumatic growth is in its infancy, this dissertation reported the associations between exercise, exercise growth, and posttraumatic growth. This research highlights that gynecologic cancer survivors who participate in an activity that is novel, physically and cognitively demanding, and contains some risk may experience some aspects of posttraumatic growth, improved objective health-related and functional fitness outcomes, and improved quality of life in the domains of mental health. These findings have important implications for the development of other alternative physical activity programs for cancer survivors. Moreover, if novel physical activity interventions are found to have an effect on health outcomes important to gynecologic cancer survivors it is important to translate them into practice.

It is important that cancer survivors are offered a broad array of physical activity opportunities that are feasible and may lead to important health benefits. Health care professionals and practitioners may play a role in facilitating access to wall climbing programs for cancer survivors by identifying opportunities that exist within the community. For example, practitioners can learn what indoor climbing walls exist in the community in an effort to refer cancer survivors. Furthermore, they can explore the various programs that are available for cancer survivors to facilitate cancer survivors registering in a wall climbing program that reflects their current fitness levels and skills. Health care professionals and practitioners may attempt to arrange a free wall climbing trial or a subsidized low-cost wall climbing trial to provide survivors an opportunity to try wall climbing without the financial burden. By offering a broader

array of physical activity opportunities that may appeal to cancer survivors, physical activity participation may increase.

To participate in wall climbing, participants require access to a bouldering/top rope climbing wall and trained staff. If these findings are replicated and show benefits over other forms of physical activity, cancer survivorship organizations and centers may wish to consider building a bouldering wall within their exercise facility to provide an opportunity for climbing in a safe environment. Further refinements to a wall climbing intervention could explore whether optimal improvements in health outcomes occur in a private setting with only gynecologic cancer survivors or integrating gynecologic cancer survivors together with the general population of wall climbing enthusiasts. The design, building fees and staff salaries could potentially be subsidized by philanthropic donations. Additionally, if we can show that wall climbing leads to important health benefits (e.g., symptom management) insurance companies may provide compensation for participation in an attempt to mitigate long-term medical costs. Lastly, the novelty of this intervention may be particularly attractive for community initiatives to raise funds for a bouldering/top rope climbing wall for cancer survivors. Given the sample size and the highly controlled nature of this trial, it is not the intention to provide implications for other samples. However, should these findings be replicated in other cancer survivorship groups and/or individuals who are suffering from a variety of medical illnesses, it will be important to offer wall climbing to improve physical and psychological health. It is important to note, that wall climbing programs should reflect the current fitness levels of participants.

7.5 STRENGTHS AND LIMITATIONS

The primary strengths and limitations of each study in the dissertation have been considered in each chapter. The overall strengths of this dissertation are the novel population, the incremental process to guide the randomized controlled trial, and a well conducted complex intervention. The two studies in this dissertation have focused on gynecologic cancer survivors which are an understudied population in psychosocial oncology and physical activity research. Gynecologic cancers are among the most common types of cancers diagnosed in women [22]. Furthermore, the 5-year survival rates are quite varied [22]. Consequently, these studies add to the exercise and cancer survivorship literature in an understudied population that stands to benefit from increasing their levels of physical activity. The findings from these two studies are

important because they not only warrant future research within this population, but give valuable information on the benefits and design of alternative physical activity programs.

Overall, a major strength of the dissertation was the incremental process used to guide the development of the GROWTH trial. The dissertation collected preliminary quantitative data on the association between exercise and posttraumatic growth in gynecologic cancer survivors to determine if an intervention was warranted in this population (Chapter 2). Following, a positive association between the combined exercise guidelines and posttraumatic growth, Chapter 3 identified the prevalence and interest of extreme sports/adventure activities in our sample of gynecologic cancer survivors to enhance the intervention efforts based on the specific interests of gynecologic cancer survivors. Furthermore, it identified an association between gynecologic cancer survivors who changed the amount, type, and nature of their physical activity following their diagnosis and posttraumatic growth. Chapter (4) identified demographic, medical, and behavioural correlates to extreme sport/ adventure activity participation and interest to determine important facilitators and barriers to participation in the GROWTH trial.

Lastly, a major strength of the dissertation was the well-designed complex intervention of the GROWTH trial. The well designed two-armed randomized controlled trial examined the safety and feasibility of a wall climbing intervention in gynecologic cancer survivors. Moreover, the present study explored the preliminary efficacy of a wall climbing intervention on objective health-related fitness and functional outcomes, posttraumatic growth, quality of life, fatigue, depression and endocrine symptoms. As noted previously, it is the first study to examine the feasibility and safety of a wall climbing intervention in any cancer survivor group; therefore, many potential outcomes (e.g., recruitment rate, adherence rate, adverse events, loss to follow up, and physical capabilities) were unknown prior to this study. Previous wall climbing interventions in other clinical populations, have not reported any information on these outcomes of interest thereby limiting conclusions. Tracking the recruitment rate is essential to determine selection biases and whether there is interest in alternative physical activity interventions. Tracking adherence to the wall climbing intervention and reasons for missed sessions identified specific barriers to climbing for gynecologic cancer survivors. These findings are important for future study design in this patient population. Reporting adverse events meant that we examined the harms (minimal in this study) associated with wall climbing which will be beneficial for the development of future wall climbing studies. Lastly, it was important to assess climbing skills to

determine whether gynecologic cancer survivors were physically capable of climbing and their rate of skill progression.

Other strengths of the dissertation include the validated psychosocial and exercise measures used in the survey study and randomized controlled trial, the use of a randomized controlled design to evaluate whether wall climbing can facilitate posttraumatic growth, and the use of the Alberta Cancer Registry, to recruit gynecologic cancer survivors to both studies. The additional strengths of this dissertation provide valuable information on the participation, future interest, and design of alternative physical activity interventions (i.e., wall climbing) for improving psychological and physical functioning outcomes in gynecologic cancer survivors.

Despite the importance and novelty of this dissertation, there are limitations that should be considered when interpreting the data and planning future research. The limitations to the dissertation were the inherent selection biases, small sample size and the use of the Posttraumatic Growth Inventory in the randomized controlled trial. In both studies, it is important to note the possible selection bias given the transparent nature of the studies from the recruitment material. The cross sectional study was limited by the modest response rate and the GROWTH trial was limited by the small sample size. Consequently, the findings may not be generalizable to all gynecologic cancer survivors and should be interpreted with caution. As half of the gynecologic cancer survivors enrolled in the GROWTH trial were meeting aerobic public health guidelines perhaps gynecologic cancer survivors who are already engaging in physical activity are more motivated to be physical active and more likely to participate in this type of novel intervention.

Another limitation of the GROWTH trial was the time of year the two studies were conducted (summer), where participants were away at times on vacation. It is unknown what impact seasonal variation may have on recruitment and adherence to the wall climbing intervention. Future research should consider conducting a study during the fall or winter months, to obtain a larger sample size.

Lastly in the GROWTH trial, our intervention was limited by the use of the Posttraumatic Growth Inventory. As discussed previously, the stem statements do not provide reference to trauma and time. While I modified the stem statements in an attempt to capture levels of posttraumatic growth post trauma (pre intervention) and post intervention, it was evident the pre and post assessment items assessing posttraumatic growth were not assessing the same construct. Therefore, it was not possible to determine the within group differences that occurred over the 8-

week intervention. This highlights the need to modify the Posttraumatic Growth Inventory for future studies that utilize it as an outcome measure in clinical trials.

7.6 CONCLUSIONS

The traumatic effects of a cancer diagnosis have prompted research efforts into promoting positive psychological outcomes for cancer survivors. This dissertation was designed to examine the role of physical activity in promoting posttraumatic growth in gynecologic cancer survivors. The dissertation provides preliminary evidence that exercise is associated with counteracting the negative effects of a cancer diagnosis and its treatments. Furthermore, the finding that exercise growth (e.g., increasing the amount of exercise, trying new exercises or sports, or taking up a physically challenging or higher risk sport or activity) is associated with posttraumatic growth provides valuable information on exercise factors that appear to be necessary to facilitate growth. The GROWTH trial has indicated that a supervised wall climbing intervention in gynecologic cancer survivors appears to be feasible, safe, and enjoyable. Furthermore, the GROWTH trial has provided promising findings suggesting that a wall climbing intervention has the potential to prompt posttraumatic growth in the areas of new possibilities and personal strength. Lastly, the GROWTH trial has revealed that wall climbing improved functional fitness and mental health in gynecologic cancer survivors. Future phase II and III trials are needed to fully explore the potential benefits of wall climbing in gynecologic cancer survivors. Long-term follow up should be incorporated to examine whether the psychosocial and physical benefits are sustained over time.

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Appendix A

Literature Review of Gynecologic Cancer and Physical Activity

GYNECOLOGIC CANCER

Gynecologic cancers result from the uncontrollable growth and spread of abnormal cells which originate in the female reproductive system. Gynecologic cancer includes cervical cancer, endometrial/uterine cancer, ovarian cancer, vaginal cancer and other genital cancer, and vulvar cancer [1]. The three most common gynecologic cancers are ovarian, endometrial, and cervical which will be the focus of this dissertation [1].

OVARIAN CANCER

Overview

Ovarian cancer (i.e., cancer of the ovaries) is the eighth most common incident cancer in Canadian women [2]. An estimated 2,700 new cases of ovarian cancer are projected to be diagnosed in 2014 in Canada [2]. Additionally, it is estimated that 1,750 Canadians will die from ovarian cancer in 2014. [2] The prognosis upon diagnosis is relatively poor with an overall 5-year survival rate of approximately 45% [2]. Staging is completed in accordance with the International Federation of Gynecology and Obstetrics (FIGO) system. Surgical stages range from I (tumor confined to the ovaries) to IV (growth involving one or both ovaries and distant metastases) [3]. There are three distinct subtypes of ovarian cancer: epithelial ovarian cancer, ovarian germ cell tumors, and sex-cord stromal tumors.

Malignant Epithelial Ovarian Tumors

Surface epithelial-stromal tumors originate from the surface epithelium of the ovary and include five major subtypes: serous, mucinous, endometrioid, clear cell, and transitional cell [3]. Tumors are classified as benign if they do not present with exuberant cellular proliferation and invasive behavior; as borderline if there is exuberant cellular proliferation however no invasive behavior; and as malignant if invasive behavior is present [4]. Surface

epithelial-surface tumors account for more than 90% of malignant ovarian tumors and they tend to present most often in women over the age of 50 [4]. The 5-year survival rates for women with Stages I, II, III, and IV diseases are 89%, 66%, 34%, and 18% however, the majority are diagnosed with advanced stage disease as the disease causes few specific symptoms especially when it is localized to the ovary [5].

Ovarian Germ Cell Tumors

Germ cell tumors originate from cells derived from primordial germ cells and tend to develop in young women in their teens and in their early 20s [6]. The 5-year survival rates for women with Stages I, II, III, and IV disease are 98%, 80%, 84%, and 55% [7]. The majority of germ cell tumors are benign however, some are cancerous and may be life threatening. Germ cell tumors account for approximately five percent of all ovarian cancers and include several subtypes including dysgerminomas, endodermal tumors, embryonal carcinomas, polyembryomas, choriocarcinomas, and teratomas [7]. Mixed subtypes of germ cell tumors may also occur.

Sex-Cord Stromal Tumors

Sex cord-stromal tumors account for five percent of all ovarian cancers that originate in connective tissue that holds the ovary together and produces estrogen and progesterone. Sex cord-stromal subtypes include: granulosa stromal cell, gyaandroblastomas, Steroly-Lydid cell tumors, and lipid cell tumors (steroid cell tumors) [8]. Stromal tumors are generally diagnosed in women under the age of 40 and may occur in adolescents and young women [8]. The 5-year survival rates for women with Stages I, II, and III are >90%, 55%, and 25% [6].

Risk factors for ovarian cancer

Although the cause of ovarian cancer is not fully understood many associated risk factors have been identified such as hereditary factors (e.g., family history of ovarian cancer, personal history of breast cancer, BRCA gene mutations, and lynch syndrome), reproductive factors (e.g., advanced age, nulliparity, and infertility), hormonal factors (e.g., early age at menarche, late age at natural menopause, hormone replacement therapy, estrogens, and androgens), inflammatory factors (e.g., perineal talc exposure, endometriosis, and pelvic inflammatory disease), and lifestyle factors (e.g. obesity) [9]. Reproductive (e.g., multiparity and breast feeding) hormonal (e.g., oral contraceptives and progestins), and surgical factors (e.g., hysterectomy and tubal ligation) have been linked to decreased risk of ovarian cancer [9]. Nonetheless fertility drugs, exercise, and cigarette smoking remain as indeterminate factors therefore; future research is warranted to determine if there is a causal relationship [9].

Signs and symptoms

Patients with ovarian cancer may have few or no symptoms making an early clinical diagnosis difficult. Symptoms are most commonly present with advanced disease. The most common symptoms include abdominal or pelvic pain, constipation, diarrhoea, urinary frequency, vaginal bleeding, abdominal distension and fatigue. In advanced stages, ascites and abdominal masses may lead to increased abdominal girth, bloating, nausea, anorexia, dyspepsia and early satiety [10].

Treatment

Treatment of ovarian cancer depends on the type of cancer and the stage of the disease at the time of presentation. The aim of surgery for early ovarian cancer is to undertake adequate staging and debulking. Surgery may involve a total abdominal hysterectomy (i.e., removing the uterus), bilateral salpin-go-oophorectomy (i.e. removing the ovaries and

fallopian tubes), omentectomy (i.e. removing the omentum), retroperitoneal lymph node sampling, inspection under the diaphragms, random biopsies, peritoneal cavity washes, and resecting as much of the tumor as possible (i.e., debulking) [10]. The findings will provide prognostic information and whether chemotherapy is required. In order to preserve childbearing potential, fertility sparing surgery should be considered during early stage-disease.

Neoadjuvant chemotherapy may be considered for patients who present with extensive intra-abdominal disease, when initial debulking surgery is not feasible. Future research is warranted to establish the role of neoadjuvant chemotherapy in this setting. Chemotherapy treatment occurs following surgery for most types and stages of ovarian cancer. Ovarian cancer is highly chemotherapy-sensitive and research indicates that adjuvant treatment has a strong impact on survival. Adjuvant chemotherapy options include intravenous and intraperitoneal chemotherapy [10]. A standard dose regimen includes 3-6 cycles of outpatient IV chemotherapy with a combination of a platinum compound and a taxane [5, 7]. Intraperitoneal chemotherapy involves injecting the drugs cisplatin and paclitaxel into the abdominal cavity through a catheter in addition to receiving the chemo drug paclitaxel intravenously however, this practice is quite rare. Additionally, chemotherapy may be used to relieve pain or control the symptoms of advanced ovarian cancer. Myelosuppression, alopecia, peripheral neuropathy, arthralgias and hypersensitivity reactions are the most commonly observed toxicities associated with ovarian cancer chemotherapy combinations [11]. Nephrotoxicity, ototoxicity, and gastrointestinal toxicities are also common [11].

Radiation therapy is not commonly used to treat ovarian cancer. It may be used post-surgery for women who are unable to receive chemotherapy due to age or a serious health

condition [5]. Additionally, it may be used to relieve pain or control the symptoms of advanced ovarian cancer.

There are a number of side effects that concern ovarian cancer survivors. The ovarian cancer side effects most commonly reported are cognitive changes, gastrointestinal side effects, sexual side effects, peripheral neuropathy, fatigue, and decreased quality of life [12;13].

PA in Ovarian Cancer Survivors

There have been several studies on the role of physical activity and ovarian cancer development however, findings are inconsistent. Given the side effects from surgery and current treatment options of ovarian cancer, health related quality of life has become an important medical outcome among this population. Stevinson et al. [14] examined the associations between physical activity and quality of life in 359 ovarian cancer survivors, and found that those meeting public health guidelines for physical activity had significantly better quality of life than those not meeting guidelines. Furthermore, those meeting guidelines reported lower levels of fatigue, and better scores for happiness, peripheral neuropathy, depression, anxiety, and sleep quality than those who were not meeting guidelines [15]. Beesley et al. [16] evaluated health behaviors and body mass index and their association with quality of life in 802 gynecologic cancer survivors. The findings indicate a positive linear trend of physical activity with quality of life. Given these findings additional research is warranted to gain a comprehensive understanding of the effects of physical activity on quality of life. Posttraumatic growth is a desired outcome for cancer survivors that can dramatically improve quality of life after a cancer diagnosis. It is recommended that ovarian cancer

survivors follow the American College of Sports Medicine exercise guidelines as they may derive physical and psychological health benefits [17].

ENDOMETRIAL CANCER

Overview

Endometrial cancer (i.e. cancer of the lining of the uterus) ranks as the fourth most common cancer in Canadian women [2]. An estimated 6,000 new cases of endometrial cancer are projected to be diagnosed in Canada in 2014, with 920 deaths [2]. The clinical course is quite favorable, with an overall 5-year survival rate of approximately 85% [2]. The majority of cases are in women over the age of 50 with peak incidence between the ages of 55-65 years [18].

There are several histological types of endometrial cancers. Approximately 90% of endometrial cancers are categorized as endometrioid adenocarcinomas which are composed of glands that appear similar to the normal endometrium and can be associated with, or preceded by, endometrial hyperplasia [19]. The remaining 10% of endometrial cancers consist of rare cell types for instance, mixed carcinoma, uterine papillary serous carcinoma, clear cell carcinoma, mucinous carcinoma, squamous cell carcinoma, and undifferentiated carcinoma [18]. Staging is completed in accordance with the International Federation of Gynecology and Obstetrics (FIGO) system. Surgical stages range from IA (tumour limited to the endometrium) to IVB (distant metastases) and assist in determining whether the patient is suitable for operative intervention or primary radiation therapy [18].

Risk factors for endometrial cancer

Risk factors for endometrial cancer are listed in order of importance and include estrogen replacement therapy, obesity, tamoxifen use, nulliparity, early menarche and late menopause.

Signs and symptoms

The most common clinical presentation is abnormal vaginal bleeding [19]. Late signs and symptoms include pain (e.g., lower abdomen, pelvis back, and legs), change in bladder habits (e.g., pain during urination, difficult urination, and blood in the urine), change in bowel habits (e.g., pain during bowel movement, difficult bowel movement, blood in the stool), ascities, weight loss, and weakness [20].

Treatment

Treatment of endometrial cancer depends on the type of cancer and the stage of the disease at the time of presentation [19]. The majority of patients are diagnosed with adenocarcinomas and in the early stages; the standard surgical treatment involves a hysterectomy with bilateral salpingo-oophorectomy with or without lymph node dissection. Whereas papillary serous, clear cell carcinomas, and carcinosarcomas of the uterus require a complex staging procedure which include hysterectomy, bilateral salpingo-oopherctomy, pelvic and para-aortic lymph node dissection, and an omentectomy [18]. Based on the stage of disease, neo-adjuvant/adjuvant therapy may include chemotherapy and/or abdominopelvic radiotherapy with or without vaginal brachytherapy. Recommended systemic therapy includes a combination of carboplatin with paclitaxel as research has indicated better efficacy and less toxicity compared to other regimens [18]. The most frequent dose-limiting events are myelosuppression, neuropathy, hypersensitivity reactions and musculoskeletal effects [21]. The most predominant side effects in uterine cancer survivors include sexual dysfunction,

changes in bowel pattern, changes in cognitive function, changes in skin cosmesis, peripheral neuropathy, a decreased quality of life and psychological symptoms [13, 22].

PA in Endometrial Cancer Survivors

The available evidence suggests that a lack of exercise and obesity are associated with a diminished quality of life in endometrial cancer survivors. Arem et al. investigated the association between baseline body mass index and physical activity with survival in endometrial cancer patients and found that baseline body mass index but not physical activity was associated with survival in women with endometrial cancer survivor [23]. A survey of 386 Alberta endometrial cancer survivors found that lack of exercise and excess body weight were associated with declines in quality of life [24]. Similarly, a survey of 432 pre-obese and obese endometrial cancer survivors found that BMI was associated with several HRQoL outcomes (e.g., decreased physical function, decreased vitality, more lymphoedema symptoms and more fatigue) [25]. Von Gruenigen et al. conducted a randomized controlled trial assessing the feasibility of a lifestyle intervention program aimed at promoting weight loss, change in eating behaviors, and increased physical activity in endometrial cancer survivors [26]. The researchers found that a lifestyle intervention is feasible and can result in behavioral changes and weight loss over the period of 1-year. Given these findings endometrial cancer survivors who are overweight or obese need to make lifestyle changes to increase their quality of life and decrease mortality. It is recommended that endometrial cancer survivors follow the American College of Sports Medicine guidelines for cancer survivors to experience positive physical and psychological health benefits [27].

Cervical Cancer

Cervical cancer is the thirteenth most common cancer in Canadian women [2]. An estimated 1,450 new cases of endometrial cancer will be diagnosed in Canada in 2014, with 380 deaths [2]. The prognosis upon diagnosis is generally favorable as most cases are detected early due to the use of Pap tests. The current overall 5-year survival rate for cervical cancer is approximately 74% [2]. The majority of cases present themselves in women under the age of 50 [28].

There are a number of histological types of cervical cancer which include squamous cell carcinoma, adenocarcinoma, adenosquamous carcinoma, small cell carcinomas, and primary sarcomas of the cervix [28]. Squamous cell carcinomas account for approximately 70% of cervical cancers and adenocarcinomas for approximately 10% [28].

Risk factors for cervical cancer

The primary risk factor for cervical cancer is infection by the human papilloma virus. The human papilloma virus is detected in approximately 99% of all cervical tumors [29]. Other risk factors include: smoking, a weak immune system, birth control pills, and multiple full-term pregnancies [30].

Signs and symptoms

Women with early cervical cancers generally display no symptoms. Symptoms generally do not begin until the cancer becomes invasive. The most common clinical presentation is abnormal vaginal bleeding [29].

Treatment

Dependent on disease stage, primary treatment consists of surgery, radiotherapy, or a combination of radiotherapy and chemotherapy [29]. Surgical procedures may include, cone biopsy, trachelectomy or simple or modified radical hysterectomy, with or without pelvic

lymphadenectomy [28]. Medically fit patients with advanced stage cervical cancer should be considered for treatment with concurrent radiotherapy (pelvic external beam radiation and intracavitary brachytherapy) and chemotherapy [28]. The type of adjuvant therapy will depend on the patients risk factors and may include histology, tumour size, depth of stromal invasion, lymphovascular space invasion, nodal status, parametrial margin, and vaginal margin [28]. The most commonly reported side effects in cervical cancer survivors were sexual dysfunction, changes in cognitive function, peripheral neuropathy and fatigue [13, 31].

PA in Cervical Cancer Survivors

There is insufficient evidence to draw conclusions on a possible role of physical activity in the development of cervical cancer as few studies have been conducted. Cervical cancer survivors should follow guidelines to accumulate at least 150 minutes of moderate-to-vigorous or 60 minutes of vigorous physical activity per week in conjunction with muscle strengthening exercises at least two days per week [32].

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Appendix B

Gynecologic Cancer Survivors Cover Letter (Study 1)

A Study of Health in Gynecologic Cancer Survivors

Dear Madam,

My name is Kerry Courneya and I am a Professor and Canada Research Chair at the University of Alberta. I am also a Scientific Staff member of the Cross Cancer Institute in Edmonton. As part of my responsibilities, I conduct research on physical activity (PA) and cancer. The Alberta Cancer Registry is contacting you on my behalf to see if you might be interested in participating in a survey study which requires the voluntary participation of gynecologic cancer survivors. The study has been approved by the Alberta Cancer Research Ethics Committee and the University of Alberta Health Research Ethics Board, and has met rigorous requirements for ethical approval.

The study is about exploring the potential association between physical activity and physical and mental health in gynecologic cancer survivors. The information gained from this study will be used to help develop physical activity programs to improve health in gynecologic cancer survivors.

To participate in the study, all you need to do is complete the enclosed questionnaire. For this study, you will not be asked to do any PA tests or follow any PA program; just complete the one-time survey that is enclosed. If you agree to participate, please simply complete and return the enclosed questionnaire in the business reply envelope provided. No postage is necessary. The questionnaire should take approximately 45 minutes to complete.

If we have not heard from you in a few weeks, the Alberta Cancer Registry will be sending you a postcard reminder on our behalf and then a second copy of the questionnaire. If you do not wish to participate in the study, simply ignore the materials the Registry will be sending you. Alternatively, you can send us back the unanswered questionnaire in the envelope provided to ensure that the Registry will not send you any further materials about this study.

Your participation in this study is completely voluntary. Any information that you provide will be held in strict confidence. It is only through voluntary participation in research projects that we increase our knowledge about issues that are important to gynecologic cancer survivors, and we hope that you find the time to assist us. If you have any questions about the study, or about completing the questionnaire, please contact my research co-ordinator, Jennifer Crawford, at (780) 492-2829 (call collect from out of town) or e-mail jcrawfor@ualberta.ca.

Thank you for considering our study.
Sincerely,



Kerry S. Courneya, PhD
Professor and Canada Research Chair in PA and Cancer
University of Alberta

Appendix C

Letter from the Alberta Cancer Registry (Study 1)



Dear Sir/Madam:

From time to time on behalf of researchers, the Alberta Cancer Registry contacts individuals who may be eligible for research studies. This letter is to introduce you to a research study being undertaken by an affiliate of the Alberta Health Services. These types of studies *must* be approved by the Alberta Cancer Research Ethics Committee. Information on new cancer cases and cancer-related deaths is recorded in the Alberta Cancer Registry. The Alberta Health Services is mandated by the Regional Health Authorities Act, please read the enclosed letter for further information describing the Registry.

We are enclosing information from a research study that has been recently approved by the Ethics Board and which may be of interest to you. Please note that we have not disclosed any of your personal information to the researchers. We are simply contacting you on their behalf to provide you with an opportunity to participate in a research study. Your participation in this, or any, research study is absolutely voluntary.

Enclosed is some information from the researchers describing the study in order to help you make an informed choice about whether or not you would like to participate. If you are interested in finding out more about the study, please follow the enclosed instructions. If you are not interested in participating, simply ignore the materials that we have sent you or return the unanswered questionnaire in the envelope provided by the researchers.

The Alberta Cancer Registry is very supportive of research studies conducted with its registry, as voluntary participation in research projects helps to improve our knowledge about issues that are important to cancer patients and survivors. We hope that you find time to read the enclosed materials closely and participate in the study if you feel it is of interest to you.

If you have further questions regarding the Alberta Cancer Registry, please call me at (780) 432-8781 or email me at carol.russell@albertahealthservices.ca

Sincerely,

Carol Russell, CHIM
Provincial Manager, Alberta Cancer Registry
Cancer Care, Alberta Health Services
Cross Cancer Institute

Appendix D

Postcard Reminder (Study 1)

A Study of Health in Gynecologic Cancer Survivors

A few weeks ago, the Alberta Cancer Registry sent you a letter inviting you to consider participating in a survey study. This postcard is just a friendly reminder to complete the questionnaire and mail back in the provided business reply envelope to the researcher at your earliest convenience if you are interested.

Thank you in advance for considering our request.

Carol Russell, CHIM
Provincial Manager, Alberta Cancer Registry
Cancer Care, Alberta Health Services
Cross Cancer Institute



Appendix E

Questionnaire for Gynecologic Cancer Survivors (Study 1)

Date Completed: _____

Identification#: _____

A Study of Health in Gynecologic Cancer Survivors

Principal Investigator: Kerry S. Courneya, PhD, University of Alberta

Instructions

In this questionnaire, we are going to ask you a series of questions about yourself. Many of the questions ask about how cancer has affected your life, and some may be viewed as personal. If you feel uncomfortable answering certain questions please leave them blank. All responses are completely confidential and will never be used in any way that could link them to you. Many of the questions may seem similar but it is important to answer each question separately. There are no right or wrong answers and all we ask is that you provide responses that are as honest and accurate as possible. The questionnaire should take about 30-45 minutes to complete. If you have any questions about completing the questionnaire, please contact Jennifer Crawford (Research Coordinator) at (780) 492-2829 (call collect from out of town) or email jcrawfor@ualberta.ca.

This first set of questions ask about how your diagnosis and treatment for gynecologic cancer (ovarian, endometrial, or cervical) may have changed your life. Please circle the number that best represents the **degree to which your life** has changed **as result of being diagnosed and treated for gynecologic cancer**. Please use the following scale to guide your responses.

0	1	2	3	4	5
did not experience this change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree

After being diagnosed and treated for gynecologic cancer...

- | | | | | | | |
|---|---|---|---|---|---|---|
| 1. I changed my priorities about what is important in life. | 0 | 1 | 2 | 3 | 4 | 5 |
| 2. I have a greater appreciation for the value of my own life. | 0 | 1 | 2 | 3 | 4 | 5 |
| 3. I developed new interests. | 0 | 1 | 2 | 3 | 4 | 5 |
| 4. I have a greater feeling of self-reliance. | 0 | 1 | 2 | 3 | 4 | 5 |
| 5. I have a better understanding of spiritual matters. | 0 | 1 | 2 | 3 | 4 | 5 |
| 6. I more clearly see that I can count on people in times of trouble. | 0 | 1 | 2 | 3 | 4 | 5 |
| 7. I established a new path for my life. | 0 | 1 | 2 | 3 | 4 | 5 |
| 8. I have a greater sense of closeness with others. | 0 | 1 | 2 | 3 | 4 | 5 |
| 9. I am more willing to express my emotions. | 0 | 1 | 2 | 3 | 4 | 5 |

0	1	2	3	4	5
did not experience this change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree

After being diagnosed and treated for gynecologic cancer...

- | | | | | | | |
|---|---|---|---|---|---|---|
| 10. I know better that I can handle difficulties. | 0 | 1 | 2 | 3 | 4 | 5 |
| 11. I am able to do better things with my life. | 0 | 1 | 2 | 3 | 4 | 5 |
| 12. I am better able to accept the way things work out. | 0 | 1 | 2 | 3 | 4 | 5 |
| 13. I can better appreciate each day. | 0 | 1 | 2 | 3 | 4 | 5 |
| 14. New opportunities are available which wouldn't have been otherwise. | 0 | 1 | 2 | 3 | 4 | 5 |
| 15. I have more compassion for others. | 0 | 1 | 2 | 3 | 4 | 5 |
| 16. I put more effort into my relationships. | 0 | 1 | 2 | 3 | 4 | 5 |
| 17. I am more likely to try to change things that need changing. | 0 | 1 | 2 | 3 | 4 | 5 |
| 18. I have a stronger religious faith. | 0 | 1 | 2 | 3 | 4 | 5 |
| 19. I discovered that I'm stronger than I thought I was. | 0 | 1 | 2 | 3 | 4 | 5 |
| 20. I learned a great deal about how wonderful people are. | 0 | 1 | 2 | 3 | 4 | 5 |

0	1	2	3	4	5
did not experience this change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree

After being diagnosed and treated for gynecologic cancer...

21. I better accept needing others.
0 1 2 3 4 5
22. I have significantly increased the amount of exercise I do.
0 1 2 3 4 5
23. I have tried new exercises I have never tried before.
0 1 2 3 4 5
24. I have taken up a mind-body exercise such as yoga or tai chi.
0 1 2 3 4 5
25. I have taken up a new sport that I never played before such as tennis or golf.
0 1 2 3 4 5
26. I have taken up a physically challenging activity such as marathon running or triathlon.
0 1 2 3 4 5
27. I have taken up a “high risk” sport or activity such as rock climbing or white water rafting.
0 1 2 3 4 5

This next set of questions also ask about how cancer has impacted your life. We are interested to know how having had cancer NOW affects your body and your health, if at all. **Please circle the number for each statement that best describes how much you agree or disagree with the statement.**

1. I am concerned that my energy has not returned to what it was before I had cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

2. I am bothered that my body cannot do what it could before having had cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

3. I worry about how my body looks.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

4. I feel disfigured.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

5. I sometimes wear clothes to cover up parts of my body that I don't want to see.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

6. I am angry about having had cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

7. I feel guilty for somehow being responsible for getting cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

8. Having had cancer made me feel old.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

9. I feel guilty today for not having been available to my family when I had cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

10. Having had cancer makes me feel unsure about my future.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

11. I worry about my future.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

12. I am afraid to die.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

13. I feel time in my life is running out.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

14. Having to pay attention to my physical health interferes with my life.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

15. Having had cancer keeps me from doing activities I enjoy (e.g socializing, time with family).

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

16. On-going cancer related or treatment related symptoms (examples: bladder or bowel control, lymphedema, hair loss, scars) interfere with my life.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

17. I worry about my health.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

18. I worry about my cancer coming back.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

19. New symptoms (aches, pains, getting sick or the flu) make me worry about the cancer coming back.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

20. I do not take my body for granted since the cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

21. Having had cancer has made me more concerned about my health.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

22. I am more aware of physical problems or changes in my body since having had cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

23. Having had cancer has made me take better care of myself (my health).

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

24. I feel a sense of pride or accomplishment having survived cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

25. I learned something about myself because of having had cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

26. I feel that I am a role model to other people that have had cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

27. Because of cancer I became better at expressing what I want.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

28. Because of cancer I have more confidence in myself.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

29. Because I had cancer I am more understanding of what other people may feel when they are seriously ill.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

30. Having had cancer made me more willing to help others.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

31. I feel I should give something back to others because I survived cancer

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

32. Having had cancer made me realize that time is precious.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

33. Having had cancer has strengthened my religious faith or my sense of spirituality.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

34. I learned something about life because of having had cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

35. I place a higher value on my relationships with my family or friends that I did before having had cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

36. I feel a special bond to people with cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

37. Having had cancer has been the most difficulty experience in my life.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

38. I wonder why I got cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

39. It is important for me to know why I got cancer.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

40. Having had cancer turned into a reason to make changes in my life.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

41. Having had cancer has given me direction in life.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

Below is a list of statements that women with gynecologic cancer may have experienced following their diagnosis. Please indicate the extent to which you have experienced each of the statements following your diagnosis by circling the appropriate number using the following scale.

1	2	3	4
not at all	somewhat	quite a bit	very much

Having been diagnosed with gynecologic cancer:

- | | | | | |
|---|---|---|---|---|
| 1. has showed me that all people need to be loved. | 1 | 2 | 3 | 4 |
| 2. has made me more sensitive to family issues. | 1 | 2 | 3 | 4 |
| 3. has led me to be more accepting of things. | 1 | 2 | 3 | 4 |
| 4. has taught me that everyone has a purpose in life. | 1 | 2 | 3 | 4 |
| 5. has expanded my social contact with other women who have had gynecologic cancer. | 1 | 2 | 3 | 4 |
| 6. has confirmed my faith in God. | 1 | 2 | 3 | 4 |
| 7. has led me to have a larger circle of friends. | 1 | 2 | 3 | 4 |
| 8. has made us more in charge of ourselves as a family. | 1 | 2 | 3 | 4 |
| 9. has encouraged me to attend religious services more frequently. | 1 | 2 | 3 | 4 |
| 10. has made me more aware and concerned for the future of humankind. | 1 | 2 | 3 | 4 |

Having been diagnosed with gynecologic cancer:

	1	2	3	4
	not at all	somewhat	quite a bit	very much
11. has taught me how to adjust to things I cannot change.	1	2	3	4
12. has given my family a sense of continuity, a sense of history.	1	2	3	4
13. has led me to meet people who have become some of my best friends.	1	2	3	4
14. has made me a more responsible person.	1	2	3	4
15. has made me realize the importance of planning for my family's future.	1	2	3	4
16. has given my life better structure.	1	2	3	4
17. has brought my family closer together.	1	2	3	4
18. has made me more productive.	1	2	3	4
19. has helped me take things as they come.	1	2	3	4
20. has helped me be more realistic about my job.	1	2	3	4
21. has helped me budget my time better.	1	2	3	4
22. has made me more grateful for each day.	1	2	3	4

Having been diagnosed with gynecologic cancer:

	1	2	3	4
	not at all	somewhat	quite a bit	very much
23. has taught me to be patient.	1	2	3	4
24. has put me on common ground with other women who have had breast cancer.	1	2	3	4
25. has taught me to control my temper.	1	2	3	4
26. has renewed my interest in participating in different activities.	1	2	3	4
27. has given me a new perspective on my job.	1	2	3	4
28. has inspired me to improve my job skills.	1	2	3	4
29. has been an advantage to my career.	1	2	3	4
30. has led me to cope better with stress and problems.	1	2	3	4

This next set of questions ask about your leisure-time physical activity. Leisure time means activity done during your free time and does not include your work/job or household chores. Physical activity means any activity that results in a substantial increase in energy expenditure (resulting in a noticeable increase in heart rate and breathing rate). Examples of physical activities include brisk walking, jogging, cycling, swimming, and dancing. Please note that from here on out we will use **PA** as a short form for physical activity. For this next question, we would like you to recall your average weekly participation in leisure time PA during the past month.

When answering these questions please:

- ✓ only count PA sessions that lasted 10 minutes or longer in duration.
- ✓ only count PA that was done during free time (i.e., not occupation or housework).
- ✓ note that the main difference between the three categories is the intensity of the exercise.
- ✓ please write the average frequency on the first line and the average duration on the second.
- ✓ if you did not do any PA in one of the categories, please write in “0”.

Considering a typical week (7 days) over the PAST MONTH how many days on average did you do the following kinds of PA and what was the average duration (in minutes)?

	Times Per Week	Average Duration
a. VIGOROUS EXERCISE (HEART BEATS RAPIDLY, SWEATING) (e.g., running, aerobics classes, cross country skiing, vigorous swimming, vigorous bicycling).	_____	_____
b. MODERATE EXERCISE (NOT EXHAUSTING, LIGHT PERSPIRATION) (e.g., fast walking, tennis, easy bicycling, easy swimming, popular and folk dancing).	_____	_____
c. LIGHT EXERCISE (MINIMAL EFFORT, NO PERSPIRATION) (e.g., easy walking, yoga, bowling, lawn bowling, shuffleboard).	_____	_____

The next question asks about two specific types of activities that you may have done. Please provide answers for each of the two specific activities.

(a) **STRENGTH EXERCISES** are defined as physical activity/exercise that increases skeletal muscle strength, power endurance or mass such as strength training, resistance training or muscular strength and endurance. Some examples include weight lifting, sit-ups, push-ups and resistance band exercises.

Have you done any strength exercises in the past month? Yes No

If yes, what type(s) of strength exercise did you do?

How often did you do them? _____ days per week.

How long did they usually take you? _____ minutes each day.

(b) **“EXTREME/ADVENTURE” ACTIVITIES** are defined as high risk or physically challenging activities involving speed, height and/or a high level of physical exertion. Examples include mountaineering, white water rafting, triathlon, marathon, scuba diving, rock climbing, dragon boating and downhill skiing.

Have you participated in any extreme/adventure activities in the past year? Yes No

If yes, what type of extreme/adventure activity (ies) did you do (list all you have done)?

This next question asks about how much time you spend sitting doing various activities on a workday and non-working day. Please use the scale below to guide your responses. On a typical **NON-WORKING DAY (weekend or day off)**, how much time do you spend per day (from when you wake up until you go to bed) doing the following?

	None	15 mins or less	30 mins	1 hour	2 hours	3 hours	4 hours	5 hours	6+
1. watching television (including videos on VCR/DVD)	1	2	3	4	5	6	7	8	9
2. playing computer or video games	1	2	3	4	5	6	7	8	9
3. sitting while listening to music on the radio, tapes, or CDs	1	2	3	4	5	6	7	8	9
4. sitting and talking on the phone	1	2	3	4	5	6	7	8	9
5. doing paperwork or computer work (office work, emails, paying bills, etc.)	1	2	3	4	5	6	7	8	9
6. sitting and reading a book or magazine	1	2	3	4	5	6	7	8	9
7. playing a musical instrument	1	2	3	4	5	6	7	8	9
8. doing arts and crafts	1	2	3	4	5	6	7	8	9
9. sitting and driving/riding in a car, bus, or train	1	2	3	4	5	6	7	8	9

On a typical **WORKDAY (paid or unpaid work)**, how much time do you spend (from when you wake up until you go to bed) doing the following? If you do not work (paid or unpaid), please skip this question.

	None	15 mins or less	30 mins	1 hour	2 hours	3 hours	4 hours	5 hours	6+
1. watching television (including videos on VCR/DVD)	1	2	3	4	5	6	7	8	9
2. playing computer or video games	1	2	3	4	5	6	7	8	9
3. sitting while listening to music on the radio, tapes, or CDs	1	2	3	4	5	6	7	8	9
4. sitting and talking on the phone	1	2	3	4	5	6	7	8	9
5. doing paperwork or computer work (office work, emails, paying bills, etc.)	1	2	3	4	5	6	7	8	9
6. sitting and reading a book or magazine	1	2	3	4	5	6	7	8	9
7. playing a musical instrument	1	2	3	4	5	6	7	8	9
8. doing arts and crafts	1	2	3	4	5	6	7	8	9
9. sitting and driving/riding in a car, bus, or train	1	2	3	4	5	6	7	8	9

This next part of the questionnaire is needed to help understand the medical characteristics of the people participating in the study. For this reason it is very important information. All information is held in strict confidence. Please answer the questions to the best of your knowledge. If you don't know the answer to a question, just circle "don't know" (DK).

1. When were you diagnosed with gynecologic cancer (month/year)? _____ DK

2. Which type of gynecologic cancer were you diagnosed with?

_____ ovarian _____ endometrial _____ cervical

4. Was your cancer described as "localized" (confined to the area) or "metastasized" (spread to other parts of the body) (please circle)?

Localized Metastasized DK

5. Did your treatment include surgery (please circle)? Yes No

6. Did your treatment include radiation therapy (please circle)? Yes No

7. Did your treatment include chemotherapy/drugs (please circle)? Yes No

8. What is the current status of your cancer treatments?

_____ I have completed all my cancer treatments for now.

_____ I am still receiving cancer treatments (If so, what? _____).

9. Have you ever had a recurrence of your cancer? Yes No

10. What is the current status of your cancer?

_____ the doctors have told me that the cancer is gone from my body.

_____ the doctors have told me that I still have some cancer in my body.

This next part of the questionnaire is needed to help understand the demographic characteristics of the people participating in the study. For this reason it is very important information. All information is held in strict confidence and its presentation to the public will be group data only.

1. Age: _____

2. Marital Status:

Never Married _____ Married _____ Common Law _____

Separated _____ Widowed _____ Divorced _____

3. Education (Please check highest level attained):

Some High School _____ Completed High School _____

Some University/College _____ Completed University/College _____

Some Graduate School _____ Completed Graduate School _____

4. Annual Family Income: < 20,000 _____ 20-39,999 _____ 40-59,999 _____
60-79,999 _____ 80-99,999 _____ > 100,000 _____

5. Current Employment Status:

Disability _____ Retired _____ Part Time _____ Homemaker _____
Full Time _____ Temporarily Unemployed _____

6. Height _____ Weight _____

7. What is your primary ethnic origin or race (please circle)?

White Black Hispanic Asian Aboriginal Other _____

8. Do you own a dog? _____ Yes _____ No

The next set of questions asks you about your smoking and diet habits and current health. This information is to help us understand other important health issues. Please provide as honest and accurate responses as possible.

1. Which of the following best describes your current smoking?

Never Smoked Ex-Smoker Occasional Regular Smoker
(smoke every day)

2. Which of the following best describes your current alcohol consumption?

Never Drink Social Drinker Regular Drinker
(drink every day)

3. How would you rate your general health?

Excellent Very Good Good Fair Poor

4. Has a doctor or nurse ever told you that you had any of the following conditions? (check all that apply):

High blood pressure	<input type="checkbox"/> No	<input type="checkbox"/> Yes	High cholesterol	<input type="checkbox"/> No	<input type="checkbox"/> Yes
Heart attack	<input type="checkbox"/> No	<input type="checkbox"/> Yes	Stroke	<input type="checkbox"/> No	<input type="checkbox"/> Yes
Emphysema	<input type="checkbox"/> No	<input type="checkbox"/> Yes	Chronic bronchitis	<input type="checkbox"/> No	<input type="checkbox"/> Yes
Diabetes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	Other cancer	<input type="checkbox"/> No	<input type="checkbox"/> Yes
Angina (chest pains)	<input type="checkbox"/> No	<input type="checkbox"/> Yes	Arthritis	<input type="checkbox"/> No	<input type="checkbox"/> Yes

Any other long term health condition? _____

5. In the past month, was your ability to participate in physical activity limited by a health condition, injury, or disability?

1 2 3 4 5
No, Not at All A Little Somewhat Quite a lot Completely

Would you be interested in participating in a future exercise study? If yes, please provide your contact information. Please note that this does not mean that you have to participate in any future exercise study, it only means that we may contact you to see if you are interested

Please do not contact me about any future exercise study

Sure, you have my permission to contact me about a future exercise study
(please provide contact information below)

Name: _____

Address: _____

Telephone: Home: _____ cell: _____

E-mail: _____

How do you prefer we contact you? _____

When do you prefer we contact you? (days and/or times)

If you were interested in participating in a future exercise study, which type of exercise would you be most interested in trying? Please check all that apply.

Walking

Running

Biking

Weight training

Yoga

Pilates

Would you be interested in trying any “extreme/adventure” type activities? Yes No

If yes, check all that apply:

Wall/rock climbing

Mountaineering (Hiking)

Triathlon

Waterskiing/ Wakeboarding

River rafting

Kayaking

Scuba diving

Mountain biking

Cross country skiing

Downhill skiing

Horseback riding

Other

If other, please specify:

Appendix F

GROWTH Trial Patient Cover Letter (Study 2)

A Study of Wall Climbing and Health in Gynecologic Cancer Survivors

Dear Madam,

My name is Kerry Courneya and I am a Professor and Canada Research Chair at the University of Alberta. I am also a Scientific Staff member of the Cross Cancer Institute in Edmonton. As part of my responsibilities, I conduct research on physical activity in cancer survivors. The Alberta Cancer Registry is contacting you on my behalf to see if you might be interested in a study that I am conducting. The study has been approved by the Health Research Ethics Board of Alberta – Cancer Committee.

As you probably know, exercise has positive effects on the physical and mental health of cancer survivors; however, we don't really know which kinds of exercise programs are best. Some research suggests that "extreme sports or adventure activities" that challenge the person may be more beneficial than standard exercise programs such as walking. To study this question, we are conducting a clinical trial exploring the effects of a wall climbing program on the psychological and physical health of gynecologic cancer survivors, and we would like to invite you to participate in the study.

If you decide to participate in this study, you will be asked to complete two physical fitness tests over a 3-month period which require approximately 2 hours each to complete. You would also then be assigned by chance to either participate in the supervised wall climbing program (i.e., the intervention group) or to continue with your usual exercise levels (i.e., the control group). If you are assigned to the intervention group, we would ask you to complete an 8-week supervised wall climbing program that would meet twice per week for about 2 hours each time at the University of Alberta. The program would be done with other gynecologic cancer survivors and would be led by a highly qualified wall climbing instructor. No prior wall climbing experience is required as this program is for beginners. If you are assigned by chance to the control group, we would offer you a shorter version of the wall climbing program after you have completed the final assessment (i.e., 4 wall climbing sessions over a 2 week period). Your wall climbing instructor, access to the climbing wall, and equipment are available to you free of charge for the 8-week (or 2 week) program. We will also pay for all of your parking when you come for your fitness testing and wall climbing sessions.

Your participation in this study is completely voluntary. Any information that you provide will be held in strict confidence. It is only through voluntary participation in research projects that we increase our knowledge about developing alternative physical activity programs to improve the health and quality of life of gynecologic cancer survivors. We hope that you find the time to assist us. If you would like to participate in this study, or have any questions about the study before deciding, please contact my research co-ordinator, Jennifer Crawford, at (780) 492-2829 or e-mail jcrawfor@ualberta.ca.

Thank you for considering our study.

Sincerely,



Kerry S. Courneya, PhD
Professor and Canada Research Chair in Physical Activity and Cancer, University of Alberta

Appendix G

GROWTH Trial Letter from the Registry (Study 2)

Dear Madam:

From time to time on behalf of researchers, the Alberta Cancer Registry contacts individuals who may be eligible for research studies. This letter is to introduce you to a research study being undertaken by an affiliate of the Alberta Health Services. These types of studies *must* be approved by the Health Research Ethics Board of Alberta-Cancer Committee (HREBA-CC). Information on new cancer cases and cancer-related deaths is recorded in the Alberta Cancer Registry. The Alberta Health Services is mandated by the Regional Health Authorities Act, please read the enclosed letter for further information describing the Registry.

We are enclosing information from a research study that has been recently approved by the Ethics Board and which may be of interest to you. Please note, this is a random sample generated by the computer and your name was selected, however, depending upon your diagnosis, this study may not apply to you. We have not disclosed any of your personal information to the researchers and are simply contacting you on their behalf to provide you with an opportunity to participate in a research study. Your participation in this or any research study is absolutely voluntary. Enclosed is some information from the researchers describing the study in order to help you make an informed choice about whether or not you would like to participate. If you are interested in finding out more about the study, please follow the enclosed instructions. If you are not interested in participating, simply ignore the materials that we have sent you or return the unanswered questionnaire in the envelope provided by the researchers.

The Alberta Cancer Registry is very supportive of research studies conducted with its registry, as voluntary participation in research projects helps to improve our knowledge about issues that are important to cancer patients and survivors. We hope that you find time to read the enclosed materials closely and participate in the study if you feel it is of interest to you.

If you have further questions regarding the Alberta Cancer Registry, please call me at (780) 432-8781 or email me at carol.russell@albertahealthservices.ca

Sincerely,

Carol Russell, CHIM
Director, Alberta Cancer Registry
Cancer Measurement Outcomes & Evaluation
Cancer Care, Alberta Health Services
Cross Cancer Institute

Appendix H

GROWTH Trial Consent Form (Study 2)

Protocol/Study 2015-003 Revision Date: October 15th, 2014

A study to see the feasibility and effects of wall climbing on posttraumatic growth and physical functioning in gynecologic cancer survivors

CONSENT FORM

This form is part of the process of informed consent. It is designed to explain this research study and what will be the process if you choose to be in this study.

If you would like to know more about something mentioned in this consent form, or have any questions at any time regarding this research study, please be sure to contact the Primary Investigator-Dr. Kerry Courneya at (780)-492-1031 or the Research Coordinator-Jennifer Crawford at (780)492-2829. Read this consent form carefully to make sure you understand all the information it provides. You will get a copy of this consent form to keep. You do not have to take part in this study and your care does not depend on whether or not you take part.

Your participation in this study is entirely voluntary. Please take your time to make your decision. It is recommended that you discuss with your friends and/or family about whether to participate in this study.

“WHY IS THIS STUDY BEING DONE?”

You are being asked to take part in this study because you had gynecologic cancer. Research has shown that there is preliminary evidence to suggest a positive relationship exists between extreme/adventure leisure activities and posttraumatic growth (or positive psychological growth). For instance, participation in dragon boating and mountaineering in a sample of breast cancer survivors led to a better quality of life, wellbeing and posttraumatic growth. Findings from the current study will compare the effects of wall climbing on psychological and physical outcomes and may provide added knowledge to this understudied field and lead to alternative types of exercise prescription for those who have a similar diagnosis to you.

This study is being done because currently there are no studies that examine the effects of wall climbing on psychological and physical outcomes in gynecologic cancer survivors. Further, no study is currently being conducted that compares those allocated to wall climbing and usual care on these outcomes.

“WHAT DO WE HOPE TO LEARN?”

We hope to learn if wall climbing results in posttraumatic growth and improved physical functioning in gynecologic cancer survivors, as well as other clinical outcomes.

More specifically, the purpose of this study is to examine whether a twice weekly 8 week wall climbing program is feasible for gynecologic cancer survivors. The primary outcome will be posttraumatic growth. The secondary outcomes will be quality of life, sleep quality, fatigue, depression, cognitive function, cardiorespiratory fitness, physical functioning and muscular strength.

This is a Phase II study which is designed to find out the feasibility and effects of wall climbing program on psychological and physical outcomes in gynecologic cancer survivors.

“WHAT IS INVOLVED IN THIS STUDY?”

In this study, you will be “randomized” to participate in one of the groups described below. Randomization means the treatment that you are assigned will be determined by chance. It is like flipping a coin. Randomization is done by a computer. Neither you nor the researcher will choose which group you will be assigned. You will have an equal chance of being assigned to either group.

Following your initial (baseline) assessments, you will be randomly assigned to the wall climbing program or to usual care: (1) wall climbing twice weekly for 8 weeks or (2) usual care*.

If you are allocated to the wall climbing program you will receive custom wall climbing instruction with a group (8-10/group) of gynecologic cancer survivors. This will be a progressive program and will be customized to each participant’s abilities and skill levels. You do not require any previous rock climbing or wall climbing experience.

*IMPORTANT: If you are assigned to the usual care group you will be asked not to begin a wall climbing program over the upcoming 8 weeks. After post intervention testing is complete you will be offered four introductory wall climbing classes free of charge.

“HOW MANY PEOPLE WILL TAKE PART IN THIS STUDY?”

Overall we hope to recruit about 40 people for this study from Edmonton, Alberta.

“WHAT WILL MY PARTICIPATION INVOLVE?”

If you take part in this study, you will be asked to complete the following tasks:

- You will be required to complete two physical function assessments, one at the beginning (baseline) and one at the end of the physical activity program (at 8 weeks). The physical function assessment should take no longer than 45 minutes to complete, and will consist of chair stands, arm curls, sit and reach and back scratch flexibility tests, walking around an 8-foot course, and walking for 6 minutes.
- Complete two muscular strength tests, one at the beginning (baseline), and one at the end of the physical activity program (at 8 weeks). Your muscular strength will be measured by the

Hand Grip Strength test to measure hand and forearm strength. This assessment will take approximately 5 minutes to complete.

- Complete a flexibility assessment, one at the beginning (baseline), and one at the end of the physical activity program (at 8 weeks). Your flexibility will be assessed by using the Sit and Reach and will measure hamstring and lower back flexibility.
- Complete two body composition assessments, one at the beginning (baseline), and one at the end of the physical activity program (at 8 weeks). Your body composition will be estimated by measurements of height, weight, and circumferences. Height and weight will be obtained using a balance beam scale and stadiometer. Waist and hip circumference will be measured using a tape measure. This assessment will take approximately 5 minutes to complete.
- Complete self-administered questionnaires (which will take about 20-45 minutes each to fill out). The questionnaires will be completed at the beginning of the program (baseline) and, at the end of the program (at 8 weeks).

Type of Assessment	Baseline	Post-Intervention
Muscular Strength	X	X
Anthropometrics	X	X
Flexibility	X	X
Physical Functioning Testing	X	X
Clinical Outcome Questionnaires	X	X

Following your initial (baseline) assessments, you will be randomly assigned as noted above to either the wall climbing group or usual care group.

1) Wall climbing group: If you are randomized to the wall climbing program, you will be asked to partake in a twice weekly 2 hour 8 week wall climbing program. The wall climbing program will be customized to each individual and the level of difficulty will progress over the 8 weeks.

2) Usual care group: If you are randomized to this group, you will be asked to maintain your current level of exercise but avoid partaking in any wall climbing program. Once you have finished the post intervention assessment, you will have the opportunity to receive four free wall climbing sessions.

For all those who are randomized to the wall climbing group, or any of the usual care participants who choose to partake in the free wall climbing sessions post intervention, you will be given a customized and supervised wall climbing program. All fitness testing will take place at the Behavioral Medicine Fitness Center at the University of Alberta. All wall climbing sessions will take place at the University of Alberta’s Physical Activity and **Wellness Center climbing wall**. Wall climbing sessions will be scheduled based on the wall climbing class schedule and your availability.

“HOW LONG WILL I BE INVOLVED IN THE STUDY?”

You may be in this study for as long as 8 weeks.

“WHAT ARE THE SIDE EFFECTS?”

There are a few risks associated with participating in this research. It is possible that some people will experience muscle soreness and fatigue following the fitness testing. This type of response is normal, and generally poses no threat to health. Do not take any over the counter medications without speaking to your doctor first. If the soreness persists more than five days, or might be associated with a muscle or joint injury, participants should see a physician. Some of the side effects of chemotherapy could be made worse with exercise (e.g., fatigue, cardiac problems), but no research has shown this to be the case. These risks will be reduced as much as possible by the attention and careful instruction of research staff and by the fact that your exercise testing will be conducted by certified fitness appraisers and that you are no longer receiving active cancer treatment.

There is some risk associated with the physical function fitness tests. During and immediately after the tests, it is possible to experience symptoms such as abnormal blood pressure, fainting, light-headedness, muscle cramps or strain, nausea, and in very rare cases heart rhythm disturbances or heart attack. While serious risk to healthy participants is highly unlikely, such risks must be acknowledged, and participants must willingly assume the risks associated with very rigorous exercise.

There is a small risk of injury associated with wall climbing. We plan to minimize the risk of injury as much as possible as the University of Alberta climbing wall is staffed by train professionals who will ensure a safe and technically rigorous wall climbing experience.

UNIQUE SIDE EFFECTS/ PRECAUTIONS

There are no unforeseeable special precautions that should be taken other than the side effects listed above.

“WHAT ARE MY RESPONSIBILITIES?”

You must be willing to attend all scheduled study visits and undergo all of the procedures described above. It is very important that you inform the Principle Investigator or Research Coordinator of any side effects or health problems that you may be experiencing as well as any medications (prescribed or holistic) that you are taking while on this study. Additionally, you must be willing to fill out the questionnaires that are part of the study protocol.

“WHAT ARE MY ALTERNATIVES?”

You may choose not to participate in this study and obtain a fitness appraisal and participate in extreme/adventure leisure activity programs from a private organization that would include some of the tests and potentially a wall climbing program similar to that being completed in

this study. We encourage all participants to continue to exercise on their own, even when the study is finished.

“ARE THERE ANY BENEFITS TO PARTICIPATING IN THIS STUDY?”

The benefits to you for participating in this research may include improvements in your fitness level, quality of life, and health. The information you provide may help us understand whether this type of extreme/adventure exercise can improve psychological and physical outcomes in gynecologic cancer survivors.

We understand that there is a significant time commitment to the study, but this is necessary for the successful completion of the research.

“CAN I WITHDRAW FROM THIS STUDY?”

Taking part in this study is voluntary; you may withdraw from the study at any time if you wish to do so. If you decide to stop participating in the study, we encourage you to talk to the research coordinator first. Simply inform the study coordinator of your wish.

Should you decide to withdraw from the study at any time, information collected on you up until that point would still be utilized in this study unless you request to remove the information. The information collected in this study will be used for research and teaching purposes, and to help develop guidelines for helping improve the quality of life and health for people with cancer.

The researchers can take you off the study group early for reasons such as:

- Your cancer comes back.
- Your doctor (general practitioner) feels that you are unable to participate in a physical activity program and/or participate in the follow up fitness testing.

“ARE THERE COSTS TO ME FOR TAKING PART IN THIS STUDY?”

There are no financial costs to you for participating in this study. The quality of life assessments, fitness assessments, body composition assessments, and wall climbing program are free. We will also pay for your parking at the Behavioural Medicine Fitness Centre when you come for your wall climbing sessions as well as your exercise testing. Your wall climbing instructors and wall climbing program are also free.

“WHAT ARE MY RIGHTS AS A PARTICIPANT?”

If you suffer an injury or become ill as a result of participating in this research, you will receive all medical treatments (or services) recommended by your doctors. No compensation will be provided beyond this point. However, it is important to note that nothing said in this consent form alters your legal rights to recover damages (e.g. legal action).

“WILL MY PERSONAL INFORMATION BE KEPT CONFIDENTIAL?”

Identifiable health information will be collected from you during this study. This information may be used by the researchers who are carrying out this study, and may be disclosed to others as described below. Any research proposal to use information that identifies you for a purpose other than this study must be approved in advance by the Health Research Ethics Board of Alberta-Cancer Committee.

Direct access to your identifiable health information collected for this study will be restricted to the researchers who are directly involved in this study except in the following circumstances:

Your identifiable health information may need to be inspected or copied from time to time for quality assurance (to make sure the information being used in the study is accurate) and for data analysis (to do statistical analysis that will not identify you). The following organizations may do this inspection:

- Health Canada, the Canadian regulatory body
- Health Research Ethics Board of Alberta- Cancer Committee

Any disclosure of your identifiable health information will be in accordance with the Alberta Health Information Act. As well, any person from the organizations listed above looking at your records on-site at the Cross Cancer Institute will follow the relevant Alberta Health Services and Health Research Ethics Board of Alberta- Cancer Committee policies and procedures that control these actions. Any disclosure of your identifiable health information to another individual or organization not listed here will need the approval of the Alberta Cancer Research Ethics Committee.

Your identifiable health information collected as part of this study which includes records of your progress and your responses to the questionnaires will be kept confidential. We will be retaining the anonymous data file for a period of 5 years after the completion of the research project. The data will be stored in the Behavioural Medicine Laboratory. This laboratory is secure. If a secondary analysis is planned using the data, appropriate ethical approval will be obtained.

The researchers who are directly involved in your study may share information about you with other researchers, but you will not be identified in that shared information except by a number. The key that indicates what number you have been assigned will be kept secure by the researchers directly involved with your study and will not be released.

Although absolute confidentiality can never be guaranteed, the Alberta Health Services will make every effort to keep your identifiable health information confidential, and to follow the ethical and legal rules about collecting, using and disclosing this information in accordance with the Alberta Health Information Act and other regulatory requirements.

“WHO DO I CALL IF I HAVE QUESTIONS OR PROBLEMS?”

For information about your disease and/or research related injury/illness, you may contact the Principal Investigator Dr. Kerry Courneya at (780) 492-1031 or the Research Coordinator Jennifer Crawford at 780-492-2829, to answer any questions regarding this study.

If the above mentioned individuals have not been able to answer or resolve your questions and/or concerns about this study, or if you feel at any time that you have not been informed to your satisfaction about the risks, benefits, or alternatives to this study, or that you have been encouraged to continue in this study after you wanted to withdraw, you can call the Alberta Health Services Patient Relations Department toll free at 1-855-550-2555.

I have read and understood all of the information in this consent form. I have asked questions, and received answers concerning areas I did not understand. I have had the opportunity to take this consent form home for review and discussion. My consent has not been forced or influenced in any way. I consent to participate in this research study. Upon signing this form I will receive a signed copy of the consent.

(PRINT NAMES CLEARLY)

_____	_____	_____
Name of Patient	Signature of Patient	Date
_____	_____	_____
Name of Person Obtaining Consent	Signature of Person Obtaining Consent	Date

Patient Study Number or Hospital Number: _____

Was the patient assisted during the consent process in one of the ways listed below?
 Yes No

If yes, please check the relevant box and complete the signature space below:

- The consent form was read to the patient, and the person signing below attests that the study was accurately explained to, and apparently understood by the patient.
- The person signing below acted as a translator for the patient during the consent process.

_____	_____
Signature of person assisting In the consent discussion	Date

Please note: More information regarding the assistance provided during the consent process should be noted in the medical record for the patient if applicable.

Appendix I

GROWTH Trial Baseline Questionnaire (Study 2)

Date Completed: _____

Identification#: _____

A Feasibility Study of Wall Climbing in Gynecologic Cancer Survivors Baseline Questionnaire

Principal Investigator: Kerry S. Courneya, PhD, University of Alberta

Instructions

In this questionnaire, we are going to ask you a series of questions about yourself. Many of the questions ask about how cancer has affected your life, and some may be viewed as personal. If you feel uncomfortable answering certain questions please leave them blank. All responses are completely confidential and will never be used in any way that could link them to you. Many of the questions may seem similar but it is important to answer each question separately. There are no right or wrong answers and all we ask is that you provide responses that are as honest and accurate as possible. The questionnaire should take about 30-45 minutes to complete. If you have any questions about completing the questionnaire, please contact Jennifer Crawford (Research Coordinator) at (780) 492-2829 (call collect from out of town) or email jcrawfor@ualberta.ca.

This first set of questions asks about how your diagnosis and treatment for gynecologic cancer (ovarian, endometrial, or cervical) may have changed your life. Please circle the number that best represents the **degree to which your life has changed as result of being diagnosed and treated for gynecologic cancer. Please use the following scale to guide your responses.**

After being diagnosed and treated for gynecologic cancer...

	0	1	2	3	4	5
	did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree
1. I changed my priorities about what is important in life.	0	1	2	3	4	5
2. I have a greater appreciation for the value of my own life.	0	1	2	3	4	5
3. I developed new interests.	0	1	2	3	4	5
4. I have a greater feeling of self-reliance.	0	1	2	3	4	5
5. I have a better understanding of spiritual matters.	0	1	2	3	4	5
6. I more clearly see that I can count on people in times of trouble.	0	1	2	3	4	5
7. I established a new path for my life.	0	1	2	3	4	5
8. I have a greater sense of closeness with others.	0	1	2	3	4	5
9. I am more willing to express my emotions.	0	1	2	3	4	5

After being diagnosed and treated for gynecologic cancer...

	0	1	2	3	4	5
	did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree
10. I know better that I can handle difficulties.	0	1	2	3	4	5
11. I am able to do better things with my life.	0	1	2	3	4	5
12. I am better able to accept the way things work out.	0	1	2	3	4	5
13. I can better appreciate each day.	0	1	2	3	4	5
14. New opportunities are available which wouldn't have been otherwise.	0	1	2	3	4	5
15. I have more compassion for others.	0	1	2	3	4	5
16. I put more effort into my relationships.	0	1	2	3	4	5
17. I am more likely to try to change things that need changing.	0	1	2	3	4	5
18. I have a stronger religious faith.	0	1	2	3	4	5
19. I discovered that I'm stronger than I thought I was.	0	1	2	3	4	5
20. I learned a great deal about how wonderful people are.	0	1	2	3	4	5

After being diagnosed and treated for gynecologic cancer...

	0	1	2	3	4	5
	did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree
21. I better accept needing others.	0	1	2	3	4	5
22. I have significantly increased the amount of exercise I do.	0	1	2	3	4	5
23. I have tried new exercises I have never tried before.	0	1	2	3	4	5
24. I have taken up a mind-body exercise such as yoga or tai chi.	0	1	2	3	4	5
25. I have taken up a new sport that I never played before such as tennis or golf.	0	1	2	3	4	5
26. I have taken up a physically challenging activity such as marathon running or triathlon.	0	1	2	3	4	5
27. I have taken up a “high risk” sport or activity such as rock climbing or white water rafting.	0	1	2	3	4	5

A gynecologic cancer diagnosis may be so powerful for some women that it “shakes their world and leads them to seriously examine core beliefs about the world, other people, themselves, and their future. **Please reflect upon your gynecologic cancer diagnosis and indicate the extent to which it led you to seriously examine each of the following core beliefs.** Please use the following scale to guide your responses.

Because of my gynecologic cancer diagnosis, I seriously examined:

1. The degree to which I believe things that happen to people are fair.
0 1 2 3 4 5

2. The degree to which I believe things that happen to people are controllable.
0 1 2 3 4 5

3. My assumptions concerning why other people think and behave the way that they do.
0 1 2 3 4 5

4. My beliefs about my relationships with other people.
0 1 2 3 4 5

5. My beliefs about my own abilities, strengths and weaknesses.
0 1 2 3 4 5

6. My beliefs about my expectations for my future.
0 1 2 3 4 5

7. My beliefs about the meaning of my life.
0 1 2 3 4 5

8. My spiritual or religious beliefs.
0 1 2 3 4 5

9. My beliefs about my own value or worth as a person.
0 1 2 3 4 5

After a gynecologic cancer diagnosis, people sometimes, but not always, find themselves having thoughts about their experience even though they don't try to think about it. Indicate for the following items how often, if at all, you had the experiences described during the last few weeks. Please use the following scale to guide your responses.

0	1	2	3
Not at all	Rarely	Sometimes	Often

1. I thought about my gynecologic cancer when I did not mean to.

0	1	2	3
---	---	---	---
2. Thoughts about my gynecologic cancer came to mind and I could not stop thinking about them.

0	1	2	3
---	---	---	---
3. Thoughts about my gynecologic cancer distracted me or kept me from being able to concentrate.

0	1	2	3
---	---	---	---
4. I could not keep images or thoughts about my gynecologic cancer from entering my mind.

0	1	2	3
---	---	---	---
5. Thoughts, memories, or images of my gynecologic cancer came to mind even when I did not want them.

0	1	2	3
---	---	---	---
6. Thoughts about my gynecologic cancer caused me to relive my experience.

0	1	2	3
---	---	---	---
7. Reminders of my gynecologic cancer brought back thoughts about my experience.

0	1	2	3
---	---	---	---
8. I found myself automatically thinking about my gynecologic cancer.

0	1	2	3
---	---	---	---
9. Other things kept leading me to think about my gynecologic cancer.

0	1	2	3
---	---	---	---
10. I tried not to think about my gynecologic cancer, but could not keep the thoughts from my mind.

0	1	2	3
---	---	---	---

After a gynecologic cancer diagnosis, people sometimes, but not always, deliberately and intentionally spend time thinking about their experience. Indicate for the following items how often, if at all, you deliberately spent time thinking about your gynecologic cancer diagnosis in the last few weeks. Please use the following scale to guide your responses.

0	1	2	3
Never	Rarely	Sometimes	Often

1. I thought about whether I could find meaning from my gynecologic cancer diagnosis.

0	1	2	3
---	---	---	---
2. I thought about whether changes in my life have come from dealing with my gynecologic cancer diagnosis.

0	1	2	3
---	---	---	---
3. I forced myself to think about my feelings about my gynecologic cancer diagnosis.

0	1	2	3
---	---	---	---
4. I thought about whether I have learned anything as a result of my gynecologic cancer diagnosis.

0	1	2	3
---	---	---	---
5. I thought about whether my gynecologic cancer diagnosis has changed my beliefs about the world.

0	1	2	3
---	---	---	---
6. I thought about what my gynecologic cancer diagnosis might mean for my future.

0	1	2	3
---	---	---	---
7. I thought about whether my relationships with others have changed following my gynecologic cancer diagnosis.

0	1	2	3
---	---	---	---
8. I forced myself to deal with my feelings about my gynecologic cancer diagnosis.

0	1	2	3
---	---	---	---
9. I deliberately thought about how my gynecologic cancer diagnosis had affected me.

0	1	2	3
---	---	---	---
10. I thought about my gynecologic cancer diagnosis and tried to understand what happened.

0	1	2	3
---	---	---	---

In answering the next set of questions think about your current relationship with friends, family members, coworkers, community members, and so on. **To what extent do you agree that each statement describes your current relationships with other people.** Use the following scale to give your opinion. So, for example, if you feel a statement is very true of your current relationships, you would indicate that you “strongly agree”. If you feel a statement clearly does not describe your relationships, you would respond by indicating that you “strongly disagree”.

	1	2	3	4
	Strongly Disagree	Disagree	Agree	Strongly Agree
1. There are people I can depend on to help me if I really need it.	1	2	3	4
2. I feel that I do not have close personal relationships with other people.	1	2	3	4
3. There is no one I can turn to for guidance in times of stress.	1	2	3	4
4. There are people who depend on me for help.	1	2	3	4
5. There are people who enjoy the same social activities I do.	1	2	3	4
6. Other people do not view me as competent.	1	2	3	4
7. I feel personally responsible for the well-being of another person.	1	2	3	4
8. I feel part of a group of people who share my attitudes and beliefs.	1	2	3	4
9. I do not think other people respect my skills and abilities.	1	2	3	4
10. If something went wrong, no one would come to my assistance.	1	2	3	4
11. I have close relationships that provide me with a sense of emotional security and well-being.	1	2	3	4

To what extent do you agree that each statement describes your current relationships with other people:

	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
12. There is someone I could talk to about important decisions in my life.	1	2	3	4
13. I have relationships where my competence and skills are recognized.	1	2	3	4
14. There is no one who shares my interests and concerns.	1	2	3	4
15. There is no one who really relies on me for their well-being.	1	2	3	4
16. There is a trustworthy person I could turn to for advice if I were having problems.	1	2	3	4
17. I feel a strong emotional bond with at least one other person.	1	2	3	4
18. There is no one I can depend on for aid if I really need it.	1	2	3	4
19. There is no one I feel comfortable with to talk about problems.	1	2	3	4
20. There are people who admire my talents and abilities.	1	2	3	4
21. I lack a feeling of intimacy with another person.	1	2	3	4
22. There is no one who likes to do the things I do.	1	2	3	4
23. There are people I can count on in an emergency.	1	2	3	4
24. No one needs me to care for them.	1	2	3	4

This set of questions asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. Answer every question by marking a single answer. If you are unsure about how to answer a question please give the best answer you can.

1. In general, would you say your health is:

1	2	3	4	5
Excellent	Very good	Good	Fair	Poor

2. Compared to one year ago, how would you rate your health in general now?

1	2	3	4	5
Much better now than one year ago	Somewhat better now than one year ago	About the same as one year ago	Somewhat worse now than one year ago	Much worse now than one year ago

3. The following questions are about activities you might do during a typical day. Does your current health limit you in these activities? If so, how much?

	1	2	3
	Yes, limited a lot	Yes, limited a little	No, not limited at all
a. Vigorous Activities , such as running, lifting heavy objects, participating in strenuous sports	1	2	3
b. Moderate Activities , such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
c. Lifting or carrying groceries	1	2	3
d. Climbing several flights of stairs	1	2	3
e. Climbing one flight of stairs	1	2	3
f. Bending, kneeling or stooping	1	2	3
g. Walking more than a mile	1	2	3
h. Walking several hundred yards	1	2	3
i. Walking one hundred yards	1	2	3
j. Bathing or dressing yourself	1	2	3

4. During the past 4 weeks, as a result of your physical health, how much of the time have you experienced any of the following problems with your work or other regular daily activities?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Cut down on the amount of time you spent on work or other activities	1	2	3	4	5
b. Accomplished less than you would like	1	2	3	4	5
c. Were limited in the kind of work or other activities	1	2	3	4	5
d. Had difficulty performing the work or other activities (e.g., it took extra effort)	1	2	3	4	5

5. During the past 4 weeks, as a result of any emotional problems (such as feeling depressed or anxious) how much of the time have you had any of the following problems with your work or other regular daily activities?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Cut down on the amount of time you spent on work or other activities	1	2	3	4	5
b. Accomplished less than you would like	1	2	3	4	5
c. Did work or other activities less carefully than usual .	1	2	3	4	5

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

1	2	3	4	5
Not at all	Slightly	Moderately	Quite a bit	Extremely

7. How much bodily pain have you had during the past 4 weeks?

1	2	3	4	5	6
None	Very mild	Mild	Moderate	Severe	Very severe

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

1	2	3	4	5
Not at all	A little bit	Moderately	Quite a bit	Extremely

9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give one answer that comes closest to the way you have been feeling. **How much of the time during the past 4 weeks...**

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Did you feel full of life?	1	2	3	4	5
b. Have you been very nervous?	1	2	3	4	5
c. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5
d. Have you felt calm and peaceful?	1	2	3	4	5
e. Did you have a lot of energy?	1	2	3	4	5
f. Have you felt downhearted and depressed?	1	2	3	4	5
g. Did you feel worn out?	1	2	3	4	5
h. Have you been happy?	1	2	3	4	5
i. Did you feel tired?	1	2	3	4	5

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

1	2	3	4	5
All of the time	Most of the time	Some of the time	A little of the time	None of the time

11. How TRUE or FALSE is each of the following statements for you?

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
a. I seem to get sick a little easier than other people	1	2	3	4	5
b. I am as healthy as anybody I know	1	2	3	4	5
c. I expect my health to get worse	1		2	3	4
d. My health is excellent	1		2	3	4

The following section asks about any fatigue that you have been feeling. For each of the questions, please indicate the extent to which you have experienced each of the statements during the past 7 days by circling the appropriate number using the following scale.

0	1	2	3	4
not at all	a little bit	somewhat	quite a bit	very much

During the PAST WEEK:

1. I feel fatigued	0	1	2	3	4
2. I feel weak all over	0	1	2	3	4
3. I feel listless (“washed out”)	0	1	2	3	4
4. I feel tired	0	1	2	3	4
5. I have trouble <u>starting</u> things because I am tired	0	1	2	3	4
6. I have trouble <u>finishing</u> things because I am tired	0	1	2	3	4
7. I have energy	0	1	2	3	4
8. I am able to do my usual activities	0	1	2	3	4
9. I need to sleep during the day	0	1	2	3	4
10. I am too tired to eat	0	1	2	3	4
11. I need help doing my usual activities	0	1	2	3	4
12. I am frustrated by being too tired to do the things I want to do	0	1	2	3	4
13. I have to limit my social activity because I am tired	0	1	2	3	4

The following section asks about any endocrine symptoms that you have been feeling. Please indicate the extent to which you have experienced each of the statements during the past 7 days.

0	1	2	3	4
not at all	a little bit	Somewhat	quite a bit	very much

During the PAST WEEK:

1. I have hot flashes	0	1	2	3	4
2. I have cold sweats	0	1	2	3	4
3. I have night sweats	0	1	2	3	4
4. I have vaginal discharge	0	1	2	3	4
5. I have vaginal itching/irritation	0	1	2	3	4
6. I have vaginal bleeding or spotting	0	1	2	3	4
7. I have vaginal dryness	0	1	2	3	4
8. I have pain or discomfort with intercourse	0	1	2	3	4
9. I have lost interest in sex	0	1	2	3	4
10. I have gained weight	0	1	2	3	4
11. I feel lightheaded (dizzy)	0	1	2	3	4
12. I have been vomiting	0	1	2	3	4
13. I have diarrhea	0	1	2	3	4
14. I get headaches	0	1	2	3	4
15. I feel bloated	0	1	2	3	4
16. I have breast sensitivity/tenderness	0	1	2	3	4
17. I have mood swings	0	1	2	3	4
18. I am irritable	0	1	2	3	4
19. I have pain in my joints	0	1	2	3	4

Below is a list of statements concerning how you might have felt or behaved in the past week. Please use the following scale to indicate how often you felt or behaved in these ways in the past week

0	1	2	3
rarely/none of the time (<1 day)	some of the time (1-2 days)	much of time (3-4 days)	most or all of the time (5-7 days)

During the PAST WEEK:

1. I felt depressed.	0	1	2	3
2. I felt that everything I did was an effort.	0	1	2	3
3. My sleep was restless.	0	1	2	3
4. I was happy.	0	1	2	3
5. I felt lonely.	0	1	2	3
6. People were unfriendly.	0	1	2	3
7. I enjoyed life.	0	1	2	3
8. I felt sad.	0	1	2	3
9. I felt that people disliked me.	0	1	2	3
10. I could not get "going".	0	1	2	3

For this next question, we would like you to recall the amount of exercise you have done in the past month.

When answering these questions please:

- only count exercise sessions that lasted 10 minutes or longer in duration.
- only count exercise that was done during free time (i.e., not occupation or housework).
- note that the main difference between the first three categories is the intensity of the endurance (aerobic) exercise, the fourth category is for strength (resistance) exercise,
- please write the average frequency on the first line and the average duration on the second.
- if you did not do any exercise in one of the categories, please write in “0”.

Considering a typical week (7 days) over the PAST MONTH how many days on average did you do the following kinds of PA and what was the average duration (in minutes)?

	Days Per Week	Average Duration
a. VIGOROUS/STRENUOUS EXERCISE (HEART BEATS RAPIDLY, SWEATING) (e.g., running, aerobics classes, cross country skiing, vigorous swimming, vigorous bicycling).	_____	_____
b. MODERATE EXERCISE (NOT EXHAUSTING, LIGHT PERSPIRATION) (e.g., fast walking, tennis, easy bicycling, easy swimming, popular and folk dancing).	_____	_____
c. LIGHT/MILD EXERCISE (MINIMAL EFFORT, NO PERSPIRATION) (e.g., easy walking, yoga, bowling, lawn bowling, shuffleboard).	_____	_____
d. RESISTANCE EXERCISE (e.g., lifting weights, push ups, sit ups).	_____	_____

For this next question we would like you to recall any previous extreme sport/adventure activity participation.

“Extreme Sport/Adventure Activities” are defined as high risk or physically challenging activities involving speed, height, and/or a high level of physical exertion. Examples include mountaineering, white water rafting, triathlon, marathon, scuba diving, rock climbing, dragon boating, and downhill skiing.

1. Prior to your gynecologic cancer diagnosis did you participate in any extreme sport/adventure activities?

Yes No

If yes, please list each extreme sport/adventure activity you have done and how many times you have done them in your life?

Extreme sport/adventure activity	Number of times
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____

2. Since your gynecologic cancer diagnosis have you participated in any extreme sport/adventure activities? Yes No

If yes, how many times have you done each extreme sport/adventure activity (list all you have done)?

Extreme sport/adventure activity	Number of times
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____

3. Prior to you gynecologic cancer diagnosis did you participate in any wall/rock climbing?

Yes No

If yes, how many times have you participated in wall/rock climbing? _____ times

4. Since your gynecologic cancer diagnosis have you participated in any wall/rock climbing?

Yes No

If yes, how often did you participate in wall/rock climbing activities? _____ times

The following questions ask you to rate how you feel about doing the wall-climbing program over the next 8 weeks. For each of the questions, please indicate the number that best represents how you feel by circling the appropriate number using the following scale.

1	2	3	4	5
Not at all	A little bit	Somewhat	Quite a bit	Very much

1. How beneficial do you think it will be for you to do the wall climbing program over the next 8 weeks?

1	2	3	4	5
---	---	---	---	---

2. How enjoyable do you think it will be for you to do the wall climbing program over the next 8 weeks?

1	2	3	4	5
---	---	---	---	---

3. How supportive do you think your family/friends will be of you doing the wall climbing program?

1	2	3	4	5
---	---	---	---	---

4. How motivated are you to do the wall climbing program over the next 8 weeks?

1	2	3	4	5
---	---	---	---	---

5. How difficult do you think it will be for you to do the wall climbing program over the next 8 weeks?

1	2	3	4	5
---	---	---	---	---

6. How novel will it be for you to do the wall climbing program over the next 8 weeks?

1	2	3	4	5
---	---	---	---	---

7. How physically challenging will it be for you to do the wall climbing program over the next 8 weeks ?

1	2	3	4	5
---	---	---	---	---

8. How emotionally demanding will it be for you to do the wall climbing program over the next 8 weeks ?

1	2	3	4	5
---	---	---	---	---

9. How risky will it be for you to do the wall climbing program over the next 8 weeks?

1	2	3	4	5
---	---	---	---	---

We are interested in knowing what, if any, specific benefits you feel the wall climbing program will have for you? (List up to three).

We are also interested in knowing what, if any, specific barriers you feel may make it more difficult for you to participate in the wall climbing program? (List up to three).

We are also interested in know what, if any, specific things may make the wall climbing program more fun and enjoyable for you? (List up to three).

This next part of the questionnaire is needed to help understand the medical characteristics of the people participating in the study. For this reason it is very important information. All information is held in strict confidence. Please answer the questions to the best of your knowledge. If you don't know the answer to a question, just circle "don't know" (DK).

1. When were you diagnosed with gynecologic cancer (month/year)? _____ . DK

2. Which type of gynecologic cancer were you diagnosed with?

_____ ovarian _____ endometrial _____ cervical

4. Was your cancer described as "localized" (confined to the area) or "metastasized" (spread to other parts of the body) (please circle)?

Localized Metastasized DK

5. Did your treatment include surgery (please circle)? Yes No

6. Did your treatment include radiation therapy (please circle)? Yes No

7. Did your treatment include chemotherapy/drugs (please circle)? Yes No

8. What is the current status of your cancer treatments?
_____ I have completed all my cancer treatments for now.
_____ I am still receiving cancer treatments (If so, what? _____).

9. Have you ever had a recurrence of your cancer? Yes No

10. What is the current status of your cancer?
_____ the doctors have told me that the cancer is gone from my body.
_____ the doctors have told me that I still have some cancer in my body.

This next part of the questionnaire is needed to help understand the demographic characteristics of the people participating in the study. For this reason it is very important information. All information is held in strict confidence and its presentation to the public will be group data only.

1. Age: _____

2. Marital Status:

Never Married _____ Married _____ Common Law _____
Separated _____ Widowed _____ Divorced _____

3. Education (Please check highest level attained):

Some High School _____ Completed High School _____
Some University/College _____ Completed University/College _____
Some Graduate School _____ Completed Graduate School _____

4. Annual Family Income(\$): < 20,000 _____ 20,000-39,999 _____ 40,000-59,999 _____
60,000-79,999 _____ 80,000-99,999 _____ > 100,000 _____

5. Current Employment Status:

Disability _____ Retired _____ Part Time _____ Homemaker _____
Full Time _____ Temporarily Unemployed _____

6. Height _____ m Weight _____ kg

7. What is your primary ethnic origin or race (please circle)?

White Black Hispanic Asian Aboriginal Other _____

The next set of questions asks you about your smoking and diet habits and current health. This information is to help us understand other important health issues. Please provide as honest and accurate responses as possible.

1. Which of the following best describes your current smoking?

Never Smoked Ex-Smoker Occasional Regular Smoker (every day)

2. Which of the following best describes your current alcohol consumption?

Never Drink Social Drinker Regular Drinker (drink every day)

3. How would you rate your general health?

Excellent Very Good Good Fair Poor

4. Has a doctor or nurse ever told you that you had any of the following conditions? (check all that apply):

High blood pressure No Yes High cholesterol No Yes

Heart attack No Yes Stroke No Yes

Emphysema No Yes Chronic bronchitis No Yes

Diabetes No Yes Other cancer No Yes

Angina No Yes Arthritis No Yes
(chest pains)

Do you have any other long term health condition?

5. In the past month, was your ability to participate in physical activity limited by a health condition, injury, or disability?

1 2 3 4 5

No, not at all A little Somewhat Quite a lot Completely

Anything else you would like to tell us? On this final page, please feel free to make any comments concerning your gynecologic cancer, your treatments, the questionnaire, the wall climbing program, or anything else you think may be helpful to us. All comments are welcome.

Appendix J

GROWTH Trial Post Intervention Questionnaire for Wall Climbing Group (Study 2)

Date Completed: _____ Identification#: _____

A Feasibility Study of Wall Climbing in Gynecologic Cancer Survivors Postintervention Questionnaire

Principal Investigator: Kerry S. Courneya, PhD, University of Alberta

Instructions

Thank you for your continued participation in this study. At this postintervention assessment, we are going to ask you many of the same questions as in the previous questionnaires. However, it is important to answer these questions based on what you are thinking and feeling right now, and not on how you answered the questions the last time. This will give us important information about how your thoughts and feelings have changed. Many of the questions may seem similar but it is important to treat each question separately and provide an answer for each. Also, if at all possible, it is important to answer all questions. However, if you feel uncomfortable answering certain questions please leave them blank. All responses are completely confidential and will never be used in any way that could link them to you. There are no right or wrong answers and all we ask is that you provide responses that are as honest and accurate as possible. The questionnaire should take about 30-45 minutes of your time to complete. If you have any questions about completing the questionnaire, please contact Jennifer Crawford (Research Coordinator) at (780) 492-2829 (call collect from out of town) or email jcrawfor@ualberta.ca.

This first set of questions asks about how your life has changed over the past three months. Please circle the number that best represents the **degree to which your life** has changed over the past three months. **Please use the following scale to guide your responses.**

0	1	2	3	4	5
did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree

Over the past three months...

- | | | | | | | |
|---|---|---|---|---|---|---|
| 1. I changed my priorities about what is important in life. | 0 | 1 | 2 | 3 | 4 | 5 |
| 2. I have a greater appreciation for the value of my own life. | 0 | 1 | 2 | 3 | 4 | 5 |
| 3. I developed new interests. | 0 | 1 | 2 | 3 | 4 | 5 |
| 4. I have a greater feeling of self-reliance. | 0 | 1 | 2 | 3 | 4 | 5 |
| 5. I have a better understanding of spiritual matters. | 0 | 1 | 2 | 3 | 4 | 5 |
| 6. I more clearly see that I can count on people in times of trouble. | 0 | 1 | 2 | 3 | 4 | 5 |
| 7. I established a new path for my life. | 0 | 1 | 2 | 3 | 4 | 5 |
| 8. I have a greater sense of closeness with others. | 0 | 1 | 2 | 3 | 4 | 5 |
| 9. I am more willing to express my emotions. | 0 | 1 | 2 | 3 | 4 | 5 |

0	1	2	3	4	5
did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree

Over the past three months...

10. I know better I can handle difficulties

0 1 2 3 4 5

11. I am able to do better things with my life.

0 1 2 3 4 5

12. I am better able to accept the way things work out.

0 1 2 3 4 5

13. I can better appreciate each day.

0 1 2 3 4 5

14. New opportunities are available which wouldn't have been otherwise.

0 1 2 3 4 5

15. I have more compassion for others.

0 1 2 3 4 5

16. I put more effort into my relationships.

0 1 2 3 4 5

17. I am more likely to try to change things that need changing.

0 1 2 3 4 5

18. I have a stronger religious faith

0 1 2 3 4 5

19. I discovered that I'm stronger than I thought I was.

0 1 2 3 4 5

0	1	2	3	4	5
did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree

Over the past three months...

20. I learned a great deal about how wonderful people are.

0 1 2 3 4 5

21. I better accept needing others.

0 1 2 3 4 5

22. I have significantly increased the amount of exercise I do.

0 1 2 3 4 5

23. I have tried new exercises I have never tried before.

0 1 2 3 4 5

24. I have taken up a mind-body exercise such as yoga or tai chi.

0 1 2 3 4 5

25. I have taken up a new sport that I never played before such as tennis or golf.

0 1 2 3 4 5

26. I have taken up a physically challenging activity such as marathon running or triathlon.

0 1 2 3 4 5

27. I have taken up a “high risk” sport or activity such as rock climbing or white water rafting.

0 1 2 3 4 5

Please reflex upon the past three months and indicate the extent to which you have seriously examined each of the following core beliefs. Please use the following scale to guide your responses.

0	1	2	3	4	5
did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree

Over the past three months, I seriously examined:

1. The degree to which I believe things that happen to people are fair.

0	1	2	3	4	5
---	---	---	---	---	---
2. The degree to which I believe things that happen to people are controllable.

0	1	2	3	4	5
---	---	---	---	---	---
3. My assumptions concerning why other people think and behave the way that they do.

0	1	2	3	4	5
---	---	---	---	---	---
4. My beliefs about my relationships with other people.

0	1	2	3	4	5
---	---	---	---	---	---
5. My beliefs about my own abilities, strengths and weaknesses.

0	1	2	3	4	5
---	---	---	---	---	---
6. My beliefs about my expectations for my future.

0	1	2	3	4	5
---	---	---	---	---	---
7. My beliefs about the meaning of my life.

0	1	2	3	4	5
---	---	---	---	---	---
8. My spiritual or religious beliefs.

0	1	2	3	4	5
---	---	---	---	---	---
9. My beliefs about my own value or worth as a person.

0	1	2	3	4	5
---	---	---	---	---	---

After a gynecologic cancer diagnosis, people sometimes, but not always, find themselves having thoughts about their experience even though they don't try to think about it. Indicate for the following items how often, if at all, you had the experiences described over the past three months. Please use the following scale to guide your responses.

0	1	2	3
Not at all	Rarely	Sometimes	Often

Over the past three months...

1. I thought about my gynecologic cancer when I did not mean to.

0	1	2	3
---	---	---	---

2. Thoughts about my gynecologic cancer came to mind and I could not stop thinking about them.

0	1	2	3
---	---	---	---

3. Thoughts about my gynecologic cancer distracted me or kept me from being able to concentrate.

0	1	2	3
---	---	---	---

4. I could not keep images or thoughts about my gynecologic cancer from entering my mind.

0	1	2	3
---	---	---	---

5. Thoughts, memories, or images of my gynecologic cancer came to mind even when I did not want them.

0	1	2	3
---	---	---	---

6. Thoughts about my gynecologic cancer caused me to relive my experience.

0	1	2	3
---	---	---	---

7. Reminders of my gynecologic cancer brought back thoughts about my experience.

0	1	2	3
---	---	---	---

8. I found myself automatically thinking about my gynecologic cancer.

0	1	2	3
---	---	---	---

9. Other things kept leading me to think about my gynecologic cancer.

0	1	2	3
---	---	---	---

10. I tried not to think about my gynecologic cancer, but could not keep the thoughts from my mind.

0	1	2	3
---	---	---	---

After a gynecologic cancer diagnosis, people sometimes, but not always, deliberately and intentionally spend time thinking about their experience. Indicate for the following items how often, if at all, you deliberately spent time thinking about your gynecologic cancer diagnosis over the past three months. Please use the following scale to guide your responses.

	0	1	2	3
	Never	Rarely	Sometimes	Often
1. I thought about whether I could find meaning from my gynecologic cancer diagnosis.	0	1	2	3
2. I thought about whether changes in my life have come from dealing with my gynecologic cancer diagnosis.	0	1	2	3
3. I forced myself to think about my feelings about my gynecologic cancer diagnosis.	0	1	2	3
4. I thought about whether I have learned anything as a result of my gynecologic cancer diagnosis.	0	1	2	3
5. I thought about whether my gynecologic cancer diagnosis has changed my beliefs about the world.	0	1	2	3
6. I thought about what my gynecologic cancer diagnosis might mean for my future.	0	1	2	3
7. I thought about whether my relationships with others have changed following my gynecologic cancer diagnosis.	0	1	2	3
8. I forced myself to deal with my feelings about my gynecologic cancer diagnosis.	0	1	2	3
9. I deliberately thought about how my gynecologic cancer diagnosis had affected me.	0	1	2	3
10. I thought about my gynecologic cancer diagnosis and tried to understand what happened.	0	1	2	3

In answering the next set of questions think about your current relationship with friends, family members, coworkers, community members, and so on. **To what extent do you agree that each statement describes your current relationships with other people.** Use the following scale to give your opinion. So, for example, if you feel a statement is very true of your current relationships, you would indicate that you “strongly agree”. If you feel a statement clearly does not describe your relationships, you would respond by indicating that you “strongly disagree”.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

1. There are people I can depend on to help me if I really need it.

1	2	3	4
---	---	---	---

2. I feel that I do not have close personal relationships with other people.

1	2	3	4
---	---	---	---

3. There is no one I can turn to for guidance in times of stress.

1	2	3	4
---	---	---	---

4. There are people who depend on me for help.

1	2	3	4
---	---	---	---

5. There are people who enjoy the same social activities I do.

1	2	3	4
---	---	---	---

6. Other people do not view me as competent.

1	2	3	4
---	---	---	---

7. I feel personally responsible for the well-being of another person.

1	2	3	4
---	---	---	---

8. I feel part of a group of people who share my attitudes and beliefs.

1	2	3	4
---	---	---	---

9. I do not think other people respect my skills and abilities.

1	2	3	4
---	---	---	---

10. If something went wrong, no one would come to my assistance.

1	2	3	4
---	---	---	---

11. I have close relationships that provide me with a sense of emotional security and well-being.

1	2	3	4
---	---	---	---

To what extent do you agree that each statement describes your current relationships with other people:

	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
12. There is someone I could talk to about important decisions in my life.	1	2	3	4
13. I have relationships where my competence and skills are recognized.	1	2	3	4
14. There is no one who shares my interests and concerns.	1	2	3	4
15. There is no one who really relies on me for their well-being.	1	2	3	4
16. There is a trustworthy person I could turn to for advice if I were having problems.	1	2	3	4
17. I feel a strong emotional bond with at least one other person.	1	2	3	4
18. There is no one I can depend on for aid if I really need it.	1	2	3	4
19. There is no one I feel comfortable with to talk about problems.	1	2	3	4
20. There are people who admire my talents and abilities.	1	2	3	4
21. I lack a feeling of intimacy with another person.	1	2	3	4
22. There is no one who likes to do the things I do.	1	2	3	4
23. There are people I can count on in an emergency.	1	2	3	4
24. No one needs me to care for them.	1	2	3	4

This set of questions asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. Answer every question by marking a single answer. If you are unsure about how to answer a question please give the best answer you can.

1. In general, would you say your health is:

1	2	3	4	5
Excellent	Very good	Good	Fair	Poor

2. Compared to one year ago, how would you rate your health in general now?

1	2	3	4	5
Much better now than one year ago	Somewhat better now than one year ago	About the same as one year ago	Somewhat worse now than one year ago	Much worse now than one year ago

3. The following questions are about activities you might do during a typical day. Does your current health limit you in these activities? If so, how much?

	1	2	3
	Yes, limited a lot	Yes, limited a little	No, not limited at all
a. Vigorous Activities , such as running, lifting heavy objects, participating in strenuous sports	1	2	3
b. Moderate Activities , such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
c. Lifting or carrying groceries	1	2	3
d. Climbing several flights of stairs	1	2	3
e. Climbing one flight of stairs	1	2	3
f. Bending, kneeling or stooping	1	2	3
g. Walking more than a mile	1	2	3
h. Walking several hundred yards	1	2	3
i. Walking one hundred yards	1	2	3
j. Bathing or dressing yourself	1	2	3

4. During the past 4 weeks, as a result of your physical health, how much of the time have you experienced any of the following problems with your work or other regular daily activities?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Cut down on the amount of time you spent on work or other activities	1	2	3	4	5
b. Accomplished less than you would like	1	2	3	4	5
c. Were limited in the kind of work or other activities	1	2	3	4	5
d. Had difficulty performing the work or other activities (e.g., it took extra effort)	1	2	3	4	5

5. During the past 4 weeks, as a result of any emotional problems (such as feeling depressed or anxious) how much of the time have you had any of the following problems with your work or other regular daily activities?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Cut down on the amount of time you spent on work or other activities	1	2	3	4	5
b. Accomplished less than you would like	1	2	3	4	5
c. Did work or other activities less carefully than usual .	1	2	3	4	5

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

1	2	3	4	5
Not at all	Slightly	Moderately	Quite a bit	Extremely

7. How much bodily pain have you had during the past 4 weeks?

1	2	3	4	5	6
None	Very mild	Mild	Moderate	Severe	Very severe

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

1	2	3	4	5
Not at all	A little bit	Moderately	Quite a bit	Extremely

9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give one answer that comes closest to the way you have been feeling. **How much of the time during the past 4 weeks...**

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Did you feel full of life?	1	2	3	4	5
b. Have you been very nervous?	1	2	3	4	5
c. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5
d. Have you felt calm and peaceful?	1	2	3	4	5
e. Did you have a lot of energy?	1	2	3	4	5
f. Have you felt downhearted and depressed?	1	2	3	4	5
g. Did you feel worn out?	1	2	3	4	5
h. Have you been happy?	1	2	3	4	5
i. Did you feel tired?	1	2	3	4	5

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

1	2	3	4	5
All of the time	Most of the time	Some of the time	A little of the time	None of the time

11. How TRUE or FALSE is each of the following statements for you?

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
a. I seem to get sick a little easier than other people	1	2	3	4	5
b. I am as healthy as anybody I know	1	2	3	4	5
c. I expect my health to get worse	1	2	3	4	5
d. My health is excellent	1	2	3	4	5

The following section asks about any fatigue that you have been feeling. For each of the questions, please indicate the extent to which you have experienced each of the statements during the past 7 days by circling the appropriate number using the following scale.

0	1	2	3	4
not at all	a little bit	somewhat	quite a bit	very much

During the PAST WEEK:

- | | | | | | |
|---|---|---|---|---|---|
| 1. I feel fatigued | 0 | 1 | 2 | 3 | 4 |
| 2. I feel weak all over | 0 | 1 | 2 | 3 | 4 |
| 3. I feel listless (“washed out”) | 0 | 1 | 2 | 3 | 4 |
| 4. I feel tired | 0 | 1 | 2 | 3 | 4 |
| 5. I have trouble <u>starting</u> things because I am tired | 0 | 1 | 2 | 3 | 4 |
| 6. I have trouble <u>finishing</u> things because I am tired | 0 | 1 | 2 | 3 | 4 |
| 7. I have energy | 0 | 1 | 2 | 3 | 4 |
| 8. I am able to do my usual activities | 0 | 1 | 2 | 3 | 4 |
| 9. I need to sleep during the day | 0 | 1 | 2 | 3 | 4 |
| 10. I am too tired to eat | 0 | 1 | 2 | 3 | 4 |
| 11. I need help doing my usual activities | 0 | 1 | 2 | 3 | 4 |
| 12. I am frustrated by being too tired to do
the things I want to do | 0 | 1 | 2 | 3 | 4 |
| 13. I have to limit my social activity because I am tired | 0 | 1 | 2 | 3 | 4 |

The following section asks about any endocrine symptoms that you have been feeling. Please indicate the extent to which you have experienced each of the statements during the past 7 days.

	0	1	2	3	4
	not at all	a little bit	Somewhat	quite a bit	very much
During the <u>PAST WEEK</u>:					
1. I have hot flashes				0	1 2 3 4
2. I have cold sweats				0	1 2 3 4
3. I have night sweats				0	1 2 3 4
4. I have vaginal discharge				0	1 2 3 4
5. I have vaginal itching/irritation				0	1 2 3 4
6. I have vaginal bleeding or spotting				0	1 2 3 4
7. I have vaginal dryness				0	1 2 3 4
8. I have pain or discomfort with intercourse				0	1 2 3 4
9. I have lost interest in sex				0	1 2 3 4
10. I have gained weight				0	1 2 3 4
11. I feel lightheaded (dizzy)				0	1 2 3 4
12. I have been vomiting				0	1 2 3 4
13. I have diarrhea				0	1 2 3 4
14. I get headaches				0	1 2 3 4
15. I feel bloated				0	1 2 3 4
16. I have breast sensitivity/tenderness				0	1 2 3 4
17. I have mood swings				0	1 2 3 4
18. I am irritable				0	1 2 3 4
19. I have pain in my joints				0	1 2 3 4

Below is a list of statements concerning how you might have felt or behaved in the past week. Please use the following scale to indicate how often you felt or behaved in these ways in the past week

0	1	2	3
rarely/none of the time (<1 day)	some of the time (1-2 days)	much of time (3-4 days)	most or all of the time (5-7 days)

During the PAST WEEK:

1. I felt depressed.	0	1	2	3
2. I felt that everything I did was an effort.	0	1	2	3
3. My sleep was restless.	0	1	2	3
4. I was happy.	0	1	2	3
5. I felt lonely.	0	1	2	3
6. People were unfriendly.	0	1	2	3
7. I enjoyed life.	0	1	2	3
8. I felt sad.	0	1	2	3
9. I felt that people disliked me.	0	1	2	3
10. I could not get "going".	0	1	2	3

For this next question, we would like you to recall the amount of exercise you have done in the past 8 weeks. Please **exclude** the time you spent wall climbing.

When answering these questions please:

- only count exercise sessions that lasted 10 minutes or longer in duration.
- only count exercise that was done during free time (i.e., not occupation or housework).
- note that the main difference between the first three categories is the intensity of the endurance (aerobic) exercise, the fourth category is for strength (resistance) exercise,
- please write the average frequency on the first line and the average duration on the second.
- if you did not do any exercise in one of the categories, please write in “0”.

Considering a typical week (7 days) over the PAST 8 WEEKS how many days on average did you do the following kinds of PA and what was the average duration (in minutes)? (Not including wall climbing)

	Days Per Week	Average Duration
a. VIGOROUS/STRENUOUS EXERCISE (HEART BEATS RAPIDLY, SWEATING) (e.g., running, aerobics classes, cross country skiing, vigorous swimming, vigorous bicycling).	_____	_____
b. MODERATE EXERCISE (NOT EXHAUSTING, LIGHT PERSPIRATION) (e.g., fast walking, tennis, easy bicycling, easy swimming, popular and folk dancing).	_____	_____
c. LIGHT/MILD EXERCISE (MINIMAL EFFORT, NO PERSPIRATION) (e.g., easy walking, yoga, bowling, lawn bowling, shuffleboard).	_____	_____
d. RESISTANCE EXERCISE (e.g., lifting weights, push ups, sit ups).	_____	_____

We are also interested to know what effect, if any, the wall climbing program had on each of the following items. Please use the scale below to guide your responses.

0	1	2	3	4	5
did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree

After participating in the wall climbing program...

16. I experienced a greater appreciation for life.

0 1 2 3 4 5

17. I experienced better interpersonal relationships with friends and family.

0 1 2 3 4 5

18. I experienced an increased sense of personal strength.

0 1 2 3 4 5

19. I recognized that there are new possibilities in my life.

0 1 2 3 4 5

20. I experienced increased spiritual development and mindfulness.

0 1 2 3 4 5

This next set of questions relate to how you felt about taking part in this study. Please answer each one as honestly as possible using the following scale:

1	2	3	4	5
not at all	a little bit	somewhat	quite a bit	very much

1. How beneficial was the wall climbing program for you?

1	2	3	4	5
---	---	---	---	---

2. How enjoyable was the wall climbing program for you?

1	2	3	4	5
---	---	---	---	---

3. How supportive were your family/friends of you doing the wall climbing program?

1	2	3	4	5
---	---	---	---	---

4. How motivated were you to do the wall climbing program?

1	2	3	4	5
---	---	---	---	---

5. How difficult was it for you to do the wall climbing program?

1	2	3	4	5
---	---	---	---	---

6. How novel was the wall climbing program for you?

1	2	3	4	5
---	---	---	---	---

7. How physically challenging was the wall climbing program for you?

1	2	3	4	5
---	---	---	---	---

8. How emotionally demanding was the wall climbing program for you?

1	2	3	4	5
---	---	---	---	---

11. How risky did you feel the wall climbing program was for you?

1	2	3	4	5
---	---	---	---	---

We are interested in knowing what, if any, specific benefits you experienced from participating in the wall climbing program? (List up to three).

We are also interested in knowing what, if any, specific barriers you experienced that made it more difficult for you to participate in the wall climbing program? (List up to three).

We are also interested in knowing what, if any, specific factors made the wall climbing program more fun and enjoyable for you? (List up to three).

Anything else you would like to tell us? On this final page, please feel free to make any comments concerning your gynecologic cancer, your treatments, the questionnaire, the wall climbing program, or anything else you think may be helpful. All comments are welcome.

Any suggestions on how to improve the wall climbing program?

Appendix K

GROWTH Trial Post Intervention Questionnaire for Control Group (Study 2)

Date Completed: _____ Identification#: _____

A Feasibility Study of Wall Climbing in Gynecologic Cancer Survivors Postintervention Questionnaire

Principal Investigator: Kerry S. Courneya, PhD, University of Alberta

Instructions

Thank you for your continued participation in this study. At this postintervention assessment, we are going to ask you many of the same questions as in the previous questionnaires. However, it is important to answer these questions based on what you are thinking and feeling right now, and not on how you answered the questions the last time. This will give us important information about how your thoughts and feelings have changed. Many of the questions may seem similar but it is important to treat each question separately and provide an answer for each. Also, if at all possible, it is important to answer all questions. However, if you feel uncomfortable answering certain questions please leave them blank. All responses are completely confidential and will never be used in any way that could link them to you. There are no right or wrong answers and all we ask is that you provide responses that are as honest and accurate as possible. The questionnaire should take about 30-45 minutes of your time to complete. If you have any questions about completing the questionnaire, please contact Jennifer Crawford (Research Coordinator) at (780) 492-2829 (call collect from out of town) or email jcrawfor@ualberta.ca.

This first set of questions asks about how your life has changed over the past three months. Please circle the number that best represents the **degree to which your life** has changed **over the past three months**. Please use the following scale to guide your responses.

0	1	2	3	4	5
did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree

Over the past three months...

1. I changed my priorities about what is important in life.

0 1 2 3 4 5

2. I have a greater appreciation for the value of my own life.

0 1 2 3 4 5

3. I developed new interests.

0 1 2 3 4 5

4. I have a greater feeling of self-reliance.

0 1 2 3 4 5

5. I have a better understanding of spiritual matters.

0 1 2 3 4 5

6. I more clearly see that I can count on people in times of trouble.

0 1 2 3 4 5

7. I established a new path for my life.

0 1 2 3 4 5

8. I have a greater sense of closeness with others.

0 1 2 3 4 5

9. I am more willing to express my emotions.

0 1 2 3 4 5

	0	1	2	3	4	5
	did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree
10. I know better that I can handle difficulties.	0	1	2	3	4	5
11. I am able to do better things with my life.	0	1	2	3	4	5
12. I am better able to accept the way things work out.	0	1	2	3	4	5
13. I can better appreciate each day.	0	1	2	3	4	5
14. New opportunities are available which wouldn't have been otherwise.	0	1	2	3	4	5
15. I have more compassion for others.	0	1	2	3	4	5
16. I put more effort into my relationships.	0	1	2	3	4	5
17. I am more likely to try to change things that need changing.	0	1	2	3	4	5
18. I have a stronger religious faith	0	1	2	3	4	5
19. I discovered that I'm stronger than I thought I was.	0	1	2	3	4	5

0	1	2	3	4	5
did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree

Over the past three months...

20. I learned a great deal about how wonderful people are.

0 1 2 3 4 5

21. I better accept needing others.

0 1 2 3 4 5

22. I have significantly increased the amount of exercise I do.

0 1 2 3 4 5

23. I have tried new exercises I have never tried before.

0 1 2 3 4 5

24. I have taken up a mind-body exercise such as yoga or tai chi.

0 1 2 3 4 5

25. I have taken up a new sport that I never played before such as tennis or golf.

0 1 2 3 4 5

26. I have taken up a physically challenging activity such as marathon running or triathlon.

0 1 2 3 4 5

27. I have taken up a “high risk” sport or activity such as rock climbing or white water rafting.

0 1 2 3 4 5

Please reflect upon the past three months and indicate **the extent to which you have seriously examined each of the following core beliefs. Please use the following scale to guide your responses.**

0	1	2	3	4	5
did not experience a change	changed to a very small degree	changed to a small degree	changed to a moderate degree	changed to a great degree	changed to a very great degree

Over the past three months, I seriously examined:

1. The degree to which I believe things that happen to people are fair.

0	1	2	3	4	5
---	---	---	---	---	---

2. The degree to which I believe things that happen to people are controllable.

0	1	2	3	4	5
---	---	---	---	---	---

3. My assumptions concerning why other people think and behave the way that they do.

0	1	2	3	4	5
---	---	---	---	---	---

4. My beliefs about my relationships with other people.

0	1	2	3	4	5
---	---	---	---	---	---

5. My beliefs about my own abilities, strengths and weaknesses.

0	1	2	3	4	5
---	---	---	---	---	---

6. My beliefs about my expectations for my future.

0	1	2	3	4	5
---	---	---	---	---	---

7. My beliefs about the meaning of my life.

0	1	2	3	4	5
---	---	---	---	---	---

8. My spiritual or religious beliefs.

0	1	2	3	4	5
---	---	---	---	---	---

9. My beliefs about my own value or worth as a person.

0	1	2	3	4	5
---	---	---	---	---	---

After a gynecologic cancer diagnosis, people sometimes, but not always, find themselves having thoughts about their experience even though they don't try to think about it. Indicate for the following items how often, if at all, you had the experiences described over the past three months. Please use the following scale to guide your responses.

	0	1	2	3
	Not at all	Rarely	Sometimes	Often
Over the past three months...				
1. I thought about my gynecologic cancer when I did not mean to.	0	1	2	3
2. Thoughts about my gynecologic cancer came to mind and I could not stop thinking about them.	0	1	2	3
3. Thoughts about my gynecologic cancer distracted me or kept me from being able to concentrate.	0	1	2	3
4. I could not keep images or thoughts about my gynecologic cancer from entering my mind.	0	1	2	3
5. Thoughts, memories, or images of my gynecologic cancer came to mind even when I did not want them.	0	1	2	3
6. Thoughts about my gynecologic cancer caused me to relive my experience.	0	1	2	3
7. Reminders of my gynecologic cancer brought back thoughts about my experience.	0	1	2	3
8. I found myself automatically thinking about my gynecologic cancer.	0	1	2	3
9. Other things kept leading me to think about my gynecologic cancer.	0	1	2	3
10. I tried not to think about my gynecologic cancer, but could not keep the thoughts from my mind.	0	1	2	3

After a gynecologic cancer diagnosis, people sometimes, but not always, deliberately and intentionally spend time thinking about their experience. Indicate for the following items how often, if at all, you deliberately spent time thinking about your gynecologic cancer diagnosis over the past three months. Please use the following scale to guide your responses.

0	1	2	3
Never	Rarely	Sometimes	Often

Over the past three months...

- | | | | | | |
|-----|--|---|---|---|---|
| 1. | I thought about whether I could find meaning from my gynecologic cancer diagnosis. | 0 | 1 | 2 | 3 |
| 2. | I thought about whether changes in my life have come from dealing with my gynecologic cancer diagnosis. | 0 | 1 | 2 | 3 |
| 3. | I forced myself to think about my feelings about my gynecologic cancer diagnosis. | 0 | 1 | 2 | 3 |
| 4. | I thought about whether I have learned anything as a result of my gynecologic cancer diagnosis. | 0 | 1 | 2 | 3 |
| 5. | I thought about whether my gynecologic cancer diagnosis has changed my beliefs about the world. | 0 | 1 | 2 | 3 |
| 6. | I thought about what my gynecologic cancer diagnosis might mean for my future. | 0 | 1 | 2 | 3 |
| 7. | I thought about whether my relationships with others have changed following my gynecologic cancer diagnosis. | 0 | 1 | 2 | 3 |
| 8. | I forced myself to deal with my feelings about my gynecologic cancer diagnosis. | 0 | 1 | 2 | 3 |
| 9. | I deliberately thought about how my gynecologic cancer diagnosis had affected me. | 0 | 1 | 2 | 3 |
| 10. | I thought about my gynecologic cancer diagnosis and tried to understand what happened. | 0 | 1 | 2 | 3 |

In answering the next set of questions think about your current relationship with friends, family members, coworkers, community members, and so on. **To what extent do you agree that each statement describes your current relationships with other people.** Use the following scale to give your opinion. So, for example, if you feel a statement is very true of your current relationships, you would indicate that you “strongly agree”. If you feel a statement clearly does not describe your relationships, you would respond by indicating that you “strongly disagree”.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

- | | | | | |
|---|---|---|---|---|
| 1. There are people I can depend on to help me if I really need it. | 1 | 2 | 3 | 4 |
| 2. I feel that I do not have close personal relationships with other people. | 1 | 2 | 3 | 4 |
| 3. There is no one I can turn to for guidance in times of stress. | 1 | 2 | 3 | 4 |
| 4. There are people who depend on me for help. | 1 | 2 | 3 | 4 |
| 5. There are people who enjoy the same social activities I do. | 1 | 2 | 3 | 4 |
| 6. Other people do not view me as competent. | 1 | 2 | 3 | 4 |
| 7. I feel personally responsible for the well-being of another person. | 1 | 2 | 3 | 4 |
| 8. I feel part of a group of people who share my attitudes and beliefs. | 1 | 2 | 3 | 4 |
| 9. I do not think other people respect my skills and abilities. | 1 | 2 | 3 | 4 |
| 10. If something went wrong, no one would come to my assistance. | 1 | 2 | 3 | 4 |
| 11. I have close relationships that provide me with a sense of emotional security and well-being. | 1 | 2 | 3 | 4 |

To what extent do you agree that each statement describes your current relationships with other people:

	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
12. There is someone I could talk to about important decisions in my life.	1	2	3	4
13. I have relationships where my competence and skills are recognized.	1	2	3	4
14. There is no one who shares my interests and concerns.	1	2	3	4
15. There is no one who really relies on me for their well-being.	1	2	3	4
16. There is a trustworthy person I could turn to for advice if I were having problems.	1	2	3	4
17. I feel a strong emotional bond with at least one other person.	1	2	3	4
18. There is no one I can depend on for aid if I really need it.	1	2	3	4
19. There is no one I feel comfortable with to talk about problems.	1	2	3	4
20. There are people who admire my talents and abilities.	1	2	3	4
21. I lack a feeling of intimacy with another person.	1	2	3	4
22. There is no one who likes to do the things I do.	1	2	3	4
23. There are people I can count on in an emergency.	1	2	3	4
24. No one needs me to care for them.	1	2	3	4

This set of questions asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. Answer every question by marking a single answer. If you are unsure about how to answer a question please give the best answer you can.

1. In general, would you say your health is:

1	2	3	4	5
Excellent	Very good	Good	Fair	Poor

2. Compared to one year ago, how would you rate your health in general now?

1	2	3	4	5
Much better now than one year ago	Somewhat better now than one year ago	About the same as one year ago	Somewhat worse now than one year ago	Much worse now than one year ago

3. The following questions are about activities you might do during a typical day. Does your current health limit you in these activities? If so, how much?

	1	2	3
	Yes, limited a lot	Yes, limited a little	No, not limited at all
a. Vigorous Activities , such as running, lifting heavy objects, participating in strenuous sports	1	2	3
b. Moderate Activities , such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
c. Lifting or carrying groceries	1	2	3
d. Climbing several flights of stairs	1	2	3
e. Climbing one flight of stairs	1	2	3
f. Bending, kneeling or stooping	1	2	3
g. Walking more than a mile	1	2	3
h. Walking several hundred yards	1	2	3
i. Walking one hundred yards	1	2	3
j. Bathing or dressing yourself	1	2	3

4. During the past 4 weeks, as a result of your physical health, how much of the time have you experienced any of the following problems with your work or other regular daily activities?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Cut down on the amount of time you spent on work or other activities	1	2	3	4	5
b. Accomplished less than you would like	1	2	3	4	5
c. Were limited in the kind of work or other activities	1	2	3	4	5
d. Had difficulty performing the work or other activities (e.g., it took extra effort)	1	2	3	4	5

5. During the past 4 weeks, as a result of any emotional problems (such as feeling depressed or anxious) how much of the time have you had any of the following problems with your work or other regular daily activities?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Cut down on the amount of time you spent on work or other activities	1	2	3	4	5
b. Accomplished less than you would like	1	2	3	4	5
c. Did work or other activities less carefully than usual .	1	2	3	4	5

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

1	2	3	4	5
Not at all	Slightly	Moderately	Quite a bit	Extremely

7. How much bodily pain have you had during the past 4 weeks?

1	2	3	4	5	6
None	Very mild	Mild	Moderate	Severe	Very severe

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

1	2	3	4	5
Not at all	A little bit	Moderately	Quite a bit	Extremely

9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give one answer that comes closest to the way you have been feeling. **How much of the time during the past 4 weeks...**

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Did you feel full of life?	1	2	3	4	5
b. Have you been very nervous?	1	2	3	4	5
c. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5
d. Have you felt calm and peaceful?	1	2	3	4	5
e. Did you have a lot of energy?	1	2	3	4	5
f. Have you felt downhearted and depressed?	1	2	3	4	5
g. Did you feel worn out?	1	2	3	4	5
h. Have you been happy?	1	2	3	4	5
i. Did you feel tired?	1	2	3	4	5

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

1	2	3	4	5
All of the time	Most of the time	Some of the time	A little of the time	None of the time

11. How TRUE or FALSE is each of the following statements for you?

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
a. I seem to get sick a little easier than other people	1	2	3	4	5
b. I am as healthy as anybody I know	1	2	3	4	5
c. I expect my health to get worse	1	2	3	4	5
d. My health is excellent	1	2	3	4	5

The following section asks about any fatigue that you have been feeling. For each of the questions, please indicate the extent to which you have experienced each of the statements during the past 7 days by circling the appropriate number using the following scale.

0	1	2	3	4
not at all	a little bit	somewhat	quite a bit	very much

During the PAST WEEK:

1. I feel fatigued	0	1	2	3	4
2. I feel weak all over	0	1	2	3	4
3. I feel listless (“washed out”)	0	1	2	3	4
4. I feel tired	0	1	2	3	4
5. I have trouble <u>starting</u> things because I am tired	0	1	2	3	4
6. I have trouble <u>finishing</u> things because I am tired	0	1	2	3	4
7. I have energy	0	1	2	3	4
8. I am able to do my usual activities	0	1	2	3	4
9. I need to sleep during the day	0	1	2	3	4
10. I am too tired to eat	0	1	2	3	4
11. I need help doing my usual activities	0	1	2	3	4
12. I am frustrated by being too tired to do the things I want to do	0	1	2	3	4
13. I have to limit my social activity because I am tired	0	1	2	3	4

The following section asks about any endocrine symptoms that you have been feeling. Please indicate the extent to which you have experienced each of the statements during the past 7 days.

0	1	2	3	4
not at all	a little bit	Somewhat	quite a bit	very much

During the PAST WEEK:

1. I have hot flashes	0	1	2	3	4
2. I have cold sweats	0	1	2	3	4
3. I have night sweats	0	1	2	3	4
4. I have vaginal discharge	0	1	2	3	4
5. I have vaginal itching/irritation	0	1	2	3	4
6. I have vaginal bleeding or spotting	0	1	2	3	4
7. I have vaginal dryness	0	1	2	3	4
8. I have pain or discomfort with intercourse	0	1	2	3	4
9. I have lost interest in sex	0	1	2	3	4
10. I have gained weight	0	1	2	3	4
11. I feel lightheaded (dizzy)	0	1	2	3	4
12. I have been vomiting	0	1	2	3	4
13. I have diarrhea	0	1	2	3	4
14. I get headaches	0	1	2	3	4
15. I feel bloated	0	1	2	3	4
16. I have breast sensitivity/tenderness	0	1	2	3	4
17. I have mood swings	0	1	2	3	4
18. I am irritable	0	1	2	3	4
19. I have pain in my joints	0	1	2	3	4

Below is a list of statements concerning how you might have felt or behaved in the past week. Please use the following scale to indicate how often you felt or behaved in these ways in the past week

0 rarely/none of the time (<1 day)	1 some of the time (1-2 days)	2 much of time (3-4 days)	3 most or all of the time (5-7 days)
--	-------------------------------------	---------------------------------	---

During the PAST WEEK:

1. I felt depressed.	0	1	2	3
2. I felt that everything I did was an effort.	0	1	2	3
3. My sleep was restless.	0	1	2	3
4. I was happy.	0	1	2	3
5. I felt lonely.	0	1	2	3
6. People were unfriendly.	0	1	2	3
7. I enjoyed life.	0	1	2	3
8. I felt sad.	0	1	2	3
9. I felt that people disliked me.	0	1	2	3
10. I could not get "going".	0	1	2	3

For this next question, we would like you to recall the amount of exercise you have done in the past 8 weeks.

When answering these questions please:

- only count exercise sessions that lasted 10 minutes or longer in duration.
- only count exercise that was done during free time (i.e., not occupation or housework).
- note that the main difference between the first three categories is the intensity of the endurance (aerobic) exercise, the fourth category is for strength (resistance) exercise,
- please write the average frequency on the first line and the average duration on the second.
- if you did not do any exercise in one of the categories, please write in “0”.

Considering a typical week (7 days) over the PAST 8 WEEKS how many days on average did you do the following kinds of PA and what was the average duration (in minutes)?

	Days Per Week	Average Duration
a. VIGOROUS/STRENUOUS EXERCISE (HEART BEATS RAPIDLY, SWEATING) (e.g., running, aerobics classes, cross country skiing, vigorous swimming, vigorous bicycling).	_____	_____
b. MODERATE EXERCISE (NOT EXHAUSTING, LIGHT PERSPIRATION) (e.g., fast walking, tennis, easy bicycling, easy swimming, popular and folk dancing).	_____	_____
c. LIGHT/MILD EXERCISE (MINIMAL EFFORT, NO PERSPIRATION) (e.g., easy walking, yoga, bowling, lawn bowling, shuffleboard).	_____	_____
d. RESISTANCE EXERCISE (e.g., lifting weights, push ups, sit ups).	_____	_____

Anything else you would like to tell us? On this final page, please feel free to make any comments concerning your gynecologic cancer, your treatments, the questionnaire, or anything else you think may be helpful. All comments are welcome.

Thank you very much for participating in this research. Please bring the completed questionnaire to your fitness testing appointment at the Behavioural Medicine Fitness Center.

