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Physical Activity For Health in Kidney Cancer Survivors

by

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ABSTRACT

Background: The health benefits of physical activity (PA) have been established in cancer survivors, however, no research to date has focused on kidney cancer survivors (KCS). **Purpose:** The purpose of this dissertation was to examine the benefits and determinants of PA in KCS, and to develop a behaviour change intervention to promote PA in this population. **Methods:** Study 1 was a population-based, mailed survey of 703 KCS, which consisted of measures of self-reported PA, quality of life (QoL), sedentary behaviour, the Theory of Planned Behaviour (TPB), and PA preferences. Study 2 examined the feasibility of adding behavioural counselling to a standard supervised exercise program in 32 KCS. The primary outcome was changes in self-reported PA. Secondary outcomes included QoL, motivational outcomes, physical function, anthropometric measures, and cardiorespiratory fitness. **Results:** In Paper 1 from Study 1, 56.3% of KCS were completely sedentary and only 26.0% were meeting public health guidelines. Moreover, there was a steep dose-response association between PA and most QoL outcomes. In Paper 2 from Study 1, there were very few associations between sitting time and QoL in KCS. In Paper 3 from Study 1, some common PA preferences for KCS were to: receive information from a fitness expert at a cancer centre (55.7%), start a PA program after treatment (36.5%), and do moderate intensity PA (58.4%). In Paper 4 from Study 1, PA was strongly associated with planning and intention which, in turn, were strongly associated with PBC, instrumental attitude, and descriptive norm. In Paper 1 from Study 2, the TRACKS trial was feasible and resulted in modest improvements in

PA minutes for the supervised PA plus behavioural counselling group (SPA+BC) group compared to the supervised PA plus exercise counselling (SPA+EC) group. In Paper 2 from Study 2, KCS in the SPA+BC group reported significantly higher planning, perceived control, and self-efficacy compared to SPA+EC.

Conclusions: PA has a strong association with QoL including potential gains even for small amounts of PA. Adding behavioural counselling to supervised PA in a behaviour change trial is feasible and may result in meaningful improvements in PA and fitness outcomes in KCS.

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INTRODUCTION

1-1. OVERVIEW OF KIDNEY CANCER

The incidence of kidney cancer has been increasing in Canada with 5,600 new cases of kidney cancer and 1,700 deaths in 2012 (1). Renal cell carcinoma (RCC), also known as renal cell cancer or renal cell adenocarcinoma, is by far the most common type of kidney cancer (2). RCC represents 80-85% of all tumors of the kidney and is responsible for 2% of all cancer deaths in developed countries (3, 4). It is also the third urologic tumor in incidence following prostate and bladder cancer (5), and is the 8^{th} most common cancer and the 13^{th} leading cause of cancer death in Canada (1). Among urologic tumors, it is the worst cancer specific mortality, since 40% of the patients with RCC die of the disease, compared to the 20% mortality observed in prostate or bladder cancer (5). Most tumors are present during the fifth to seventh decade of life, with a median age of diagnosis of 66 years (6).

The estimated number of new cases of kidney in Canada in 2012 was higher in men (3,500) compared to women (2,200) (1). The incidence is 2-3 times higher in men and is slightly more common in blacks than in whites (7). The estimated five-year relative survival ratio of kidney cancer is 67% and does not differ by sex (1). The 5-year observed survival of RCC patients by the American Joint Committee on Cancer (AJCC) and International Union Against Cancer tumor-node-metastasis (TNM) staging system were as follows: stage I, 77.8%; stage II, 72.8%; stage III, 55.0%; and stage IV, 16.9%, illustrating a dramatic decline in patient survival for stage IV (8).

RCC is a diagnosis which encompasses a broad range of histologic subtypes, and knowledge of the unique attributes of each type has become increasingly important in determining response to therapy (9). The largest group, clear cell carcinoma, is the most common form of RCC, and accounts for 80-85% of cases followed by papillary carcinoma, accounting for about 10% (2, 10). The remaining types, such as chromophobe, oncocytomas, and collecting duct tumors, are more rare (2, 10). Other less common histological types include transitional cell malignancies, most often occurring in the renal pelvis; nephroblastoma or Wilms' tumor, an embryonal malignancy of early childhood; and a mixture of sarcomas (10). Since the clear cell type is the most predominant subtype, the epidemiology of RCC is strongly influenced by that of the clear cell type (7).

The signs and symptoms of RCC can remain elusive, therefore at the time of diagnosis, approximately 30% of the patients have advanced disease (11). The main symptoms of patients with RCC include hematuria (40%), flank pain (40%), and flank mass (25%). Other symptoms that arise can include blood in the urine, unexpected weight loss or fatigue, low back pain, unaccountable fever, or swelling in the ankles and legs (12). Given that approximately 25-35% of patients are asymptomatic, RCC is generally diagnosed on incidental radiologic study (11). For an overview of the risk factors for kidney cancer and the role of PA in preventing kidney cancer, see Appendix A.

1-2. TREATMENT OF KIDNEY CANCER

Treatment of localized disease.

Surgery

The principle treatment for stage I, II, and III RCC is surgical resection (13). There is a lack of sufficient evidence for the superiority of any one surgical technique. However, the most common operation is a radical nephrectomy, which is defined as the removal of the kidney and adrenal gland leaving the fatty tissue around the kidney intact (2, 13, 14). The surgeon can make the incision in several places. The most common sites are the middle of the abdomen, under the ribs on the same side as the cancer, and in the back, just behind the tumor (2).

Regional lymphadenectomy (lymph node dissection) involves the removal of nearby lymph nodes to detect cancerous tumors. This may be conducted in addition to the radical nephrectomy to try to more accurately stage the cancer by determining if it has reached the lymph nodes (instead of relying only on imaging study results). This can be important for predicting chances for survival and deciding on further treatment options (2).

Advancements in surgical techniques and minimally invasive techniques have led to other alternative approaches such as laparoscopic nephrectomy, partial nephrectomy, or needle cyroablation. Laparoscopic nephrectomy involves several small incisions (also known as "keyhole" surgery) as opposed to one large one to remove the tumor. This type of surgery has demonstrated equivalent long-term effectiveness as radical nephrectomy. In addition, hospital stay, patient discomfort, and costs are decreased (2, 13).

Partial nephrectomy was originally developed for treatment of patients with bilateral tumours, solitary kidneys, or hereditary syndromes predisposing them to multiple tumours. In this procedure, only the part of the kidney containing cancer is removed, leaving the rest of the organ behind. It is the standard of care for small, peripheral renal lesions (13). This approach is used when there is a need to save some of the remaining kidney function, such as in people with cancer in both kidneys, those who only have one kidney and develop cancer in that kidney, or in people who already have reduced kidney function. It may also be used to try to preserve as much kidney function as possible in people who are more likely to develop other kidney cancers in the future, such as those with von Hippel-Lindau (VHL) disease. Studies have shown the long-term results to be about the same as for removing the whole kidney. The obvious benefit is that the patient retains more of their kidney function. Partial nephrectomies are generally not done for larger tumors, if there is more than one tumor in the same kidney, or if the cancer has spread to the lymph nodes or distant organs (2).

Other minimally invasive renal sparing techniques include laparaoscopic cryoablation or radio frequency ablation (13). Ablation of RCC by liquid nitrogen-cooled cryoprobes under laparoscopic guidance, as well as radiofrequency ablation utilizing needles placed in the tumour with ablation being accomplished by high temperatures generated show promising preliminary results and long-term data will further define its role (13). Some risks and side effects due to surgery include: bleeding during surgery or after surgery that may require blood transfusions; wound infection; damage to internal organs and blood vessels (e.g., the spleen, pancreas, aorta, vena cava, large or small bowel) during surgery; pneumothorax (unwanted air in the chest cavity); incisional hernia (bulging of internal organs near the surgical incision due to problems with wound healing); and kidney failure (if the remaining kidney fails to function well) (2).

Adjuvant treatment

There is no indication for adjuvant therapy following surgical resection of localized RCC. Adjuvant radiation, both external beam and intraoperative, has been examined and showed no benefit outweighing the side-effects of treatment. Neoadjuvant radiation has likewise found to yield no benefit (13, 15).

Treatment of metastatic disease.

Surgery.

Surgical resection of metastatic disease does produce occasional long term survivors and is, therefore, reasonable in selected patients (15). In rare cases where there is only a single metastasis or if there are only a few that can be removed easily without causing serious side effects, surgery may lead to long-term survival in some people. The metastasis may be removed at the same time as a radical nephrectomy or at a later time if the cancer recurs. When other treatments are not indicated, palliative surgery conducted to remove the metastases can sometimes relieve pain and other symptoms, although this usually does not help patients live longer (2).

Radiation therapy.

Although RCC is extremely radioresistant, radiation therapy can play an important palliative role in metastatic disease for patients who have brain and bone metastases (2). Radiation therapy can be used to treat kidney cancer if a person's general health is too poor for them to have surgery. For patients who can have surgery, using radiation therapy before or after removing the tumor is not recommended because studies have not shown this improves survival rates. For single tumors that have spread to the brain, a special type of radiation therapy known as stereotactic radiosurgery can sometimes be used. This procedure does not actually involve surgery. There are two main techniques for stereotactic radiosurgery, which use the same principle of pinpoint radiation. One technique involves several beams of high-dose radiation that are focused on the tumor from different angles over a few minutes to hours. The second technique involves delivering radiation from different angles using a linear accelerator (2).

Acute side effects of radiation therapy may include mild skin changes (similar to sunburn), nausea, diarrhea, or tiredness. Radiation therapy to the chest area may damage the lungs and lead to shortness of breath. Side effects of radiation to the brain usually become most serious 1 or 2 years after treatment and can include headaches and lack of concentration (2).

Chemotherapy.

Chemotherapy uses anti-cancer drugs that are administered into a vein or orally (in pill form). These drugs enter the bloodstream to reach all areas of the body, which makes this treatment useful for cancer that has metastasized to organs beyond the kidney (2). In comparison to other cancers, chemotherapy is minimally effective in RCC. Many agents have been tested with most showing response rates of less than 10% (13). Some drugs, such as vinblastine, floxuridine, 5-fluorouracil (5-FU), capecitabine, and gemcitabine have been shown to help a small number of patients (2). The reason for the relative resistance of RCC to chemotherapy is likely related to the high level of expression of the drug transporter P-glycoprotein, which transports many chemotherapeutic agents out of the cells (13).

The side effects of chemotherapy depend on the type of drugs, the amount taken, and the length of treatment. Possible side effects can include: hair loss, mouth sores, loss of appetite, nausea and vomiting, increased chance of infections (due to low white blood cell counts), easy bruising or bleeding (due to low blood platelet counts), and fatigue (due to low red blood cell counts). These side effects are usually acute and dissipate after treatment is complete (2).

Immunotherapy.

Although rare, spontaneous regression of metastatic disease is well documented in RCC. As the mechanism of spontaneous regression is presumed to be immunologic, considerable research in immune modifying therapy for RCC exists (13). The main immunotherapy drugs used in RCC are cytokines (proteins that activate the immune system). The 2 cytokines most often used are interleukin-2 (IL-2) and interferon-alpha. Both cytokines cause these tumors to shrink to less than half their original size in about 10% to 20% of patients. IL-2 is the only therapy that appears to generate long-lasting responses, with only a small percentage of patients responding. Initial reports of combining low doses of both cytokines was thought to be as effective as high-dose IL-2, with fewer and less severe side effects, but recent studies have not supported this idea. Some oncologists believe that a high-dose IL-2 has a better chance of shrinking the cancer, however the toxicity levels are high (2).

The possible side effects of cytokine therapy, especially high-dose IL-2, include: extreme fatigue, low blood pressure, fluid buildup in the lungs, difficulty breathing, kidney damage, heart attacks, intestinal bleeding, diarrhea or abdominal pain, high fever and chills, rapid heart beat, and mental changes. These side effects are often severe and, rarely, can be fatal. For this reason, cytokine therapy is not used in individuals who are in poor overall health at the time of diagnosis (2).

Targeted biologic therapy

Recent developments in the knowledge of the pathways possibly explaining tumorigenesis generated a rational foundation for targeted biologic therapies. These targeted drugs work differently from standard chemotherapy drugs and have different side effects. Targeted drugs are proving to be especially important in RCC, where chemotherapy has not been shown to be very effective. Several targeted drugs have been approved by the Food and Drug Administration (FDA) for use against advanced RCC. These include drugs that stop angiogenesis (growth of the new blood vessels that nourish tumors) and drugs that target other important cell growth factors. These drugs are often used as the first line of treatment against advanced RCC. While they may shrink or slow the growth of the tumor, it is not yet clear if any of these drugs can be curative (2, 13).

Sunitinib (Sutent) is the first-line standard of care for patients with metastatic RCC with good or intermediate prognosis (14). It blocks several important cellular enzymes called tyrosine kinases that are important for cell growth and survival. This drug is a pill that has been shown to shrink or slow the progression of RCC in many cases. It attacks both blood vessel growth and other targets that stimulate tumor cell growth. The most common side effects are nausea, diarrhea, changes in skin or hair color, mouth sores, weakness, and low white and red blood cell counts. Other possible effects include tiredness, high blood pressure, congestive heart failure, bleeding, hand-foot syndrome, and low thyroid hormone levels (2).

Sorafenib (Nexavar) is another pill that has also been shown to slow the progression of the cancer in some patients with advanced disease. It also acts by blocking both angiogenesis and growth-stimulating molecules in the cancer cell. The most common side effects seen with this drug include fatigue, rash, diarrhea, increases in blood pressure, and redness, pain, swelling, or blisters on the palms of the hands or soles of the feet (hand-foot syndrome) (2).

Temsirolimus (Torisel) is the treatment option for poor prognosis patients with metastases. It is given as an intravenous (IV) infusion. It is effective by blocking a cell protein known as mTOR, which normally promotes cell growth and division. The most common side effects of this drug include skin rash, weakness, mouth sores, nausea, loss of appetite, fluid buildup in the face or legs, and increases in blood sugar and cholesterol levels (2).

Everolimus (Afinitor) is a drug (pill form) that also blocks the mTOR protein. Everolimus is used to treat advanced RCC after other drugs such as Sorafenib or Sunitinib have been administered. Common side effects of this drug include mouth sores, increased risk of infections, nausea, loss of appetite, diarrhea, skin rash, feeling tired or weak, fluid buildup (usually in the legs), and increases in blood sugar and cholesterol levels. A less common but serious side effect is damage to the lungs, which can cause shortness of breath or other problems (2).

Bevacizumab (Avastin) is an IV drug that works by slowing the growth of new blood vessels. Recent studies have shown it may be helpful against RCC especially when coupled with interferon-alpha. This drug is usually tolerated well by patients, but it can cause serious side effects such as increases in blood pressure, bleeding or blood clotting problems, and wound healing problems (2).

For a detailed overview of complementary and alternative treatment methods for kidney cancer, please refer to Appendix A.

Recurrence/Progression after treatment.

Treatment of RCC that recurs after initial treatment or does not respond to the initial treatment (refractory cancer) depends on where it recurs and what treatments have been used, as well as a person's health and wishes for further treatment. For RCC that recur after initial surgery, further surgery might be an option in some cases. Otherwise, treatment with targeted therapies or immunotherapy is recommended. For RCC that progresses during treatment with targeted therapy or cytokine therapy, another type of targeted therapy may be helpful for a period of time. If these options are unsuccessful, chemotherapy may be another route, especially in people with non-clear cell types of RCC. Clinical trials may be a good option in this situation for those who want to continue treatment. For other patients, palliative treatments such as radiation therapy may be the best option to ease the pain (2).

1-3. KIDNEY CANCER SURVIVORSHIP

Given the toxic side effects associated with current treatment options for RCC, health-related quality of life (HRQOL) has become an important medical outcome among this population (16). The most common symptoms that initially lead patients to seek medical attention are pain, fatigue, and urinary problems such as hematuria. Once diagnosed with RCC, patients with metastasized disease and localized disease who had undergone surgery, reported a high prevalence of symptoms. The symptoms most evident among localized RCC patients include irritability, pain, fatigue, worry, and sleep disturbance, whereas symptoms among metastatic-stage patients include fatigue, weakness, worry, shortness of breath, and irritability. Other reported symptoms among both groups include lack of appetite, nausea, dyspnea, flu-like symptoms, diarrhea, constipation, headache, and dry mouth (16). Due to these symptoms, patient HRQOL is affected, particularly with respect to physical functioning, psychological impairment (depression, anxiety, irritability), sleep, social functioning and role activities (16).

Few studies exist regarding information about QoL in RCC patients. Bird et al. (17) conducted a literature review on the impact of RCC therapy on QoL. A total of 873 reports of research studies pertaining to RCC were initially identified, but after applying a rigorous evaluation against the inclusion and exclusion criteria, only 16 studies were included in the review based on their main focus on QoL. Overall, the studies relating to surgery for kidney cancer suggest that QoL deteriorates with surgery and returns to baseline (pre-surgery) levels within 6-12 months following surgery. It is also evident that having a choice between types of surgery (laparoscopic or open surgery) may relieve anxiety levels with some patients as it provides them with some form of control (17). In addition, patients who undergo angiogenesis-targeted drugs or targeted biologic/molecular therapy showed no significant differences in QoL using the Functional Assessment for Cancer Therapy-General (FACT-G), but did for some sections of the Functional Assessment of Cancer Therapy-Kidney Symptom Index (FKSI). For example, compared to placebo, patients taking Sorafenib experienced greater improvement in respiratory symptoms, fevers and worry that the condition will get worse. Patients were more concerned with the treatment-related side effects, but it did not significantly impact QoL (17).

Clark et al. (18) analyzed QoL and psychological adjustment in 97 patents after radical or partial nephrectomy for localized RCC, and found that most survivors have normal physical and mental health regardless of the type of nephrectomy performed and is comparable to the general population. The QoL is better for patients with more renal parenchyma remaining after surgery for localized RCC due to less worry about cancer recurrence or the belief that renal cancer had negatively impacted their overall health. Shinohara et al. (19) evaluated the impact of nephron-sparing surgery on QoL in 66 patients with localized RCC, compared to radical nephrectomy, and found that patients who engaged in nephron-sparing surgery showed higher physical function scores than patients treated with radical nephrectomy. In another study, 38 patients suffering from organ-confined prostate or RCC were examined by Pannek et al. (20) to determine the impact of radical tumour surgery on QoL. The findings indicate that radical surgical therapy did not significantly influence QoL in prostate cancer patients, but had a positive change on the QoL of RCC patients. This may be due to the fact that patients with RCC are postoperatively more or less symptom free, while the majority of prostate cancer patients suffer from at least one surgery-related symptom (20).

Further, Anastasiadis et al. (21) investigated QoL aspects, including HRQOL, psychological functioning, relationship issues and sexual functioning in 266 kidney cancer patients. This is the first study in which sexual function in renal cancer has been addressed. Sexual health, an important aspect of QoL, may be especially vulnerable in urological patients, since treatments of the urinary tract are in close proximity to the reproductive system. Overall, the total Watts Sexual Function Questionnaire (WSFQ) scores as well as the four domain scores (desire, arousal, orgasm, and satisfaction) were similar in men and women, and lower than in female breast cancer and male hypertensive populations reported in the literature, indicated relatively worse sexual function. While patients reported HRQOL and relationship scores similar to that of the general population, about half of the men and women reported depressive symptoms. While most of the patients remained sexually active in non-distressed relationships, many reported depressive symptoms, and sexual functioning may be worse than in comparable chronically ill populations (21).

Cella et al. (22) compared the QoL between 750 metastatic RCC patients receiving Sunitinib and those receive interferon alpha, in which both are first-line therapy. The researchers found that Sunitinib offered patients with advanced

RCC a superior QoL compared to interferon alpha, including better kidney cancer disease-related symptoms. Finally, Litwin et al. (23) assessed the QoL in 20 patients with advanced RCC treated with nephrectomy and tumor infiltrating lymphocyte therapy in combination with interleukin-2. In addition, the researchers assessed HRQOL in this population compared to that of the general population and in patients with chronic diseases or other malignancies. The findings indicate that patients undergoing nephrectomy and adjuvant tumor infiltrating lymphoctyes plus interleukin-2 therapy for advanced RCC reported better HRQOL than those with other malignancies and better physical function than patients with congestive heart failure. However, HRQOL is worse than in the general population and similar or worse than in patients with hypertension or type II diabetes.

Advances in cancer care have led to the achievement of long-term survival with patients diagnosed with certain cancers, where HRQOL and symptom alleviation assume an even more important role. The addition of HRQOL measures to traditional end points of survival, disease-free survival and tumour response can be useful to patients, practitioners, and medical researchers in making informed treatment decisions based on the risks and benefits (23). Given the scant literature assessing the QoL of RCC patients, additional research is warranted to gain a comprehensive understanding of the impact of disease and treatments on various aspects of patient’s daily lives.

1-4. PHYSICAL ACTIVITY AND CANCER SURVIVORSHIP

PA has been shown to help cancer survivors optimize QoL and physical functioning; manage the chronic and/or late –appearing effects of treatments (e.g., fatigue, lymphedema, fat gain, bone loss); reduce the likelihood of their cancer recurring; and reduce the likelihood of developing other chronic diseases for which they be at increased risk (e.g., osteoporosis, heart disease, diabetes) (24). A growing number of studies have indicated that PA may be useful for improving not only psychological QoL issues, but also physical, functional and emotional complications in some populations of cancer survivors (25). Systematic reviews in breast cancer survivors (26, 27), prostate cancer survivors (28), haematologic cancer survivors (29), mixed cancer survivors (30-32), advanced disease cancer survivors (33), and older adults cancer survivors (34) have indicated that PA may improve a variety of QoL parameters in cancer survivors such as aerobic fitness, muscular strength, fatigue, depression, anxiety, self-esteem, body image, functional ability, social function, psychological well-being and overall QoL.

The majority of the studies on PA and QoL have focused on breast cancer. The most recent systematic review on the effects of exercise on the QoL among breast cancer survivors at all stages of the disease was conducted by Bicego and colleagues (26). Nine relevant randomized controlled trials were included: four of moderate methodological quality and five of high methodological quality. All of the studies involved an exercise intervention group versus a control group except for one study who separated the exercise group into supervised and non-supervised (35). Of the nine studies included, two observed the effects of an aerobic exercise program (35, 36), one studied the effects of a resistance-training program (37) and three examined the effect of the combined aerobic and resistance training (38-40). Researchers of the remaining three studies did not categorize the intervention as either aerobic or resistance (41-43). Headley et al. (42) studied the effects of a seated gentle active range of motion program, Sandel et al. (43) examined the effect of dance and movement therapy, while Mustian et al. (41) looked at the effects of a slow repetitive movement program (Tai Chi Chuan). Based on the results of these studies, there was strong evidence that exercise positively influences QoL in women living with breast cancer. Exercise improves mood and QOL by increasing overall health through socialization, goal setting, participation, decreased body weight, or decreased fatigue (26).

In another systematic review and meta-analysis, McNeely et al. (27) sought to summarize the available evidence concerning the effect of exercise primarily on QOL, physical functioning or cardiorespiratory fitness and secondarily on fatigue and body composition in women with breast cancer. Fourteen studies were included in the analysis involving 717 participants. Study methodology varied significantly, particularly with regards to timing of the exercise intervention, the chosen exercise regimen and outcomes reported. These studies were of variable quality, and only 4 were considered to be of high quality. Only 3 studies provided adequate data to assess the QoL. The pooled estimate showed that statistically significant increase of greater than 4.0 point on the Functional Assessment of Cancer Therapy (FACT) scale represented a clinically meaningful improvement in QoL from exercise. Further, analyses of the physical functioning and physical well-being subscales of QoL indicated large improvements (effect size=0.84) from exercise. Exercise also led to significant improvements in peak oxygen consumption and in reducing symptoms of fatigue (27).

Another emerging area of literature is in prostate cancer. Thorsen et al. (28) reviewed PA studies in prostate cancer survivors investigating the effects of PA on health outcomes; the prevalence of PA; and the determinants of PA. The researchers identified 16 studies that presented data on PA in prostate cancer survivors. Nine of these studies reported data on the health outcome of PA, six reported data on PA prevalence rates, and four reported data on the determinants of PA. Despite the few studies that have been conducted, most of the outcome studies used a randomized controlled trial (RCT) design, but the sample sizes were relatively small in most of these trials. The intervention studies demonstrated promising results for muscular fitness, physical functioning, fatigue, and HRQOL. To confirm preliminary findings and to develop knowledge with strong evidence, a significant amount of research is warranted in prostate cancer survivors.

Furthermore, another cancer area with growing literature is haematological malignancies. Liu et al. (29) summarized and defined the methodological quality of literature on exercise interventions, aimed at improving physical function or psychological well-being in patients treated for haematological malignancies. Ten studies met the inclusion criteria and were included in the review. Two studies were performed in children, whereas the remaining eight were conducted in adults. Of these ten studies, only three studies were randomized controlled trials, one a controlled trial, while the remaining six were single-group studies. Four trials were performed during treatment for cancer. The remainder was performed post-treatment. A wide variety of exercise protocols were applied, differing in exercise type, frequency, duration and intensity. The methodological quality of the studies included in this review was moderate to poor. The findings from these studies suggest that physical exercise is feasible in haematological cancer patients, and encouraging results were obtained for various outcomes, such as physical fitness, HRQOL and psychological well-being. Given the small number and relatively poor methodological quality of the studies included, the evidence provided by this review is insufficient to draw any conclusive findings. Future research should include high-quality randomized controlled trials, larger study populations, and a standard collection of valid outcome measures to assess the effectiveness of exercise interventions in haematological cancer patients and to improve comparability between studies (29).

Despite the rapid growth of research efforts investigating relationships between PA and improved QoL outcomes for cancer survivors, a substantial gap exists in the literature in other common tumor types such as endometrial, ovarian, non-Hodgkin's lymphoma (NHL), colorectal, multiple myeloma, and young adult cancer survivors. It is important to understand the association between PA and QoL and how it may vary across the range of relevant personal and behavioural attributes among the lesser-studied cancers. The most recent studies will be highlighted briefly for each of the cancers to gain an understanding of the study findings thus far.

Endometrial cancer is the most common gynecological malignancy. It is often diagnosed at an early stage and has a high cure rate, and thus enhancing the QoL of survivors is a high priority. Obesity is a risk factor for endometrial cancer, which explains its high prevalence among survivors of the disease (44). The QoL difficulties experienced by some endometrial cancer survivors may be attenuated by a lack of exercise and/or excess body weight (45). Basen-Engquist et al. (44) examined the prevalence of PA and obesity and their relationship to physical functioning, fatigue, and pain in 200 endometrial cancer survivors. Both lower BMI and higher levels of PA were related to better physical functioning. Higher levels of PA were also related to less fatigue, primarily for patients of normal BMI. These findings suggest that obesity and inactivity among endometrial cancer survivors contributes to poorer QoL. These results mirror the findings by Courneya et al. (45), where they investigated the associations among exercise, body weight, and QoL in a population-based sample of endometrial cancer survivors. The researchers demonstrated that endometrial cancer survivors who were meeting public health guidelines for PA had better overall QoL, physical well-being, functional well-being, and social well-being as well as less fatigue compared to those not meeting PA guidelines.

Ovarian cancer represents the fifth leading cancer-related cause of mortality among women (1), and results in more deaths than any other cancer of the female reproductive system (1, 25). Improvements in surgical techniques and chemotherapy regimes have led to the increasing survival rate, which places greater emphasis on efforts to maximize QoL in this population. Stevinson et al. (25) estimated the prevalence of PA in ovarian cancer survivors and to determine if there is a dose–response relationship between PA and QoL. Although the prevalence data indicated that over half of ovarian cancer survivors were completely sedentary and less than one third (31.1%) were meeting current public health guidelines for PA, a strong association with QoL was demonstrated. Significantly higher scores for QoL were illustrated in participants who were meeting public health guidelines for PA compared with those who were not meeting guidelines. This association was even more pronounced for participants with current disease compared with those in remission.

Non-Hodgkin's lymphoma (NHL) is one of the fastest increasing cancers, and approximately half of all adult patient cases of NHL are aggressive lymphomas, which grow rapidly and can be fatal within months without appropriate treatment (46). These aggressive therapies often generate significant acute and chronic adverse effects, and it is not uncommon for survivors of NHL to experience deficits in HRQOL even years after completion of treatment. Vallance et al. (47) examined differences in QoL between NHL survivors meeting and not meeting public health exercise guidelines. Those survivors meeting public health exercise guidelines reported less fatigue, fewer anemia symptoms, better physical and functional well-being, and better overall QoL than survivors not meeting public health exercise guidelines both during and off treatment.

Similar findings were found in a study conducted by Bellizzi et al. (46) where they examined the prevalence and correlates of PA in adult survivors of aggressive NHL and to explore the dose-response relationship between PA levels and HRQOL. The findings revealed that survivors of NHL who met public health guidelines for PA reported better HRQOL than those who were sedentary. Further, these findings also indicate a significant benefit in HRQOL among those who get at least some exercise, despite not meeting current guidelines, suggesting that even if survivors of cancer begin at lower levels of frequency and duration, this behaviour can still benefit overall HRQOL.

Colorectal cancer is the third most common cancer in men and women (1). Colorectal cancer survivors experience significant morbidity from their disease and treatments, including fatigue, limitations in physical functioning, and reduced QoL (48). Lynch et al. (49) investigated the associations of pre-to-post diagnosis changes in levels of leisure-time PA with QoL in a large, population-based sample of colorectal cancer survivors. The researchers found that those survivors meeting current public health guidelines had significantly higher overall QoL scores, and higher scores on the physical well-being, functional well-being, and additional concern subscales of the Functional Assessment of Cancer Therapy – Colorectal (FACT-C). Similarly, Peddle et al. (48) examined QoL and fatigue in colorectal cancer survivors meeting and not meeting public health exercise guidelines. In line with Lynch et al. (49), the study results revealed that those survivors who were meeting these guidelines were associated with better QoL and lower fatigue than those who were not meeting the guidelines.

Multiple myeloma is the second most common hematopoietic malignancy and accounts for 1% of all cancers diagnosed (50), and sixth and eighth most common cancer in men and women respectively (1). Multiple myeloma and associated conventional therapies causes a wide range of debilitating symptoms including anemia and fatigue that can significantly influence QoL. Jones et al. (51) examined the association between exercise and QoL in multiple myeloma cancer survivors. The results indicated that mild, moderate and strenuous minutes alone were generally not associated with QoL. However, strenuous with the addition of moderate intensity exercise was associated with three QoL domains (overall, functional well-being and fatigue) while the percentage of participants meeting exercise guidelines was correlated with all QoL outcomes except emotional wellbeing. Together, the findings of both the active and off-treatment analyses support the notion that increased exercise levels, particularly moderate intensity exercise, are associated with QoL in multiple myeloma survivors.

Approximately 10,000 young adults between the ages of 20 and 44 years are diagnosed with cancer each year in Canada with 2,000 expected deaths (52). The most common types of cancers in the young adult age group are breast for females and testicular for males. Bélanger et al. (52) examined the dose-response associations with HRQOL in 588 young adult cancer survivors. The main finding this study was that there were steep dose-response associations between PA and HRQOL in YACS, especially for the physical functioning aspects of HRQOL. Specifically, there were significant increases in the physical component score of the Medical Outcomes Study 36-Item Short Form (SF-36) survey from completely sedentary to insufficiently active and from insufficiently active to meeting guidelines, with no further increase for exceeding the guidelines. The associations between PA and HRQOL were more pronounced for those that have received past chemotherapy. In addition, PA was also strongly associated with self-esteem, stress and depression in young adult cancer survivors.

A few studies have been conducted examining the association of lifestyle factors and QoL among a mixed cancer group including breast, prostate, and colorectal cancer survivors. Blanchard et al. (53) compared a mixed group of cancer survivors on three different lifestyle behaviours (i.e., PA, fruit and vegetable consumption, and smoking) and examined the association between these lifestyle behaviours and HRQOL. Survivors who met the PA recommendation had significantly higher HRQOL than those who did not. It was also noted that survivors who met more than one lifestyle behaviour recommendation had significantly higher HRQOL than those who only met one recommendation. Similarly, Mosher et al. (54) assessed exercise, diet quality, body weight status, and physical and mental QoL by sex and cancer type and also to explore associations between lifestyle practices and body weight status in relation to physical and mental QoL among older long-term survivors of breast, prostate, and colorectal cancer. Examination of associations between dietary and exercise habits, body weight status, and QoL outcomes demonstrated that weekly minutes of moderate-to-vigorous exercise were related to better physical QoL, including less pain and role limitations because of physical problems and better health perceptions, physical functioning, and vitality among all cancer groups.

Because of the continually improving cancer survival rates, resulting in a five-year relative survival ratio of 67% for all cancers combined (1), the psychological well-being and physical functioning of survivors is important from a public health perspective (55). There is accumulating evidence in recent large observational demonstrating that engaging in moderate intensity recreational PA (3 hours per week) after diagnosis is associated with improved survival among breast cancer patients (55-57). These studies have demonstrated a 24–67% risk reduction of total deaths and 50–53% of breast cancer deaths in women who are physically active after breast cancer diagnosis compared with women reporting no recreational PA after diagnosis. Two large observational studies in colon cancer have also demonstrated that participation in a 3 hour per week moderate intensity recreational PA after diagnosis is associated with a 39–59% risk reduction of colon cancer death and a 50–63% risk reduction of total deaths in men and women who are physically active after a colon cancer diagnosis, compared with inactive men and women (58, 59).

Despite overall improvements in the health and well-being of cancer survivors, QoL remains a major concern for certain subgroups of survivors, including survivors who are diagnosed with later stage cancer, and those who undergo chemotherapy, hormone therapy, or extensive and debilitating treatment regimens (55). Many of these existing cancer therapies are costly and have significant side effects that can result in long term morbidity. Therefore, non-pharmacologic methods, such as PA participation to lower the risk of cancer mortality, especially methods that are also associated with improvements in QoL and other chronic diseases, may provide an attractive mechanism given the other treatment options currently offered.

Although a growing number of studies demonstrated a strong relationship between PA and cancer survival, the majority of the studies were conducted on breast cancer and prostate cancer survivors. A substantial gap still exists in the other cancer types that warrant future research. To date, there has been no studies conducted examining association between PA and QoL in KCS.

1-5. OVERVIEW OF THE DISSERTATION

The purpose of this dissertation was to provide an examination of the benefits and determinants of PA in KCS, and to develop a behaviour change intervention to promote PA in this population. The dissertation is presented in seven chapters. The first section of the dissertation (Chapter 1) provided an overview of kidney cancer, treatment options, survivorship issues in kidney cancer, and PA and cancer survivorship. An additional literature review on kidney cancer and PA is provided in Appendix A, which includes the following topics: complimentary and alternative treatment methods for kidney cancer, risk factors of kidney cancer, PA and kidney cancer prevention, prevalence and determinants of PA in cancer survivors, perceived environment and PA in cancer survivors, PA preferences of cancer survivors, and PA behaviour change interventions in cancer survivors. The main body of the dissertation is presented in a series of four papers based on a cross-sectional study, which is Study 1 of the dissertation. Paper 1 (Chapter 2) examines the associations between QoL and PA in KCS. Paper 2 (Chapter 3) examines the association between sitting time and QoL in KCS. Paper 3 (Chapter 4) examines the PA programming and counselling preferences of KCS. Paper 4 (Chapter 5) examines the correlates of PA in KCS using the TPB. Study 2 of the dissertation was based on the results generated from Study 1, and was a behaviour change trial among KCS. Paper 1 (Chapter 6) examines the feasibility and efficacy of adding behavioural counselling to supervised PA and Paper 2 (Chapter 7) examines motivational outcomes following the intervention based on the TPB.

REFERENCES

1. Canadian Cancer Society's Steering Committee. Canadian cancer statistics 2012. Toronto: Canadian Cancer Society; 2012.

2. Cancer.org [Internet]. American Cancer Society, Inc.; c2011 [updated 2011 Apr 18; cited 2011 Apr 27]. Available from: http://www.cancer.org/Cancer/KidneyCancer/DetailedGuide/index.

3. Hu J, Mao Y, White K. Overweight and obesity in adults and risk of renal cell carcinoma in Canada. Soz Praventivmed. 2003;48(3):178-85.

4. Pan SY, DesMeules M, Morrison H, Wen SW. Obesity, high energy intake, lack of physical activity, and the risk of kidney cancer. Cancer Epidemiol Biomarkers Prev. 2006;15(12):2453-60. 5. Pascual D, Borque A. Epidemiology of kidney cancer. Adv Urol. 2008. doi:10.1155/2008/782381.

6. Ng CS, Wood CG, Silverman PM, Tannir NM, Tamboli P, Sandler CM. Renal cell carcinoma: Diagnosis, staging, and surveillance. Am J Roentgenol. 2008;191(4):1220-32.

7. Chow W, Devesa SS. Contemporary epidemiology of renal cell cancer. Cancer J. 2008;14(5):288-301.

8. Nese N, Paner GP, Mallin K, Ritchey J, Stewart A, Amin MB. Renal cell carcinoma: Assessment of key pathologic prognostic parameters and patient characteristics in 47,909 cases using the national cancer data base. Ann Diagn Pathol. 2009;13(1):1-8.

9. Rini BI, Campbell SC, Rathmell WK. Renal cell carcinoma. Curr Opin Oncol. 2006;18(3):289-96.

10. Moore LE, Wilson RT, Campleman SL. Lifestyle factors, exposures, genetic susceptibility, and renal cell cancer risk: A review. Cancer Invest. 2005;23(3):240-55.

11. Piras SE, Dhalstrom MF. Get the facts on kidney. 2010 Dec [cited 2011 Apr 27];102;[about 10 p.]. Available from: www.NursingMadeIncrediblyEasy.com

12. Alschuler L, Gazella KA. The definitive guide to cancer of the colon, stomach, and kidney. Integr Med Clin J. 2007;6(4):30-7.

13. Nelson EC, Evans CP, Lara Jr PN. Renal cell carcinoma: Current status and emerging therapies. Cancer Treat Rev. 2007;33(3):299-313.

14. Canadian Kidney Cancer Forum. Management of kidney cancer: Canadian kidney cancer forum consensus statement. Can Urol Assoc J. 2008;2(3):175-82.

15. Martel CL, Lara PN. Renal cell carcinoma: Current status and future directions. Crit Rev Oncol Hematol. 2003;45(2):177-90.

16. Harding G, Cella D, Robinson D Jr, Mahadevia PJ, Clark J, Revicki DA. Symptom burden among patients with renal cell carcinoma (RCC): Content for a symptom index. Health Qual Life Outcomes. 2007;5. doi:10.1186/1477-7525-5-34.

17. Bird J, Hayter M. A review of the literature on the impact of renal cancer therapy on quality of life. J Clin Nurs. 2009;18(20):2783-800.

18. Clark PE, Schover LR, Uzzo RG, Hafez KS, Rybicki LA, Novick AC. Quality of life and psychological adaptation after surgical treatment for localized renal cell carcinoma: Impact of the amount of remaining renal tissue. Urology. 2001;57(2):252-6.

19. Shinohara N, Harabayashi T, Sato S, Hioka T, Tsuchiya K, Koyanagi T. Impact of nephron-sparing surgery on quality of life in patients with localized renal cell carcinoma. Eur Urol. 2001;39(1):114-9.

20. Pannek J, Hallner D, Kugler J, Haupt G, Krüskemper ,G.M., Senge T. Quality of life of patients with renal cell carcinoma or prostate cancer after radical surgery. Int Urol Nephrol. 1997;29(6):637-43.

21. Anastasiadis AG, Davis AR, Sawczuk IS, Fleming M, Perelman MA, Burchardt M, et al. Quality of life aspects in kidney cancer patients: Data from a national registry. Support Care Cancer. 2003;11(11):700-6.

22. Cella D, Li JZ, Cappelleri JC, Bushmakin A, Charbonneau C, Kim ST, et al. Quality of life in patients with metastatic renal cell carcinoma treated with sunitinib or interferon alfa: Results from a phase III randomized trial. J Clin Oncol. 2008;26(22):3763-9.

23. Litwin MS, Fine JT, Dorey F, Figlin RA, Belldegrun AS. Health related quality of life outcomes in patients treated for metastatic kidney cancer: A pilot study. J Urol. 1997;157(5):1608-12.

24. Courneya KS, Friedenreich CM. Physical activity and cancer control. Semin Oncol Nurs. 2007;23(4):242-52.

25. Stevinson C, Faught W, Steed H, Tonkin K, Ladha AB, Vallance JK, et al. Associations between physical activity and quality of life in ovarian cancer survivors. Gynecol Oncol. 2007;106(1):244-50.

26. Bicego D, Brown K, Ruddick M, Storey D, Wong C, Harris SR. Effects of exercise on quality of life in women living with breast cancer: A systematic review. Breast J. 2009 2009;15(1):45-51.

27. McNeely ML, Campbell KL, Rowe BH, Klassen TP, Mackey JR, Courneya KS. Effects of exercise on breast cancer patients and survivors: A systematic review and meta-analysis. CMAJ. 2006;175(1):34-41.

28. Thorsen L, Courneya KS, Stevinson C, Fosså S,D. A systematic review of physical activity in prostate cancer survivors: Outcomes, prevalence, and determinants. Support Care Cancer. 2008;16(9):987-97.

29. Liu RDKS, Chinapaw MJM, Huijgens PC, van Mechelen W. Physical exercise interventions in haematological cancer patients, feasible to conduct but effectiveness to be established: A systematic literature review. Cancer Treat Rev. 2009;35(2):185-92.

30. Schmitz KH, Holtzman J, Courneya KS, Mâsse L,C., Duval S, Kane R. Controlled physical activity trials in cancer survivors: A systematic review and meta-analysis. Cancer Epidemiol Biomarkers Prev. 2005;14(7):1588-95.

31. Knols R, Aaronson NK, Uebelhart D, Fransen J, Aufdemkampe G. Physical exercise in cancer patients during and after medical treatment: A systematic review of randomized and controlled clinical trials. J Clin Oncol. 2005;23(16):3830-42.

32. Visovsky C, Dvorak C. Exercise and cancer recovery. Online J Issues Nurs [internet]. 2005 May [cited 2011 Apr 27];10(2):[about 12 p.]. Available from: http://web.ebscohost.com/ehost/detail?hid=110&sid=2e37ee05-6516-4620-add9-

d4733a2ae809%40sessionmgr115&vid=7&bdata=JnNpdGU9ZWhvc3QtbGl2ZSZzY29wZT1zaXRl#db=rzh&AN=2009020990

33. Lowe SS, Watanabe SM, Courneya KS. Physical activity as a supportive care intervention in palliative cancer patients: A systematic review. J Support Oncol. 2009;7(1):27-34.

34. Courneya KS, Vallance JKH, McNeely ML, Karvinen KH, Peddle CJ, Mackey JR. Exercise issues in older cancer survivors. Crit Rev Oncol Hematol. 2004;51(3):249-61.

35. Segal R, Evans W, Johnson D, Smith J, Colletta S, Gayton J, et al. Structured exercise improves physical functioning in women with stages I and II breast cancer: Results of a randomized controlled trial. J Clin Oncol. 2001;19(3):657-65.

36. Courneya KS, Mackey JR, Bell GJ, Jones LW, Field CJ, Fairey AS. Randomized controlled trial of exercise training in postmenopausal breast cancer survivors: Cardiopulmonary and quality of life outcomes. J Clin Oncol. 2003;21(9):1660-8.

37. Ohira T, Schmitz KH, Ahmed RL, Yee D. Effects of weight training on quality of life in recent breast cancer survivors: The weight training for breast cancer survivors (WTBS) study. Cancer. 2006;106(9):2076-83.

38. Herrero F, San Juan ,A.F., Fleck SJ, Balmer J, Pérez M, Cañete S, et al. Combined aerobic and resistance training in breast cancer survivors: A randomized, controlled pilot trial. Int J Sports Med. 2006;27(7):573-80.

39. McKenzie DC, Kalda AL. Effect of upper extremity exercise on secondary lymphedema in breast cancer patients: A pilot study. J Clin Oncol. 2003;21(3):463-6.

40. Campbell A, Mutrie N, White F, McGuire F, Kearney N. A pilot study of a supervised group exercise programme as a rehabilitation treatment for women with breast cancer receiving adjuvant treatment. Eur J Oncol Nurs. 2005;9(1):56-63.

41. Mustian KM, Katula JA, Zhao H. A pilot study to assess the influence of tai chi chuan on functional capacity among breast cancer survivors. J Support Oncol. 2006;4(3):139-45.

42. Headley JA, Ownby KK, John LD. The effect of seated exercise on fatigue and quality of life in women with advanced breast cancer. Oncol Nurs Forum. 2004;31(5):977-83.

43. Sandel SL, Judge JO, Landry N, Faria L, Ouellette R, Majczak M. Dance and movement program improves quality-of-life measures in breast cancer survivors. Cancer Nurs. 2005;28(4):301-9.

44. Basen-Engquist K, Scruggs S, Jhingran A, Bodurka DC, Lu K, Ramondetta L, et al. Physical activity and obesity in endometrial cancer survivors: Associations with pain, fatigue, and physical functioning. Am J Obstet Gynecol. 2009;200(3). doi:10.1016/j.ajog.2008.10.010.

45. Courneya KS, Karvinen KH, Campbell KL, Pearcey RG, Dundas G, Capstick V, et al. Associations among exercise, body weight, and quality of life in a

population-based sample of endometrial cancer survivors. Gynecol Oncol. 2005;97(2):422-30.

46. Bellizzi KM, Rowland JH, Arora NK, Hamilton AS, Miller MF, Aziz NM. Physical activity and quality of life in adult survivors of non-hodgkin's lymphoma. J Clin Oncol. 2009;27(6):960-6.

47. Vallance JKH, Courneya KS, Jones LW, Reiman T. Differences in quality of life between non-hodgkin's lymphoma survivors meeting and not meeting public health exercise guidelines. Psychooncology. 2005;14(11):979-91.

48. Peddle CJ, Au H, Courneya KS. Associations between exercise, quality of life, and fatigue in colorectal cancer survivors. Dis Colon Rectum. 2008;51(8):1242-8.

49. Lynch BM, Cerin E, Owen N, Aitken JF. Associations of leisure-time physical activity with quality of life in a large, population-based sample of colorectal cancer survivors. Cancer Causes Control. 2007;18(7):735-42.

50. Birmann BM, Giovannucci E, Rosner B, Anderson KC, Colditz GA. Body mass index, physical activity, and risk of multiple myeloma. Cancer Epidemiol Biomarkers Prev. 2007;16(7):1474-8.

51. Jones LW, Courneya KS, Vallance JKH, Ladha AB, Mant MJ, Belch AR, et al. Association between exercise and quality of life in multiple myeloma cancer survivors. Support Care Cancer. 2004;12(11):780-8.

52. Bélanger L, Plotnikoff R, Clark A, Courneya K. Physical activity and health-related quality of life in young adult cancer survivors: A Canadian provincial survey. J Cancer Surviv. 2011;5:44-53

53. Blanchard CM, Stein KD, Baker F, Dent MF, Denniston MM, Courneya KS, et al. Association between current lifestyle behaviors and health-related quality of life in breast, colorectal, and prostate cancer survivors. Psychol Health. 2004;19(1):1-13.

54. Mosher CE, Sloane R, Morey MC, Snyder DC, Cohen HJ, Miller PE, et al. Associations between lifestyle factors and quality of life among older long-term breast, prostate, and colorectal cancer survivors. Cancer. 2009;115(17):4001-9.

55. Irwin ML. Physical activity interventions for cancer survivors. Br J Sports Med. 2009;43(1):32-8.

56. Holmes MD, Chen WY, Feskanich D, Kroenke CH, Colditz GA. Physical activity and survival after breast cancer diagnosis. JAMA. 2005;293(20):2479-86.

57. Holick CN, Newcomb PA, Trentham-Dietz A, Titus-Ernstoff L, Bersch AJ, Stampfer MJ, et al. Physical activity and survival after diagnosis of invasive breast cancer. Cancer Epidemiol Biomarkers Prev. 2008;17(2):379-86.

58. Meyerhardt JA, Giovannucci EL, Holmes MD, Chan AT, Chan JA, Colditz GA, et al. Physical activity and survival after colorectal cancer diagnosis. J Clin Oncol. 2006;24(22):3527-34.

59. Meyerhardt JA, Heseltine D, Niedzwiecki D, Hollis D, Saltz LB, Mayer RJ, et al. Impact of physical activity on cancer recurrence and survival in patients with stage III colon cancer: Findings from CALGB 89803. J Clin Oncol. 2006;24(22):3535-41.

2: CHAPTER 2

Study 1: Paper 1

Associations Between Physical Activity and Quality of Life in a Population-Based Sample of Kidney Cancer Survivors

A version of this chapter has been published. Trinh, L., Plotnikoff, R. C., Rhodes, R. E., North, S., & Courneya, K. S. (2011). Associations between physical activity and quality of life in a population-based sample of kidney cancer survivors. Reprinted from, *Cancer Epidemiology, Biomarkers & Prevention, 20*(5): 859-868, by permission of publisher.

2-1. INTRODUCTION

Kidney cancer is the 10th most common cancer in Canada and the 13th leading cause of cancer death, with 4,800 new cases and 1,650 deaths in 2010 (1). In the United States, an estimated 58,240 new cases of kidney cancer are expected in 2010 (2). Renal cell carcinoma (RCC) is the most common type of kidney cancer accounting for 80% of all tumors (1). The prognosis for kidney cancer is fair, with a predicted five-year survival rate of 67% for all stages. Despite increasing incidence rates, mortality rates due to kidney cancer have declined, and five-year relative survival has improved (1). The increasing survival rate has placed greater emphasis on efforts to maintain quality of life (QoL) in kidney cancer survivors (KCS).

Surgery is the primary treatment for most kidney cancers and can result in significant treatment side effects that may impact QoL. The symptoms most evident among localized RCC patients include irritability, pain, fatigue, depression, anxiety, and sleep disturbance (3). These symptoms can affect the physical functioning, psychological functioning, social functioning and role activities of KCS (3). Few interventions have focused on reducing symptoms and improving QoL in KCS.

A growing number of studies have indicated that physical activity (PA) may be useful for improving QoL in cancer survivors (4, 5). Recent systematic reviews in breast cancer survivors (6, 7), prostate cancer survivors (8), hematologic cancer survivors (9), mixed cancer survivors (10-12), advanced disease cancer survivors (13), and older adult cancer survivors (14) have indicated that PA may improve a variety of health outcomes including aerobic fitness, muscular strength, fatigue, depression, anxiety, self-esteem, functional ability, and overall QoL. No studies to date, however, have focused on KCS.

Here, we report what we believe to be the first study to examine PA in KCS. The primary objectives were to estimate the prevalence of PA in KCS and determine any associations with QoL. We hypothesized that the majority of KCS would not be meeting PA guidelines and that there would be a dose-response association between PA and QoL. A secondary objective was to explore if any medical or demographic variables moderated the association between PA and QoL.

2-2. METHODS

Study Population

Ethical approval for this study was granted by the Alberta Cancer Board Research Ethics Board and the University of Alberta Research Health Ethics Board. Eligibility for the study included: (a) 18 years or older, (b) ability to understand English, (c) currently residing in Alberta, and (d) diagnosed with kidney cancer in Alberta between 1996 and 2010. There were 1,985 KCS from the Alberta Cancer Registry who met our eligibility and all were approached to participate in the survey. The study used a cross-sectional design with a mailed, self-administered survey.

The survey was conducted by the Alberta Cancer Registry on behalf of the researchers between May and September 2010. Eligible survivors were mailed a study package containing: (a) an invitation letter from the Registry explaining the role of the Registry in this study and the general purpose of the Registry, (b) a letter from the researchers explaining the nature of the study, (c) the survey booklet, and (d) a postage paid return envelope. Participants were asked to return the completed survey. Participants not wishing to participate were informed that they could return the survey blank to avoid further contacts. The survey protocol followed a modified version of the Total Design Method (15) wherein prospective participants were mailed: (a) the initial survey package, (b) a postcard reminder 3-4 weeks later to those who did not respond, and (c) a second survey package 3-4 weeks later to those who had not responded to the initial survey and reminder. The modification to the Total Design Method was that we did not include a follow-up telephone call to the nonresponders because our ethics board deemed it to be too intrusive.

Measures

Demographic and medical information. Demographic variables were assessed using self-report and included age, sex, education level, marital status, annual income, employment status, ethnicity, and height and weight to compute body mass index (BMI). Medical variables were also assessed using self-report and included time since diagnosis, type of kidney cancer, lymph node involvement, disease stage, previous and current treatments, previous recurrence, and current disease status. Smoking and drinking status were assessed by single-items that asked participants to check one of several options as follows: Smoking status: never smoke, ex-smoker, occasional smoker, regular smoker; Drinking status: never drink, social drinker, regular drinker (drink every day) (16).

Comorbidities were assessed by asking participants to check all of the conditions listed that apply to them. The list included the most commonly reported conditions such as high blood pressure, heart attack, emphysema, diabetes, angina, high cholesterol, stroke, chronic bronchitis, other cancer, arthritis, and an open ended question that asked if they had any other long term health condition.

Physical activity. A modified version of the validated Leisure Score Index (LSI) from the Godin Leisure-Time Exercise Questionnaire (GLTEQ) (17, 18) was used to assess PA behaviour. Participants were asked to recall their average weekly frequency and duration of light (minimal effort, no perspiration), moderate (not exhausting, light perspiration), and vigorous (heart beats rapidly, sweating) PA that lasted at least 10 minutes and was done during free time in the past month. We calculated the percentage of participants meeting the public health PA guidelines established by the 2008 Physical Activity Guidelines for Americans (19) which have also been recommended for cancer survivors by the American Cancer Society (20) and the American College of Sports Medicine (21). These guidelines suggest that individuals should obtain 75 minutes of vigorous PA per week, 150 minutes of moderate PA per week or an equivalent combination. Therefore, we calculated "PA minutes" as moderate minutes plus two times the vigorous minutes. These PA minutes were then transformed into the following four categories based on the guidelines: [1] completely sedentary (CS; no PA minutes), [2] insufficiently active (IA; 1-149 PA minutes), [3] within guidelines (WG; 150 to 299 PA minutes), and [4] above guidelines (AG; ≥ 300 PA minutes).

Quality of life. QoL was assessed by the well-validated Functional Assessment of Cancer Therapy-Fatigue (FACT-F) scale which includes the 27 items from the FACT-General (FACT-G) scale plus the 13 item fatigue subscale (22, 23). The FACT-G consists of physical well-being (PWB), functional well-being (FWB), emotional well-being (EWB), and social well-being (SWB). The PWB, FWB, and fatigue scale can be summed to form the Trial Outcome Index-Fatigue (TOI-F). We also included the validated Functional Assessment of Cancer Therapy-Kidney Symptom Index-15 item (FKSI-15) which contains a combination of questions from the FACT-G subscales including PWB, FWB, and EWB, as well as questions that assess the most important targeted symptoms and concerns for KCS (24). On all scales, higher scores indicate better QoL.

Statistical Analyses

The primary outcome in our study was the TOI-F. Our planned sample size of 700 provided ample power to detect differences in QoL among the PA categories of d=0.25, which includes the minimally important differences for these QoL scales. Our primary analyses examined differences in QoL across the four PA categories using analyses of covariance (ANCOVA) that adjusted for important demographic and medical variables determined a priori including: age, sex, marital status, education level, BMI, months since diagnosis, number of comorbidities, drug therapy status, current treatment status, current disease status, previous recurrence, smoking status, and drinking status.

We explored several demographic and medical variables as potential moderators of the association between PA and the TOI-F (our primary outcome).

Interactions were tested using ANCOVAs adjusting for the same variables with potential moderators identified a priori as age (<60 versus 60-69 versus ≥70 years), sex, marital status (married versus not married), education level (some/completed high school versus some/completed university), BMI (healthy weight versus overweight versus obese), number of comorbidities (<3 comorbidities versus ≥3 comorbidities), months since diagnosis (<60 months versus ≥60 months), disease stage (localized versus metastasized), type of surgery (partial nephrectomy versus radical nephrectomy), type of incision (laparoscopic versus open cut), drug therapy treatment (yes versus no), current treatment status (not receiving treatment versus receiving treatment), and current disease status (disease-free versus existing disease). Pearson correlations were performed to test for a linear dose-response association between the PA categories and QoL.

2-3. RESULTS

Figure 1 reports the participant flow through the study. Briefly, of the 1,985 mailed surveys, 331 were returned to sender for the following reasons: wrong address (n=317), no history of kidney cancer (n=8), and deceased (n=6). Of the remaining 1,654 surveys, 793 did not respond, 100 were returned blank (indicating no interest), 49 contacted us to decline participation, 5 were returned incomplete, 4 were returned completed after the deadline, and 703 were returned completed, resulting in a 35% completion rate (703/1,985) and a 43% response rate (703/1,654) excluding the return to sender surveys.

To assess the representativeness of our sample, we compared responders (n=703) and nonresponders (n=1,282) on the limited available demographic and medical variables from the Registry. Responders and nonresponders did not differ in terms of mean age (66.2 years vs. 67.2 years; p=0.072), sex (61.9% men vs. 61.8% men; p=0.961), or surgery rate (93.6% vs. 92.7%; p=0.437). Responders were about 1 year closer to their date of diagnosis compared to nonresponders (mean=72 months vs. 84 months; p<0.001) and had a slightly higher rate of treatment with systemic therapy (5.8% vs. 3.0%; p=0.003). Moreover, there was a difference in kidney cancer morphology (p<0.001) with responders having a lower rate of renal cell carcinoma (36.4% vs. 48.5%), a higher rate of clear cell carcinoma (46.1% vs. 35.9%), but no difference in the rate of papillary carcinoma (8.0% vs. 8.0%).

To assess the validity of our self-report data, we compared our self-report data to the Registry data on the limited variables available in the Registry. We found that self-reported age was highly correlated with Registry age (r=0.98, p<0.001) and self-reported sex was highly concordant with Registry sex (99% concordance; p<0.001). Moreover, self-reported months since diagnosis was highly correlated with Registry recorded months since diagnosis (r=0.79, p<0.001). Unfortunately, treatment data are not required to be recorded in the Registry and it is often recorded in a less rigorous fashion. The typical “error” is that treatments are underreported to the Registry and this was found in our data. For example, for KCS who self-reported no systemic therapy (n=611), 99.8% had no systemic therapy recorded in the Registry. Conversely, for KCS who self-reported yes to systemic therapy (n=92), only 43.5% had yes recorded in the Registry (i.e., likely underreporting to the Registry). Consequently, given the accuracy of the self-report demographic data, and the limitations of the Registry medical data, we elected to use the self-report data for all demographic and medical variables.

Sample characteristics

The self-reported demographic, medical, and cancer characteristics of participants are displayed in Tables 1 and 2 respectively. Briefly, the mean age was 65.0±11.1, 62.9% were male, 73.6% were married, 38.0% were employed full/part-time, and 27.6% completed university/college. The mean BMI was 28.5±5.2, with 43.7% being overweight and another 31.6% being obese. The mean number of months since diagnosis was 69.0±55.5, with 86.8% disease-free, 97.3% having received surgery, and 81.8% having localized kidney cancer.

Descriptive statistics for PA and QoL variables are displayed in Table 3. The mean number of PA minutes was 135±425 which consisted of 71±231 moderate minutes and 32±174 vigorous minutes. Based on the public health guideline categories, 396 (56.3%) KCS were CS, 124 (17.6%) were IA, 84 (11.9%) were WG, and 99 (14.1%) were AG. Overall, 183 (26.0%) were meeting public health PA guidelines.

Associations between physical activity and quality of life

Differences in QoL across the PA categories are presented in Table 4. ANCOVAs indicated significant differences across the PA public health categories for PWB, FWB, fatigue, FKSI-15, FACT-G, FACT-F, and TOI-F. Significant linear trends were noted across the PA categories for PWB, FWB, fatigue, FKSI-15, FACT-G, FACT-F, and TOI-F. The general pattern for the

QoL variables was a linear increase from CS to WG with no further increases for AG. In terms of the magnitude of the associations, the overall differences among the PA categories from CS to WG were 1.6 points for PWB (95% CI, 0.5 to 2.7; *d*=0.33), 2.2 points for FWB (95% CI, 0.9 to 3.5; *d*=0.39), 4.8 points for fatigue (95% CI, 2.2 to 7.3; *d*=0.42), 3.8 points for the FKSI-15 (95% CI, 1.9 to 5.8; *d*=0.43), 6.2 points for FACT-G (95% CI, 2.7 to 9.7; *d*=0.40), 11.0 points for FACT-Fatigue (95% CI, 5.5 to 16.5; *d*=0.45), and 8.6 points for TOI-F (95% CI, 4.2 to 12.9; *d*=0.44) (Figure 2a).

Moderators of the association between physical activity and quality of life.

Education moderated the association between public health PA guidelines and the TOI-F (p for interaction=.008; Figure 2b). There was a strong dose-response relationship from CS to AG for participants who completed at least some college/university (12.8 points). Conversely, there was an "inverted U" association for those who had not completed at least some college/university with a sharp increase from CS to IA of 10.3 points and a decline from IA to AG of 6.6 points. Number of comorbidities also moderated the association between PA and the TOI-F (p for interaction=.017; Figure 2c). There was a strong dose-response association from CS to AG for participants who had fewer than three comorbidities (8.9 points). Conversely, for participants with three or more comorbidities there was a threshold association that consisted of a sharp increase from CS to IA of 11.8 points that leveled off for higher PA categories. Finally, age was a borderline significant moderator of the association between PA and the TOI-F (p for interaction=.067; Figure 2d). There was a threshold association between IA and WG of 8.4 points for those <60 years of age whereas there was an "inverted U" association for those between 60-69 with a sharp increase of 11.5 points between CS and WG and a decline of 6.4 points when exceeding the guidelines. Finally, there was a threshold association between CS and IA of 11.6 points for those ≥70 years over.

2-4. DISCUSSION

Over half of KCS in our Alberta sample are completely sedentary and only a quarter are meeting PA guidelines. This participation rate is lower than the 56.5% in the general adult Alberta population (25) but similar to other cancer survivor groups in Alberta (5, 26-30). No previous data exist on the prevalence of PA among KCS. Moreover, 43.7% of KCS are overweight and another 31.6% are obese. The low PA rate and high obesity rate in KCS may have implications for health and disease outcomes. Although no research has examined lifestyle and disease outcomes in KCS, research into kidney cancer risk factors has shown that lower PA and higher obesity are associated with an increased risk of kidney cancer incidence (31-37). It is possible that these same lifestyle factors are also implicated in disease recurrence, other chronic diseases, and early mortality in KCS as has been demonstrated in breast (7) and colorectal cancer survivors (38-40). Nevertheless, even if PA is not related to disease outcomes in KCS, the present study provides compelling data that it is linked to QoL.

The main finding of our study was that there is a strong association between PA and QoL in KCS. The general pattern was a dose-response association from CS to WG with no further increases for exceeding guidelines.

The associations appear to be meaningful based on guidelines for minimal important differences (MID) on the FACT scales (41). Specifically, the observed difference for the TOI-F in our study was 8.6 points which exceeds the MID of 5.0 points (42). Moreover, the observed difference on the FACT-F was 11.0 points which exceeds the MID of 7.0 points (42). For the FKSI-15, a difference of 3.8 points was observed which is within the range of the MID of 3.0 to 5.0 points for this scale (24). Finally, the difference in the fatigue subscale of 4.8 points exceeds the MID of 3.0 to 4.0 points (42).

There are no published studies that have examined PA and QoL in KCS with which to compare our results. Research in other cancer survivors groups has examined the association between PA guidelines and QoL with the general pattern of results showing better QoL in those cancer survivors meeting guidelines (5, 26-30, 43-45). Few of these studies, however, have examined more than the simple distinction between meeting versus not meeting guidelines.

Our study is one of the few to further divide PA into four categories based on public health guidelines. These additional categories were created because, although the recommended guidelines are for 150 “PA minutes” per week, the guidelines also note that some PA is better than none and that additional benefits can be achieved by exceeding the guidelines of 300 PA minutes (20, 21). Only a handful of studies have examined this issue in cancer survivors. Karvinen et al. (29) examined the association between three PA categories (CS, IA, and WG) and QoL in 525 bladder cancer survivors and found a similar dose-response association as reported in the present study. Similar findings were also demonstrated in 200 endometrial cancer survivors (45). Similar to our study, Bélanger et al. (43) examined all four PA categories in young adult cancer survivors and found the same steep dose response association from CS to WG with no further increases above guidelines. Conversely, also using all four PA categories, Stevinson et al. (5) reported a threshold association between IA and WG in 359 ovarian cancer survivors, suggesting that the association between PA and QoL may vary by cancer survivor group.

Data from our study also suggest that PA is most strongly associated with the physical and functional aspects of QoL, including fatigue, rather than the social and emotional dimensions. This finding is consistent with established evidence in other cancer survivors showing that PA has the most benefits for cancer survivors in the physical and functional domains of QoL, including fatigue (5, 30, 31, 42). Our study also found that the kidney symptom index was positively associated with PA. This suggests that even the symptoms most important to KCS such as irritability, pain, fatigue, worry, sleep disturbance, weakness, and shortness of breath (3) may also benefit from PA participation. Mechanisms through which PA may influence physical, functional, and symptom-related QoL in KCS include improved cardiorespiratory fitness, muscular strength, body composition, flexibility, balance, and reduced risk of other chronic diseases.

We found that only education, age, and comorbidities moderated the association between PA and our primary QoL outcome, the TOI-F. Specifically, among survivors who had some or completed college/university, there was a strong dose-response relationship with a 12.8 point difference observed from CS to AG. Conversely, those survivors who had only some or completed high school demonstrated a sharp increase from CS to IA (10.3 points) with a decline from IA to AG (6.6 points). The explanation for this finding is unclear and may be due to chance given the large number of moderators tested. Nevertheless, one possibility is that KCS who have only completed high school may have occupations that require higher levels of PA (e.g., carpenters, farmers, labourers) resulting in benefits from some additional leisure-time PA but not from higher levels that may be unhelpful or even harmful to QoL. Conversely, KCS who have some/completed university may have more sedentary occupations for which successively higher levels of leisure-time PA may be beneficial. It is also possible that KCS who have lower literacy levels may have had difficulty completing the self-report measures. Nevertheless, Hahn et al. (46) developed a multimedia touchscreen program to assess QoL using the FACT-General, and evaluated its use in low and high literacy among cancer patients. The researchers found that the touchscreen program was valid and useful for QoL assessment in lower literacy populations, and that most QoL items performed similarly across literacy levels, indicating unbiased measurement.

Age was a borderline significant moderator of PA and QoL in a fairly complex manner. Nevertheless, the general pattern suggests that KCS under 60 years of age need to meet the PA guidelines in order to derive QoL benefit whereas for those KCS between 60 and 69, and over 70, doing some PA appears to be beneficial, with no clear association with additional PA. These data are consistent with findings showing that smaller amounts of PA may be beneficial for older adults compared to younger adults (19). The only medical variable to moderate the association between PA and TOI-F was the number of comorbidities. In general, those survivors who had fewer than three comorbidities demonstrated a steady dose-response association between PA and TOI-F. For those survivors with ≥3 comorbidities, a sharp increase was observed from CS to IA of 11.8 points that declined slightly with higher PA categories. This finding suggests that engaging in some PA generates substantial improvements in the health status of KCS with established comorbidities. Additional moderators were examined but showed that the association between PA and QoL was not influenced by sex, marital status, BMI, months since diagnosis, disease stage, type of surgery, type of surgical incision, drug treatment, current treatment status, and current cancer status.

Overall, a valuable insight from our study was the improvement in QoL observed among KCS who reported some PA but less than meeting the public health PA guidelines. This is consistent with a previous study of 319 non-Hodgkin's lymphoma survivors (47). This finding has practical implications in the development of appropriate PA interventions in this population. Since more than half of KCS are completely sedentary, it is essential to develop appropriate messages that might play a role in the motivation of sedentary individuals to engage in some PA. PA does not necessarily need to be performed at a high volume for survivors to derive benefit. Beginning a PA program at lower levels of frequency, intensity, and duration may be less daunting and more attainable for many KCS who are completely sedentary, and may still potentially improve QoL.

Our study needs to be interpreted within the context of important strengths and limitations. To the best of our knowledge, our study is the first to examine PA in KCS. Furthermore, we sampled all KCS diagnosed between 1996 and 2010 from a comprehensive Registry in Alberta, Canada. Our study is also one of the few studies to have examined a dose-response relationship between PA and QoL across four PA categories. One limitation of our study is the cross-sectional design which precludes any inferences about causality. Randomized controlled trials on the effects of PA on QoL and other health outcomes in KCS are needed. Moreover, our study also relied on a self-report measure of PA which, although validated, can introduce measurement error. Our study also used self-reported medical data which is not as reliable as data from medical records. Finally, our study achieved a modest response rate that resulted in a sample that was not entirely representative of Alberta KCS in terms of kidney cancer morphology, rate of systemic treatment, months since diagnosis, and likely other unmeasured variables (e.g., QoL levels, PA levels). Our response rate (43%) is lower compared to some US-based PA studies in cancer survivors (48), however, many of these studies employ prescreening of patient eligibility based on health conditions to eliminate unlikely responders whereas our study approached all KCS without any prescreening.

In conclusion, our study presents the first data on PA in KCS. We found that over half of KCS are completely sedentary and only a quarter are meeting PA guidelines. Moreover, PA has a strong association with QoL including potential gains even for small amounts of PA. Future research should consider testing these dose-response findings in randomized controlled trials to determine the causal effects of PA on QoL and other health outcomes. Moreover, research into the determinants of PA in KCS is needed to inform strategies for promoting PA in this understudied cancer survivor group.

Table 2-1. Demographic and medical characteristics of kidney cancer survivors in Alberta, Canada, May, 2010 (N=703)

Variable	n (%)
Age (Mean ± SD=65.0 ± 11.1)	
<60	251 (35.7)
60-69	213 (30.3)
≥70	239 (34.0)
Sex	
Male	442 (62.9)
Female	261 (37.1)
Marital Status	
Married/common law	518 (73.6)
Not married	185 (26.3)
Education	
Some high school	162 (23.0)
Completed high school	158 (22.5)
Some university/college	99 (14.1)
Completed university/college	194 (27.6)
Some/completed graduate school	90 (12.8)
Annual Family Income	
<$20 000	73 (10.4)
$20 000-$59 999	223 (31.7)
$60 000-$99 999	164 (23.3)
>$100 000	128 (18.2)
Missing data	115 (16.4)
Employment status	
Employed full-/part-time	267 (38.0)
Retired	356 (50.6)
Other	80 (11.4)
Ethnicity	
White	640 (91.0)
Other	63 (9.0)
Body mass index (Mean ± SD=28.5 ± 5.2)	
Healthy weight	174 (24.8)
Overweight	307 (43.7)
Obese	222 (31.6)
Number of comorbidities	
None	66 (9.4)
1	130 (18.5)
2	161 (22.9)
≥3	346 (49.2)

Table 2-1. cont'd

Variable	n (%)
*Most common comorbidities	
High blood pressure	415 (59.0)
Arthritis	328 (46.7)
High cholesterol	294 (41.8)
Other cancer	183 (26.0)
Not specified	101 (55.2)
Prostate	25 (33.8)
Skin	11 (15.1)
Breast	10 (13.7)
Diabetes	129 (18.3)
Angina	80 (11.4)
Heart attack	72 (10.2)
Smoking status	
Never smoked	287 (40.8)
Ex-smoker	321 (45.7)
Regular/occasional smoker	95 (13.5)
Drinking status	
Never drink	229 (32.6)
Social drinker	438 (62.3)
Regular drinker	36 (5.1)
General health rating	
Excellent	38 (5.4)
Very good	178 (25.3)
Good	300 (42.7)
Fair	159 (22.6)
Poor	28 (4.0)

*could check more than one response

Table 2-2. Cancer and treatment characteristics of kidney cancer survivors in Alberta, Canada, May, 2010 (N=703).

Variable	n (%)
Months since diagnosis (Mean ± SD=69.0 ± 55.5)	
<24	145 (20.6)
24-59	199 (28.3)
≥60	359 (51.1)
Type of kidney cancer	
Papillary	140 (19.9)
Non-papillary	246 (35.0)
Don't know	317 (45.1)
Lymph nodes involved	
Yes	37 (5.3)
No	517 (73.5)
Don't know	149 (21.2)
Disease stage	
Localized	574 (81.7)
Metastatic	88 (12.5)
Don't know	41 (5.8)
Location of Metastases (N=88)	
Lung	47 (53.4)
Lymph	18 (20.5)
Liver	15 (17.0)
Other	28 (31.8)
Surgery treatment	
Yes	684 (97.3)
No	19 (2.7)
Type of surgery (N=684)	
Partial nephrectomy	124 (18.1)
Radical nephrectomy	535 (78.2)
Don't know	25 (3.7)
Type of incision (N=684)	
Laparoscopic	206 (30.1)
Open incision	459 (67.1)
Don't know	19 (2.8)
Radiation treatment	
Yes	27 (3.8)
No	676 (96.2)
Drug treatment	
Yes	92 (13.1)
No	611 (86.9)
*Type of drug treatment (N=92)	
Sunitinib (Sutent)	53 (57.6)
Sorafenib (Nexavar)	18 (19.6)
Everolimus (Afinitor)	7 (7.6)
Interferon	7 (7.6)
Don't know	32 (34.8)

Table 2-2. cont'd

Variable	n (%)
Current treatment status	
Completed treatment	642 (91.3)
Receiving treatment	61 (8.7)
Recurrence	
Yes	54 (7.7)
No	649 (92.3)
Current disease status	
Disease-free	610 (86.8)
Existing disease	93 (13.2)

*could check more than one response

Table 2-3. Descriptive statistics for physical activity and quality of life in kidney cancer survivors in Alberta, Canada, May, 2010 (N=703).

Variable	M ± SD or n (%)
Average weekly physical activity in the past month	
Light minutes	115 ± 265
Moderate minutes	71 ± 231
Vigorous minutes	32 ± 174
Physical activity minutes[1]	135 ± 425
Public health physical activity categories	
Completely sedentary	396 (56.3%)
Insufficiently active	124 (17.6%)
Within guidelines	84 (11.9%)
Above guidelines	99 (14.1%)
Meeting guidelines[2]	183 (26.0%)
Quality of Life	
Physical well-being (0-28)	23.3 ± 4.9
Functional well-being (0-28)	21.2 ± 5.7
Emotional well-being (0-24)	19.3 ± 4.4
Social well-being (0-24)	18.7 ± 5.4
Fatigue (0-52)	38.1 ± 11.3
Kidney symptom index (0-60)	46.7 ± 8.9
FACT-General (0-104)	82.6 ± 15.4
FACT-Fatigue (0-156)	120.6 ± 24.6
Trial outcome index-Fatigue (0-108)	82.6 ± 19.6

Note. FACT= Functional Assessment of Cancer Therapy.[1]Physical activity minutes are calculated as moderate minutes plus two times vigorous minutes.[2]Combines within and above guidelines.

Table 2-4. Differences in quality of life across public health physical activity categories in kidney cancer survivors, Alberta, Canada, May, 2010 (N=703).

	Completely sedentary (CS) (n=396)	Insufficiently active (IA) (n=124)	Within guidelines (WG) (n=84)	Above guidelines (AG) (n=99)	p-difference	p for trend
Physical well-being[a]	22.5 (5.4)	24.2 (4.3)	24.7 (4.1)	24.4 (4.0)	<0.001	
Physical well-being[b]	22.7 (0.23)	23.9 (0.41)	24.3 (0.50)	24.3 (0.46)	=0.001	<0.001
Functional well-being[a]	20.1 (6.0)	22.1 (4.9)	23.1 (4.9)	23.1 (5.2)	<0.001	
Functional well-being[b]	20.3 (0.28)	21.8 (0.49)	22.6 (0.60)	22.8 (0.55)	<0.001	<0.001
Emotional well-being[a]	19.1 (4.5)	19.2 (4.2)	20.5 (3.3)	19.4 (4.6)	0.083	
Emotional well-being[b]	19.1 (0.21)	19.2 (0.38)	20.4 (0.46)	19.5 (0.42)	0.102	=0.097
Social well-being[a]	18.3 (5.7)	18.7 (4.8)	19.4 (5.0)	19.7 (5.0)	0.073	
Social well-being[b]	18.2 (0.27)	18.8 (0.48)	19.4 (0.59)	19.7 (0.54)	0.059	=0.01
Fatigue[a]	35.7 (11.5)	39.4 (10.0)	42.4 (9.3)	42.0 (10.9)	<0.001	
Fatigue[b]	36.3 (0.54)	38.8 (0.94)	41.1 (1.16)	41.6 (1.06)	<0.001	<0.001
Kidney symptom index[a]	45.0 (9.1)	48.2 (7.8)	50.4 (7.5)	48.6 (9.1)	<0.001	
Kidney symptom index[b]	45.5 (0.41)	47.6 (0.72)	49.3 (0.88)	48.1 (0.80)	<0.001	<0.001
FACT-General[a]	80.0 (15.9)	84.1 (14.2)	87.6 (13.0)	86.6 (14.8)	<0.001	
FACT-General[b]	80.4 (0.74)	83.8 (1.29)	86.6 (1.59)	86.5 (1.45)	<0.001	<0.001
FACT-Fatigue[a]	115.7 (25.1)	123.5 (22.7)	129.9 (20.6)	128.7 (23.3)	<0.001	
FACT-Fatigue[b]	116.7 (1.16)	122.6 (2.04)	127.7 (2.51)	128.1 (2.29)	<0.001	<0.001
Trial outcome index-Fatigue[a]	78.3 (20.2)	85.6 (17.5)	90.1 (15.7)	89.5 (17.7)	<0.001	
Trial outcome index-Fatigue[b]	79.3 (0.91)	84.6 (1.60)	87.9 (1.97)	88.8 (1.80)	<0.001	<0.001

[a]Unadjusted mean (standard deviation); [b]Adjusted mean (standard error) is adjusted for age, sex, martial status, education, BMI, months since diagnosis, drug treatment, current treatment status, recurrence, current disease status, smoking, drinking, and number of comorbidities. FACT=functional assessment of cancer therapy.

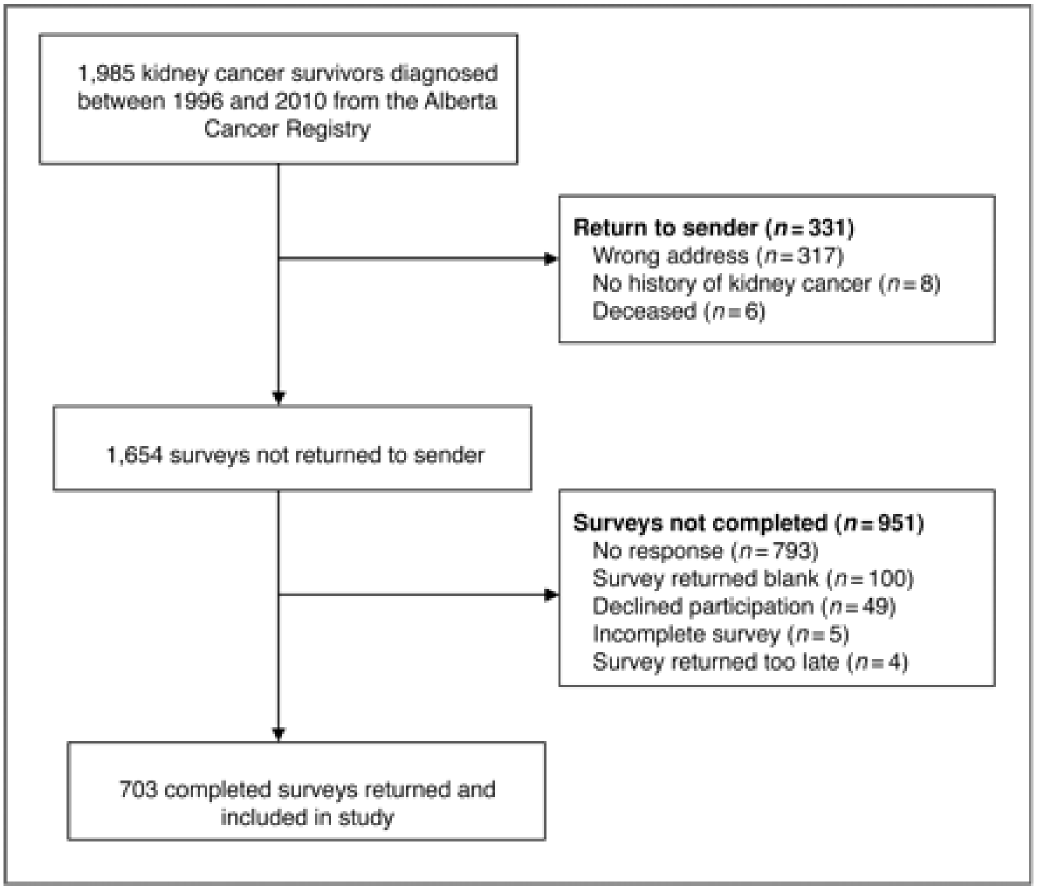

Figure 2-1. Flow of participants through the study.

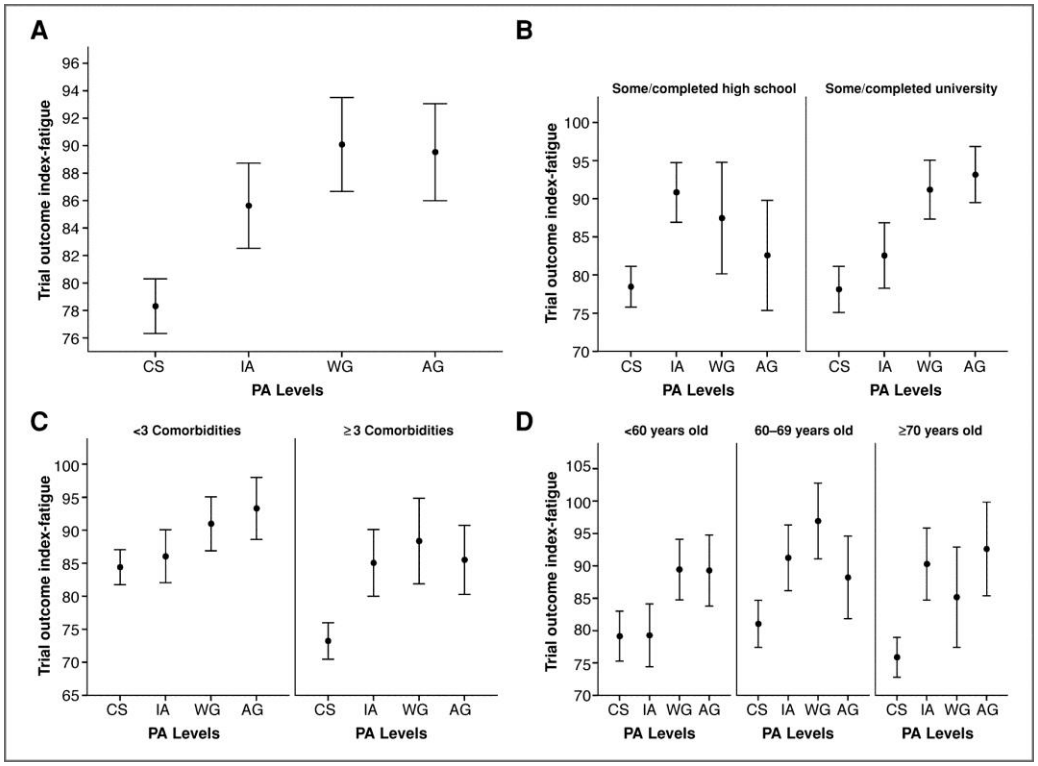

Figure 2-2.

A. Quality of life of kidney cancer survivors across public health physical activity categories in Alberta, Canada, May, 2010 (N=703).

B. Interaction between education and public health physical activity categories on quality of life in kidney cancer survivors in Alberta, Canada, May, 2010 (N=703).

C. Interaction between number of comorbidities and public health physical activity categories on quality of life in kidney cancer survivors in Alberta, Canada, May, 2010 (N=703).

D. Interaction between age and public health physical activity categories on quality of life in kidney cancer survivors in Alberta, Canada, May, 2010 (N=703).

[CS=Completely sedentary; IA=Insufficiently active; WG=Within guidelines; AG=Above guidelines]

REFERENCES

1. Canadian Cancer Society's Steering Committee. Canadian cancer statistics 2010. Toronto: Canadian Cancer Society; 2010.

2. American Cancer Society. Cancer facts & figures 2010. Atlanta: American Cancer Society; 2010.

3. Harding G, Cella D, Robinson D Jr, Mahadevia PJ, Clark J, Revicki DA. Symptom burden among patients with renal cell carcinoma (RCC): Content for a symptom index. Health Qual Life Outcomes. 2007;5:34. doi:10.1186/1477-7525-5-34.

4. Courneya KS, Friedenreich CM. Physical activity and cancer control. Semin Oncol Nurs. 2007 11;23(4):242-52.

5. Stevinson C, Faught W, Steed H, Tonkin K, Ladha AB, Vallance JK, et al. Associations between physical activity and quality of life in ovarian cancer survivors. Gynecol Oncol. 2007;106(1):244-50.

6. McNeely ML, Campbell KL, Rowe BH, Klassen TP, Mackey JR, Courneya KS. Effects of exercise on breast cancer patients and survivors: A systematic review and meta-analysis. CMAJ. 2006;175(1):34-41.

7. Bicego D, Brown K, Ruddick M, Storey D, Wong C, Harris SR. Effects of exercise on quality of life in women living with breast cancer: A systematic review. Breast J. 2009;15(1):45-51.

8. Thorsen L, Courneya KS, Stevinson C, Fosså S,D. A systematic review of physical activity in prostate cancer survivors: Outcomes, prevalence, and determinants. Support Care Cancer. 2008;16(9):987-97.

9. Liu RDKS, Chinapaw MJM, Huijgens PC, van Mechelen W. Physical exercise interventions in haematological cancer patients, feasible to conduct but effectiveness to be established: A systematic literature review. Cancer Treat Rev. 2009;35(2):185-92.

10. Schmitz KH, Holtzman J, Courneya KS, Mâsse L,C., Duval S, Kane R. Controlled physical activity trials in cancer survivors: A systematic review and meta-analysis. Cancer Epidemiol Biomarkers Prev. 2005;14(7):1588-95.

11. Knols R, Aaronson NK, Uebelhart D, Fransen J, Aufdemkampe G. Physical exercise in cancer patients during and after medical treatment: A systematic review of randomized and controlled clinical trials. J Clin Oncol. 2005;23(16):3830-42.

12. Visovsky C, Dvorak C. Exercise and cancer recovery. Online J Issues Nurs [internet]. 2005 May [cited 2010 Dec 10];10(2):[about 12 p.]. Available from: http://web.ebscohost.com/ehost/detail?hid=110&sid=2e37ee05-6516-4620-add9-d4733a2ae809%40sessionmgr115&vid=7&bdata=JnNpdGU9ZWhvc3QtbGl2ZSZzY29wZT1zaXRl#db=rzh&AN=2009020990

13. Lowe SS, Watanabe SM, Courneya KS. Physical activity as a supportive care intervention in palliative cancer patients: A systematic review. J Support Oncol. 2009;7(1):27-34.

14. Courneya KS, Vallance JKH, McNeely ML, Karvinen KH, Peddle CJ, Mackey JR. Exercise issues in older cancer survivors. Crit Rev Oncol Hematol. 2004;51(3):249-61.

15. Dillman DA. Mail and internet surveys: The tailored design method. New York: Wiley; 2000.

16. Friedenreich C, Bryant H, Alexander F, Hugh J, Danyluk J, Page D. Risk factors for benign breast biopsies: A nested case-control study in the Alberta breast screening program. Cancer Detect Prev. 2001;25(3):280-291.

17. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. Can J Appl Sport Sci. 1985;10(3):141-146.

18. Pereira MA, FitzerGerald SJ, Gregg EW, Joswiak ML, Ryan WJ, Suminski RR, et al. A collection of physical activity questionnaires for health-related research. Med Sci Sports Exerc. 1997;29(6):S1-S205.

19. US Department of Health and Human Services (USDHHS). 2008 physical activity guidelines for Americans. Washington: USDHHS; 2008.

20. Doyle C, Kushi LH, Byers T, Courneya KS, Demark-Wahnefried W, Grant B, et al. Nutrition and physical activity during and after cancer treatment: An American cancer society guide for informed choices. CA Cancer J Clin. 2006;56(6):323–53.

21. Haskell WL, Lee I, Pate RR, Powell KE, Blair SN, Franklin BA, et al. Physical activity and public health: Updated recommendation for adults from the American college of sports medicine and the American heart association. Med Sci Sports Exerc. 2007;39(8):1423-34.

22. Cella DF, Tulsky DS, Gray G, Sarafian B, Linn E, Bonomi A, et al. The functional assessment of cancer therapy scale: Development and validation of the general measure. J Clin Oncol. 1993;11(3):570-9.

23. Yellen SB, Cella DF, Webster K, Blendowski C, Kaplan E. Measuring fatigue and other anemia-related symptoms with the functional assessment of cancer therapy (FACT) measurement system. J Pain Symptom Manage. 1997;13(2):63-74.

24. Cella D, Yount S, Du H, Dhanda R, Gondek K, Langefeld K, et al. Development and validation of the functional assessment of cancer therapy-kidney symptom index (FKSI). J Support Oncol. 2006;4(4):191-9.

25. Physical activity during leisure-time, by sex, provinces and territories [homepage on the Internet]. Ottawa: Statistics Canada; 2010 [updated 2010-11-05]. Available from: http://www40.statcan.gc.ca/l01/cst01/health78b-eng.htm.

26. Vallance JKH, Courneya KS, Jones LW, Reiman T. Differences in quality of life between non-hodgkin's lymphoma survivors meeting and not meeting public health exercise guidelines. Psycho-oncology. 2005;14(11):979-91.

27. Jones LW, Courneya KS, Vallance JKH, Ladha AB, Mant MJ, Belch AR, et al. Association between exercise and quality of life in multiple myeloma cancer survivors. Support Care Cancer. 2004;12(11):780-8.

28. Courneya KS, Karvinen KH, Campbell KL, Pearcey RG, Dundas G, Capstick V, et al. Associations among exercise, body weight, and quality of life in a population-based sample of endometrial cancer survivors. Gynecol Oncol. 2005;97(2):422-30.

29. Karvinen KH, Courneya KS, North S, Venner P. Associations between exercise and quality of life in bladder cancer survivors: A population-based study. Cancer Epidemiol Biomarkers Prev. 2007;16(5):984-90.

30. Peddle CJ, Au H, Courneya KS. Associations between exercise, quality of life, and fatigue in colorectal cancer survivors. Dis Colon Rectum. 2008;51(8):1242-8.

31. Pan SY, DesMeules M, Morrison H, Wen SW. Obesity, high energy intake, lack of physical activity, and the risk of kidney cancer. Cancer Epidemiol Biomarkers Prev. 2006;15(12):2453-60.

32. Mellemgaard A, Engholm G, McLaughlin JK, Olsen JH. Risk factors for renal-cell carcinoma in Denmark. III. Role of weight, physical activity and reproductive factors. Int J Cancer. 1994;56(1):66-71.

33. Chow WH, Gridley G, Fraumeni JF, J., Järvholm B. Obesity, hypertension, and the risk of kidney cancer in men. N Engl J Med. 2000;343(18):1305-11.

34. van Dijk B,A.C., Schouten LJ, Kiemeney LALM, Goldbohm RA, van den Brandt P,A. Relation of height, body mass, energy intake, and physical activity to risk of renal cell carcinoma: Results from the Netherlands cohort study. Am J Epidemiol. 2004;160(12):1159-67.

35. Amling CL. The association between obesity and the progression of prostate and renal cell carcinoma. Urol Oncol. 2004;22(6):478-84.

36. Hu J, Mao Y, White K. Overweight and obesity in adults and risk of renal cell carcinoma in canada. Soz Praventivmed. 2003;48(3):178-85.

37. Leitzmann MF. Physical activity and genitourinary cancer prevention. In: Courneya KS, Friedenreich CM, editors. Physical activity and cancer. New York: Springer; 2011. p. 43-72.

38. Meyerhardt JA, Giovannucci EL, Holmes MD, Chan AT, Chan JA, Colditz GA, et al. Physical activity and survival after colorectal cancer diagnosis. J Clin Oncol. 2006;24(22):3527-34.

39. Meyerhardt JA, Giovannucci EL, Ogino S, Kirkner GJ, Chan AT, Willett W, et al. Physical activity and male colorectal cancer survival. Arch Intern Med. 2009;169(22):2102-8.

40. Meyerhardt JA, Heseltine D, Niedzwiecki D, Hollis D, Saltz LB, Mayer RJ, et al. Impact of physical activity on cancer recurrence and survival in patients with stage III colon cancer: Findings from CALGB 89803. J Clin Oncol. 2006;24(22):3535-41.

41. Cella D, Hahn EA, Dineen K. Meaningful change in cancer-specific quality of life scores: Differences between improvement and worsening. Qual Life Res. 2002;11(3):207-21.

42. Cella D, Eton DT, Lai J, Peterman AH, Merkel DE. Combining anchor and distribution-based methods to derive minimal clinically important differences on the functional assessment of cancer therapy (FACT) anemia and fatigue scales. J Pain Symptom Manage. 2002;24(6):547-61.

43. Bélanger L, Plotnikoff R, Clark A, Courneya K. Physical activity and health-related quality of life in young adult cancer survivors: A Canadian provincial survey. J Cancer Surviv. 2011;5:44-53

44. Lynch BM, Cerin E, Owen N, Aitken JF. Associations of leisure-time physical activity with quality of life in a large, population-based sample of colorectal cancer survivors. Cancer Causes Control. 2007;18(7):735-42.

45. Basen-Engquist K, Scruggs S, Jhingran A, Bodurka DC, Lu K, Ramondetta L, et al. Physical activity and obesity in endometrial cancer survivors: Associations with pain, fatigue, and physical functioning. Am J Obstet Gynecol. 2009;200. doi:10.1016/j.ajog.2008.10.010.

46. Hahn E, Cella D, Dobrez D, Weiss B, Du H, Lai J, et al. The impact of literacy on health-related quality of life measurement and outcomes in cancer outpatients. Qual Life Res. 2007;16(3):495-507.

47. Bellizzi KM, Rowland JH, Arora NK, Hamilton AS, Miller MF, Aziz NM. Physical activity and quality of life in adult survivors of non-Hodgkin's lymphoma. J Clin Oncol. 2009;27(6):960-6.

48. Coups EJ, Park BJ, Feinstein MB, Steingart RM, Egleston BL, Wilson DJ, et al. Correlates of physical activity among lung cancer survivors. Psycho-Oncology. 2009;18(4):395-404.

3: CHAPTER 3

Study 1: Paper 2

Associations Between Sitting Time and Quality of Life in a Population-Based Sample of Kidney Cancer Survivors

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3-1. INTRODUCTION

Sedentary behaviour refers to activities that do not increase energy expenditure substantially above the resting level (i.e., <1.5 METs) (Proper, Singh, Van Mechelen, & Chinapaw, 2011; Pate, O'Neill, & Lobelo, 2008). Sedentary behaviour is characterized by prolonged sitting or lying down and the absence of whole-body movement which typically occurs when watching TV or using a computer (Lynch, 2010). There is emerging evidence of the adverse health effects of sedentary behaviour for cancer risk that are distinct from beneficial effects of moderate-to-vigorous intensity physical activity (PA) (Lynch, 2010). Moreover, it is well established that prolonged sitting time is associated with an elevated risk of other chronic disease outcomes (e.g., type 2 diabetes, obesity) (Patel et al., 2010) and all-cause and cardiovascular mortality (Katzmarzyk, Church, Craig, & Bouchard, 2009; Matthews et al., 2012).

Previous research has highlighted some associations between sedentary behaviour and mental health in adults. For example, Teychenne, Ball, and Salmon (2010) found a positive association between higher levels of sedentary behaviour and risk of depression. Hamer, Stamatakis, and Mishra (2010) examined the association between recreational screen time with mental well-being and found sedentary behaviour to be associated with poorer mental health. Other studies examining TV viewing time have reported an association between lower satisfaction in terms of quality of life (QoL) and higher viewing time (Rhodes, Mark, & Temmel, 2012).

Several epidemiologic studies have demonstrated sedentary behaviour to be independently associated with chronic disease-related risk factors such as central adiposity, elevated blood glucose and insulin, and other cardiometabolic biomarkers in health adults. These attributes may be hypothesized to exist in the development and progression of cancer (Lynch, 2010). Sedentary behaviour has been linked with colorectal, endometrial, ovarian, and prostate cancer development; cancer mortality in women; and with weight gain in colorectal cancer survivors (Lynch, 2010). Consistent positive associations between kidney cancer and obesity have been reported among both men and women (Amling, 2004), where sedentary behaviour may contribute to adiposity. Cancer survival is associated with deleterious health status and an increased risk of mortality from other comorbidities such as type 2 diabetes and cardiovascular disease. The role of sedentary behaviour remains largely unexplored in cancer survivors, but it is possible that it may contribute to progression of cancer and the development of non-cancer diseases.

Kidney cancer is the 8th most common cancer in Canada with 5,600 new cases in 2012 (Canadian Cancer Society, 2012). Renal cell carcinoma (RCC) is the most common type of kidney cancer, encompassing 80% of all tumors (Canadian Cancer Society, 2012). Despite increasing incidence rates, the survival rates have improved (Canadian Cancer Society, 2012), which highlights the need to promote healthy lifestyles in kidney cancer survivors (KCS). Most research efforts focusing on QoL among cancer survivors have focused on establishing the causal relations between PA and QoL. These studies have shown that PA may improve a variety of health outcomes in cancer survivors including aerobic fitness, muscular strength, fatigue, depression, anxiety, self-esteem, functional ability, and overall QoL (Fong et al., 2012). However, research on sedentary behaviour and QoL among cancer survivors is in its preliminary stages with only three studies examining this association among colorectal cancer survivors (Lynch, Cerin, Owen, Hawkes, & Aitken, 2011), breast cancer survivors (George et al., in press) and rural breast cancer survivors (Rogers, Markwell, Courneya, McAuley, & Verhulst, 2011).

To the best of our knowledge, no study to date has examined the relationship between sitting time and QoL among KCS. The primary purpose of this study was to estimate the prevalence of sitting time among KCS and to determine any associations with QoL. We hypothesized that the majority of KCS would engage in prolonged sitting time and that there would be a negative dose-response association between sitting time and QoL. We also explored associations separately for non-work days and work days. A secondary objective was to explore if any medical or demographic variables moderated the associations between sitting time and QoL.

3-2. METHODS

Study Population

The design and methods of the survey have been reported elsewhere (Trinh, Plotnikoff, Rhodes, North, & Courneya, 2011). Briefly, the study used a cross-sectional design with a mailed, self-administered survey. Ethical approval was obtained by the Alberta Cancer Board Research Ethics Board and the

University of Alberta Health Research Ethics Board. Eligibility for the study included: (a) 18 years or older, (b) ability to understand English, (c) currently residing in Alberta, and (d) diagnosed with kidney cancer in Alberta between 1996 and 2010. The survey was conducted between May and September 2010 and all 1,985 KCS from the Alberta Cancer Registry who met our eligibility were mailed the survey.

Eligible survivors were mailed a study package containing: (a) an invitation letter from the registry explaining its function, (b) a letter from the researchers explaining the study purpose, (c) the survey booklet, and (d) a postage paid return envelope to return the survey. The survey protocol followed a modified version of the Total Design Method (Dillman, 2000) wherein prospective participants were mailed: (a) the initial survey package, (b) a postcard reminder 3-4 weeks later to nonresponders, and (c) a second survey package 3-4 weeks later to those who had not responded to the initial survey and reminder.

Measures

Demographic and medical information. Demographic variables were assessed using self-report and included age, sex, education level, marital status, annual income, employment status, ethnicity, and height and weight to compute body mass index (BMI). Medical variables were also assessed using self-report and included time since diagnosis, type of kidney cancer, lymph node involvement, disease stage, previous and current treatments, previous recurrence, and current disease status. Smoking and drinking status were assessed by single-items that asked participants to describe their current habits. Comorbidities were assessed by asking participants to check all of the conditions (e.g., high blood pressure, heart attack, diabetes) listed that were applicable (Friedenreich et al., 2001).

Sitting time. Sitting time was estimated using a modified version of the domain-specific sitting time questionnaire (Marshall, Miller, Burton, & Brown, 2010; Miller & Brown, 2004). Sitting time was assessed on a work and non-work day rather than week and weekend days to accurately reflect the variability in work schedules (i.e., working weekends, weekdays off work). This modified measure has been shown to have acceptable measurement properties for assessing sitting time among the working population in a test-retest reliability and validity study (Chau, Van der Ploeg, Dunn, Kurko, & Bauman, 2011).

Five items were used to assess time spent sitting (hours and minutes) each day in the following domains: (a) while traveling to and from places (e.g., in a car, bus, train); (b) while at work (e.g., sitting at a desk or using a computer); (c) while watching television; (d) while using a computer at home (e.g., e-mail, games, information); and (e) at leisure not including watching television or computer use (e.g., socializing, movies) on an average work day and non-work day. Total sitting time for a work day was divided into approximate tertitles, and categorized as: 0-5.0 hours; 5.1-10.0 hours; and >10.0 hours. Total sitting time for a non-work day was also divided into approximate tertitles, and categorized as: 0-4.0 hours; 4.1-7.0 hours; and >7.0 hours. Domain-specific sitting time for a non-work day and work day were also categorized into approximate tertiles.

Physical activity. PA was assessed using a modified version of the validated Leisure Score Index (LSI) from the Godin Leisure-Time Exercise Questionnaire (GLTEQ) (Godin & Shephard, 1985; Pereira et al., 1997). Participants were asked to recall the average number of times per week and average duration they performed light (minimal effort, no perspiration), moderate (not exhausting, light perspiration), and vigorous (heart beats rapidly, sweating) PA for a minimum of 10 minutes per session during free time in the past month. The percentage of participants meeting the public health aerobic PA guidelines was calculated based on the 2008 Physical Activity Guidelines for Americans (USDHHS, 2008), which have also been recommended for cancer survivors by the American Cancer Society (Rock et al., 2012) and the American College of Sports Medicine (Schmitz et al., 2010). These guidelines recommend that individuals obtain 75 minutes of vigorous aerobic PA per week, 150 minutes of moderate aerobic PA per week or an equivalent combination. Thus, we calculated "PA minutes" as moderate minutes plus two times the vigorous minutes. These PA minutes were then transformed into the following three categories: (1) completely inactive (no PA minutes), (2) insufficiently active (1-149 PA minutes), and (3) meeting guidelines (≥150 PA minutes).

Quality of life. QoL was assessed by the well-validated Functional Assessment of Cancer Therapy-General (FACT-G) which includes 27 items assessing physical well-being (PWB), functional well-being (FWB), emotional well-being (EWB), and social well-being (SWB) (Cella et al., 1993). Fatigue was assessed by the 13-item fatigue subscale (Yellen, Cella, Webster, Blendowski, &

Kaplan, 1997). The PWB, FWB, and fatigue scale can be summed to form the Trial Outcome Index-Fatigue (TOI-F). We also included the validated Functional Assessment of Cancer Therapy-Kidney Symptom Index-15 item (FKSI-15), which contains a combination of questions from the FACT-G subscales including PWB, FWB, and EWB, as well as questions that assess the most important targeted symptoms and concerns for KCS (Cella et al., 2006). Higher scores indicate better QoL in all scales.

Data Analyses

All statistical analyses were performed using PASW Statistics 18 (PASW Inc., Chicago, IL). Our primary analyses examined differences in QoL across the three sitting categories on a work day and non-working day using analyses of covariance (ANCOVA) that adjusted for important demographic and medical variables determined a priori including: age, sex, marital status, education level, BMI, months since diagnosis, number of comorbidities, drug therapy status, current treatment status, current disease status, previous recurrence, smoking status, and drinking status.

We also explored several demographic and medical variables as potential moderators of the association between sitting time and the FACT-G, kidney symptom index subscale, and

TOI-F. Interactions were tested using ANCOVAs adjusting for the same variables as in our primary analyses with potential moderators identified a priori as age (<60 versus 60-69 versus ≥70 years), sex, marital status (married versus not married), education level (some/completed high school versus some/completed university), BMI (healthy weight versus overweight versus obese), number of comorbidities (<3 comorbidities versus ≥3 comorbidities), months since diagnosis (<60 months versus ≥60 months), disease stage (localized versus metastasized), type of surgery (partial nephrectomy versus radical nephrectomy), type of incision (laparoscopic versus open cut), drug therapy treatment (yes versus no), current treatment status (not receiving treatment versus receiving treatment), current disease status (disease-free versus existing disease), and PA categories (completely inactive versus insufficiently active versus meeting guidelines).

3-3. RESULTS

Participant flow through the study is presented elsewhere (Trinh et al., 2011). Briefly, of the 1,985 mailed surveys, 331 were returned to sender due to wrong address, no history of kidney cancer, or deceased. Of the remaining 1,654 surveys, 703 were returned, resulting in a 35.4% completion rate (703/1,985) and a 42.5% response rate (703/1,654) excluding the return to sender surveys. For the present analyses, we had 540 of 703 (76.8%) KCS provide data for sitting time on a non-work day and 386 of 703 (54.9%) provide data for sitting time on a work day (because of being retired or otherwise not working). We previously compared responders (n=703) and nonresponders (n=1,282) and found no difference in terms of age, sex, or surgery rate (Trinh et al., 2011). Responders were approximately 1 year closer to their date of diagnosis compared to nonresponders with a slightly higher rate of systemic therapy treatment. Also, responders were less likely to have RCC and more likely to have clear cell carcinoma.

Sample characteristics

The demographic and medical characteristics of participants are displayed in Tables 1 and 2 respectively. Briefly, the mean age was 63.3±10.7 years, 63.5% were male, 81.9% were married, 44.4% were employed full/part-time, and 27.6% completed university/college. The mean BMI was 28.6±5.3, with 43.7% being overweight and 32.4% being obese. The mean number of months since diagnosis was 66.7±5.2, 85.9% was disease-free, 97.6% had received surgery, and 83.3% had localized kidney cancer.

Descriptive statistics for sitting time and QoL variables are displayed in Table 3. Overall, the mean number of hours of sitting time on a work-day was 8.0±4.7 hours and 6.5±3.8 on a non-work day.

Associations between sitting time and quality of life

Differences in the unadjusted and adjusted QoL scores across the sitting categories on a work day and non-work day are presented in Tables 4 and 5, respectively. In the unadjusted analyses for a non-work day, PWB (p=0.013), fatigue subscale (p=0.023), kidney symptom index (p=0.012), FACT-F (p=0.028), and TOI-F (p=0.018) indicated significant differences across the sitting time categories for QoL. The general pattern was a negative linear association between sitting time and QoL. In terms of the magnitude of the associations, the overall differences among the sitting time categories from 0-4.0 hours to >7.0 hours were 1.5 points for PWB (95% CI, 0.5 to 2.6; *d*=0.32), 3.1 points for fatigue subscale (95% CI, 0.7 to 5.4; *d*=0.28), 2.8 points for kidney symptom index (95% CI, 0.9 to 4.6; *d*=0.32), 3.5 points for FACT-G (95% CI, 0.3 to 6.6; *d*=0.23), 6.5 points for FACT-F (95% CI, 1.4 to 11.6; *d*=0.27), and 5.6 points for TOI-F (95% CI, 1.6 to 9.7; *d*=0.29). After the adjustment for covariates, the associations between sitting time categories and QoL were no longer significant (Tables 4 and 5).

In terms of a work day, there were no significant differences with QoL across the sitting time categories for the unadjusted analyses. ANCOVAs revealed a significant difference across the sitting time categories for EWB only. The pattern for EWB was a linear increase from 0-5.0 hours to 5.1-10.0 hours of sitting with no further increase for greater than 10.0 hours of sitting. In terms of the magnitude of the association, the overall differences among the sitting time categories was 1.2 points from 0-5.0 hours to >10.0 hours for EWB (95% CI, 0.3 to 2.3; *d*=0.29). We found no significant associations between domain-specific sitting time on QoL when analyzed separately for a non-work day and work day.

Moderators of the association between sitting time and quality of life

Age was the only variable to moderate the associations between sitting time and QoL. Specifically, age moderated the association between non-work day sitting time and the FACT-G (p for interaction=.010), kidney symptom index subscale (p for interaction=.012), and TOI-F (p for interaction=.020). For the FACT-G (Figure 1a), there was a strong negative dose-response relationship from 0-4.0 hours to 4.1-7.0 hours (5.9 points) with no further decreases with >7.0 hours of sitting for participants who were younger than 60 years of age, whereas there was an “inverted U” association for those between 60-69 with an increase of 5.2 points between 0-4.0 hours to 4.1-7.0 hours, and a decline of 3.7 points for sitting greater than 7.0 hours. Finally, there was a “U” association between 0-4.0 to >7.0

hours of sitting with a decline of 1.9 points from 0-4.0 to 4.1-7.0 hours, and an increase of 4.8 points from 4.1-7.0 to >7.0 hours for those 70 years of age and older.

For the kidney symptom index subscale (Figure 1b), a similar trend was observed where there was a strong negative dose-response relationship from 0-4.0 hours to 4.1-7.0 hours (4.4 points) with no further decreases with greater than 7.0 hours of sitting for participants who were younger than 60 years of age. There was an "inverted U" association for those between 60-69 with an increase of 1.9 points between 0-4.0 hours to 4.1-7.0 hours, and a decline of 3.0 points sitting for greater than 7.0 hours. Finally, there was a "U" association between 0-4.0 to >7.0 hours of sitting, with a decline of 1.4 points from 0-4.0 to 4.1-7.0 hours, and an increase of 1.9 points from 4.1-7.0 to >7.0 hours for those 70 years of age and older.

In addition, a similar trend was also reported for TOI-F (Figure 1c). There was a strong dose-relationship from 0-4.0 hours to 4.1-7.0 hours (8.5 points) with no further decreases with greater than 7.0 hours of sitting for participants who were younger than 60 years of age. There was an "inverted U" association for those between 60-69 with an increase of 5.6 points between 0-4.0 hours to 4.1-7.0 hours, and a decline of 6.6 points sitting for greater than 7.0 hours. Finally, there was a "U" association between 0-4.0 to >7.0 hours of sitting with a decline of 2.3 points from 0-4.0 to 4.1-7.0 hours and an increase of 3.1 points from 4.1-7.0 to >7.0 hours for those 70 years of age and older.

PA categories did not moderate the association between sitting time and QoL for both a work day and non-work day. Moreover, sitting time did not differ across PA categories for both a work day and non-work day.

3-4. DISCUSSION

KCS reported sitting for an average of 8.0 hours on a work day and 6.5 hours on a non-work day. This amount of sitting time is less than other cancer survivor groups with breast cancer survivors reporting an average of 9.3 hours (Lynch et al., 2010) and prostate cancer survivors reporting an average of 9.9 hours (Lynch et al., 2011). In the general adult population, older adults tend to spend 9 or more hours of their time each day in sedentary behaviours (Matthews et al., 2012). However, the sitting duration in these studies did not separate work days and non-work days and employed different methodologies for measuring sitting time (i.e., accelerometry, single self-report item). No previous data exist on the prevalence of sitting time among KCS. It is possible that KCS may experience fewer treatment-related side effects compared to other cancer survivors groups that may reduce sitting time. Bird and Hayter (2009) found that QoL deteriorates with kidney surgery and returns to baseline (pre-surgery) levels within 6-12 months following surgery. Clark et al. (2001) found that most KCS have normal physical and mental health comparable to the general population regardless of the type of surgery performed.

The main finding of our study is that there are very few associations between sitting time and QoL in KCS. We did find an association between EWB and sitting time on a work day for KCS. The pattern was a positive dose-response relationship from 0-5.0 hours to 5.1-10.0 hours of sitting with no further increases for greater than 10.0 hours of sitting, which was contrary to our hypothesis. However, this association does not appear to be meaningful based on guidelines for minimal important differences (MID) on the FACT scales (Yost & Eton, 2005). Specifically, the observed difference for EWB in our study was 1.2 points which was slightly below the MID of 2.0 points (Yost & Eton, 2005). Moreover, given the number of analyses we conducted, this association could be a chance finding.

There are no published studies that have examined sitting time and QoL in KCS with which to compare our results. However, there have been some studies in the general adult population examining the link between QoL and sedentary behaviour, although the results are limited. Generally, depressive symptoms and low satisfaction with life are noted as positive correlates of sedentary behaviour (Rhodes et al., 2012). In terms of EWB, our results were not consistent with this previous research. Balboa-Castillo, Leon-Munoz, Graciani, Rodriguez-Artalejo, and Guallar-Castillon (2011) examined the association between sedentary behaviour and QoL in 1,097 community-dwelling older adults and found the number of sitting hours showed a gradual and inverse relationship with score scales of physical functioning, physical role, bodily pain, vitality, social functioning, and mental health. Rogers et al. (2011) found fatigue to be higher as sitting minutes increased among 483 rural breast cancer survivors. Finally, Lynch et al. (2011) found increases in television viewing time were associated with decreases in overall QoL, colorectal cancer-specific concerns, and physical, emotional, and functional well-being among 1,966 colorectal cancer survivors. The differences in our study findings may be due to the differences in cancer survivor populations, the assessment of sitting time, and the type of sitting time. We used a sedentary behaviour measure that separated sitting time during a work day and non-work day, whereas other studies have not made this distinction or used television viewing time for defining sedentary behaviour.

Data from our study did show significant negative associations between QoL and sitting time in the unadjusted means for a non-work day for PWB, fatigue subscale, kidney symptom index subscale, FACT-F, and TOI-F, consistent with expectations. The general pattern was a linear decrease in QoL scores from 0-4.0 hours to >7.0 hours of sitting on a non-work day. The associations were meaningful based on guidelines for minimal important differences (MID) (Yost & Eton, 2005) for the fatigue subscale, FACT-G, and TOI-F. However, after the adjustment for covariates in our study, the associations between sitting time and QoL were no longer significant. This suggests that demographic and medical factors explain the spurious association between sitting time and QoL in KCS. That is, factors such as higher BMI, number of comorbidities, and cancer treatments may cause declines in functional QoL and also increase sitting time or, may cause declines in functional QoL that lead to increased sitting time. Randomized controlled trials are needed to decipher the causal order among medical variables, sitting time, and QoL in cancer survivors.

We found that only age moderated the association between sitting time for a non-work day and QoL. The general pattern was the expected negative dose-response relationship for KCS who are 60 years of age and younger from 0-4.0 hours to 4.1-7.0 hours of sitting time with no further decreases with greater than 7.0 hours of sitting. Associations for older KCS were more complex. It may be that for KCS under 60 years of age, prolonged sitting may contribute to poorer QoL because it encourages social isolation and physical deconditioning that may lead to greater depression, anxiety, and poor functioning (Balboa-Castillo et al., 2011; Hamer et al., 2010). Additional moderators were examined but showed that the lack of association between sitting time and QoL was not influenced by sex, education, marital status, BMI, number of comorbidities, months since diagnosis, disease stage, type of surgery, type of surgical incision, drug treatment, current treatment status, current cancer status, and PA categories.

It is interesting to note that PA categories did not moderate the association between sitting time and QoL on a work day or non-work day suggesting that regardless of the amount of PA performed, there was no link between sitting time and QoL. Moreover, we found that there was no association between the amount of PA and the amount of sitting time performed, supporting the independence of these two behaviours. This is consistent with previous findings in breast cancer survivors where the associations between sedentary time, QoL and fatigue among survivors did not differ by PA levels (George et al., in press). Future research should continue to examine the interactive and additive effects of PA and sedentary behaviour on health outcomes in cancer survivors.

Our study needs to be interpreted within the context of important strengths and limitations. To our knowledge, this study is the first to examine sedentary behaviour in KCS. Furthermore, we approached all KCS diagnosed between 1996 and 2010 from a comprehensive Registry in Alberta, Canada. Further, we reported and compared sitting time on both a work day and non-work day in domain-specific activities; very few studies have provided this distinction. One limitation of our study is the cross-sectional design in which causality cannot be determined. Our study also achieved a modest response rate that may limit the generalizability of our findings. Moreover, our study also relied on a self-report measure of sitting time which may not provide accurate estimates of sedentary behaviour. Although the domain-specific sitting time questionnaire was modified to accurately reflect the variability in work schedules, there may have been some confusion in reporting sitting time among those participants who were retired. Specifically, participants may have included volunteer activities as part of a work day, which may have led to the discrepancy between the sample size in those who reported being employed full-/part-time and those who reported sitting time on a work day. Due to its high prevalence and passive nature, sedentary behaviour may be a challenging task to recall (Rhodes et al., 2012) and future studies should consider using objective measures of sedentary behaviour to reduce measurement error. Also, the medical variables in this study were based on self-report, which may be less accurate compared to data extracted from medical records.

In conclusion, our study presents the first data on sitting time and QoL in KCS. Although we found that KCS engage in a significant amount of sitting time on both work days and non-work days, there was very little evidence for an association with QoL. Age was the only demographic variable to moderate the relationship between sitting time and QoL, showing the predicted negative associations between sitting time and QoL for KCS under 60 years of age. Additional research is warranted on the association between sitting time and QoL among various cancer survivor groups including observational and prospective studies to further understand the relationship between sitting time and QoL. Ultimately, randomized controlled trials are warranted to determine the causal effects of reducing sedentary behaviour on health outcomes in cancer survivors such as disease outcomes, symptom management, biological mechanisms, and even recurrence and survival.

Table 3-1. Demographic and medical characteristics of kidney cancer survivors in Alberta, Canada, May, 2010 (N=540).

Variable	n (%)
Age (Mean ± SD=63.3 ± 10.7)	
<60	220 (40.7)
60-69	168 (31.1)
≥70	152 (28.1)
Sex	
Male	343 (63.5)
Female	197 (36.5)
Marital Status	
Married/common law	442 (81.9)
Not married	98 (18.1)
Education	
Some high school	110 (20.4)
Completed high school	128 (23.7)
Some university/college	81 (15.0)
Completed university/college	149 (27.6)
Some/completed graduate school	72 (13.4)
Annual Family Income	
<$20 000	49 (9.1)
$20 000-$59 999	174 (32.2)
$60 000-$99 999	164 (23.3)
>$100 000	110 (20.4)
Missing data	70 (13.0)
Employment status	
Employed full-/part-time	240 (44.4)
Retired	235 (43.5)
Other	65 (12.0)
Ethnicity	
White	493 (91.3)
Other	47 (8.7)
Body mass index (Mean ± SD=28.6 ± 5.3)	
Healthy weight	129 (23.9)
Overweight	236 (43.7)
Obese	175 (32.4)
Number of comorbidities	
None	46 (8.5)
1	111 (20.6)
2	123 (22.8)
≥3	260 (48.1)

Table 3-1. cont'd

Variable	n (%)
*Most common comorbidities	
High blood pressure	314 (58.1)
Arthritis	250 (46.3)
High cholesterol	229 (42.4)
Other cancer	137 (25.4)
Diabetes	97 (18.0)
Angina	58 (10.7)
Heart attack	42 (7.8)
Smoking status	
Never smoked	220 (40.7)
Ex-smoker	243 (45.0)
Regular/occasional smoker	77 (14.2)
Drinking status	
Never drink	161 (29.8)
Social drinker	349 (64.6)
Regular drinker	30 (5.6)
General health rating	
Excellent	34 (6.3)
Very good	138 (25.6)
Good	237 (43.9)
Fair	109 (20.2)
Poor	22 (4.1)

*could check more than one response

Table 3-2. Cancer and treatment characteristics of kidney cancer survivors in Alberta, Canada, May, 2010 (N=540).

Variable	n (%)
Months since diagnosis (Mean ± SD=66.7 ± 55.2)	
<24	114 (21.1)
24-59	163 (30.2)
≥60	263 (48.7)
Type of kidney cancer	
Papillary	102 (18.9)
Non-papillary	203 (37.6)
Don't know	235 (43.5)
Lymph nodes involved	
Yes	32 (5.9)
No	404 (74.8)
Don't know	104 (19.3)
Disease stage	
Localized	450 (83.3)
Metastatic	38 (12.6)
Don't know	22 (4.1)
Location of Metastases (N=82)	
Lung	36 (47.1)
Lymph	12 (17.6)
Liver	13 (19.1)
Other	21 (30.9)
Surgery treatment	
Yes	527 (97.6)
No	13 (2.4)
Type of surgery (N=527)	
Partial nephrectomy	96 (17.8)
Radical nephrectomy	421 (78.0)
Don't know	10 (1.9)
Type of incision (N=527)	
Laparoscopic	167 (30.9)
Open incision	353 (65.4)
Don't know	7 (1.3)
Radiation treatment	
Yes	23 (4.3)
No	517 (95.7)
Drug treatment	
Yes	78 (14.4)
No	462 (85.6)
*Type of drug treatment (N=78)	
Sunitinib (Sutent)	47 (60.3)
Sorafenib (Nexavar)	16 (20.5)
Everolimus (Afinitor)	7 (9.0)
Interferon	7 (9.0)
Don't know	24 (14.4)

Table 3-2. cont'd

Variable	n (%)
Current treatment status	
Completed treatment	490 (90.7)
Receiving treatment	50 (9.3)
Recurrence	
Yes	43 (8.0)
No	497 (92.0)
Current disease status	
Disease-free	464 (85.9)
Existing disease	76 (14.1)

*could check more than one response

Table 3-3. Descriptive statistics for sitting time, physical activity, and quality of life for kidney cancer survivors who reported sitting time on a work day (n=386) and non-work day (n=540) in Alberta, Canada, May, 2010.

	Work Day (hours) M ± SD or n (%)	Non-Work Day (hours) M ± SD or n (%)
Time spent sitting		
For transport	1.4 ± 2.2	0.6 ± 1.2
At work	3.2 ± 3.2	--
Watching TV	1.6 ± 1.5	2.8 ± 2.2
Using computer	0.7 ± 1.1	1.0 ± 1.1
Other leisure activities	0.9 ± 1.3	1.8 ± 2.1
Total	8.0 ± 4.7	6.5 ± 3.8
Sitting time categories (Work Day)		
0-5.0 hours	134 (34.7%)	--
5.1-10.0 hours	135 (35.0%)	--
>10.0 hours	117 (30.3%)	--
Sitting time categories (Non-Work Day)		
0-4.0 hours	--	163 (30.2%)
4.1-7.0 hours	--	195 (36.1%)
>7.0 hours	--	182 (33.7%)
Public health physical activity categories		
Completely inactive	182 (47.2%)	276 (51.1%)
Insufficiently active	85 (22.0%)	104 (19.3%)
Meeting guidelines	119 (30.8%)	160 (29.6%)
Quality of Life		
Physical well-being (0-28)	23.6 ± 4.7	23.4 ± 4.9
Functional well-being (0-28)	22.0 ± 5.4	21.5 ± 5.5
Emotional well-being (0-24)	19.4 ± 4.2	19.3 ± 4.3
Social well-being (0-24)	18.7 ± 5.2	18.8 ± 5.2
Fatigue subscale (0-52)	39.1 ± 10.8	38.4 ± 11.1
Kidney symptom index (0-60)	47.6 ± 8.6	46.9 ± 8.8
FACT[1] General (0-104)	83.6 ± 15.0	83.0 ± 15.0
FACT-Fatigue (0-156)	122.7 ± 23.8	121.5 ± 24.2
Trial outcome index-Fatigue (0-108)	84.7 ± 18.7	83.4 ± 19.3

[1]FACT= Functional Assessment of Cancer Therapy

Table 3-4. Differences in quality of life across sitting time categories on a work day in kidney cancer survivors, Alberta, Canada, May, 2010 (N=386).

	0-5.0 hours (n=134)	5.1-10.0 hours (n=135)	>10.0 hours (n=117)	p-value
Physical well-being[a]	23.7 (4.98)	23.7 (4.37)	23.3 (4.87)	0.797
Physical well-being[b]	23.4 (0.37)	23.8 (0.36)	23.6 (0.40)	0.678
Functional well-being[a]	22.5 (5.24)	21.9 (5.46)	21.5 (5.35)	0.378
Functional well-being[b]	22.3 (0.43)	22.0 (0.43)	21.7 (0.46)	0.607
Emotional well-being[a]	18.9 (4.82)	19.6 (3.72)	19.6 (4.00)	0.326
Emotional well-being[b]	18.6 (0.35)	19.7 (0.34)	19.8 (0.37)	0.019
Social well-being[a]	18.9 (5.26)	18.8 (5.14)	18.3 (5.32)	0.618
Social well-being[b]	18.8 (0.45)	18.8 (0.44)	18.4 (0.48)	0.787
Fatigue subscale[a]	39.4 (10.8)	39.6 (9.87)	38.3 (11.8)	0.580
Fatigue subscale[b]	38.9 (0.87)	39.9 (0.86)	38.5 (0.93)	0.490
Kidney symptom index[a]	47.8 (9.04)	47.5 (8.15)	47.5 (8.74)	0.963
Kidney symptom index[b]	47.3 (0.66)	47.8 (0.65)	47.8 (0.70)	0.844
FACT-General[a]	84.0 (15.5)	84.0 (14.0)	82.7 (15.5)	0.734
FACT-General[b]	83.0 (1.2)	84.4 (1.18)	83.4 (1.28)	0.700
FACT-Fatigue[a]	123.3 (24.5)	123.7 (21.5)	121.0 (25.6)	0.629
FACT-Fatigue[b]	121.9 (1.89)	124.3 (1.86)	121.9 (2.00)	0.577
Trial outcome index-Fatigue[a]	85.5 (19.1)	85.3 (16.8)	83.2 (20.2)	0.551
Trial outcome index-Fatigue[b]	84.6 (1.46)	85.8 (1.43)	83.7 (1.56)	0.603

[a]Unadjusted mean (standard deviation); [b]Adjusted mean (standard error) is adjusted for age, sex, martial status, education, BMI, months since diagnosis, drug treatment, current treatment status, recurrence, current disease status, smoking, drinking, and number of comorbidities.
FACT=functional assessment of cancer therapy.

Table 3-5. Differences in quality of life across sitting time categories on a non-work day in kidney cancer survivors, Alberta, Canada, May, 2010 (N=540).

	0-4.0 hours (n=163)	4.1-7.0 hours (n=195)	>7.0 hours (n=182)	p-value
Physical well-being[a]	24.1 (0.38)	23.4 (0.35)	22.6 (0.36)	0.013
Physical well-being[b]	23.9 (0.35)	23.2 (0.32)	23.1 (0.34)	0.225
Functional well-being[a]	21.9 (0.43)	21.8 (0.39)	20.9 (0.41)	0.180
Functional well-being[b]	21.8 (0.41)	21.5 (0.37)	21.4 (0.39)	0.755
Emotional well-being[a]	19.7 (4.22)	19.2 (4.46)	19.2 (4.18)	0.400
Emotional well-being[b]	19.4 (0.32)	19.0 (0.29)	19.6 (0.31)	0.419
Social well-being[a]	18.7 (5.26)	19.3 (4.95)	18.3 (5.29)	0.168
Social well-being[b]	18.6 (0.40)	19.1 (0.36)	18.7 (0.38)	0.576
Fatigue subscale[a]	39.7 (10.6)	39.1 (10.5)	36.7 (11.9)	0.023
Fatigue subscale[b]	39.3 (0.41)	38.5 (0.74)	37.7 (0.78)	0.366
Kidney symptom index[a]	48.3 (8.62)	47.0 (8.41)	45.5 (9.17)	0.012
Kidney symptom index[b]	47.9 (0.62)	46.5 (0.56)	46.5 (0.59)	0.200
FACT-General[a]	84.5 (14.5)	83.7 (15.1)	81.0 (15.1)	0.074
FACT-General[b]	83.6 (1.10)	82.8 (0.99)	82.8 (1.04)	0.838
FACT-Fatigue[a]	124.2 (23.0)	122.8 (24.1)	117.7 (25.0)	0.028
FACT-Fatigue[b]	122.9 (1.75)	121.3 (1.58)	120.5 (1.67)	0.606
Trial outcome index-Fatigue[a]	85.8 (18.4)	84.3 (18.7)	80.2 (20.2)	0.018
Trial outcome index-Fatigue[b]	85.0 (1.38)	83.2 (1.25)	82.1 (1.32)	0.340

[a]Unadjusted mean (standard deviation); [b]Adjusted mean (standard error) is adjusted for age, sex, martial status, education, BMI, months since diagnosis, drug treatment, current treatment status, recurrence, current disease status, smoking, drinking, and number of comorbidities. FACT=functional assessment of cancer therapy.

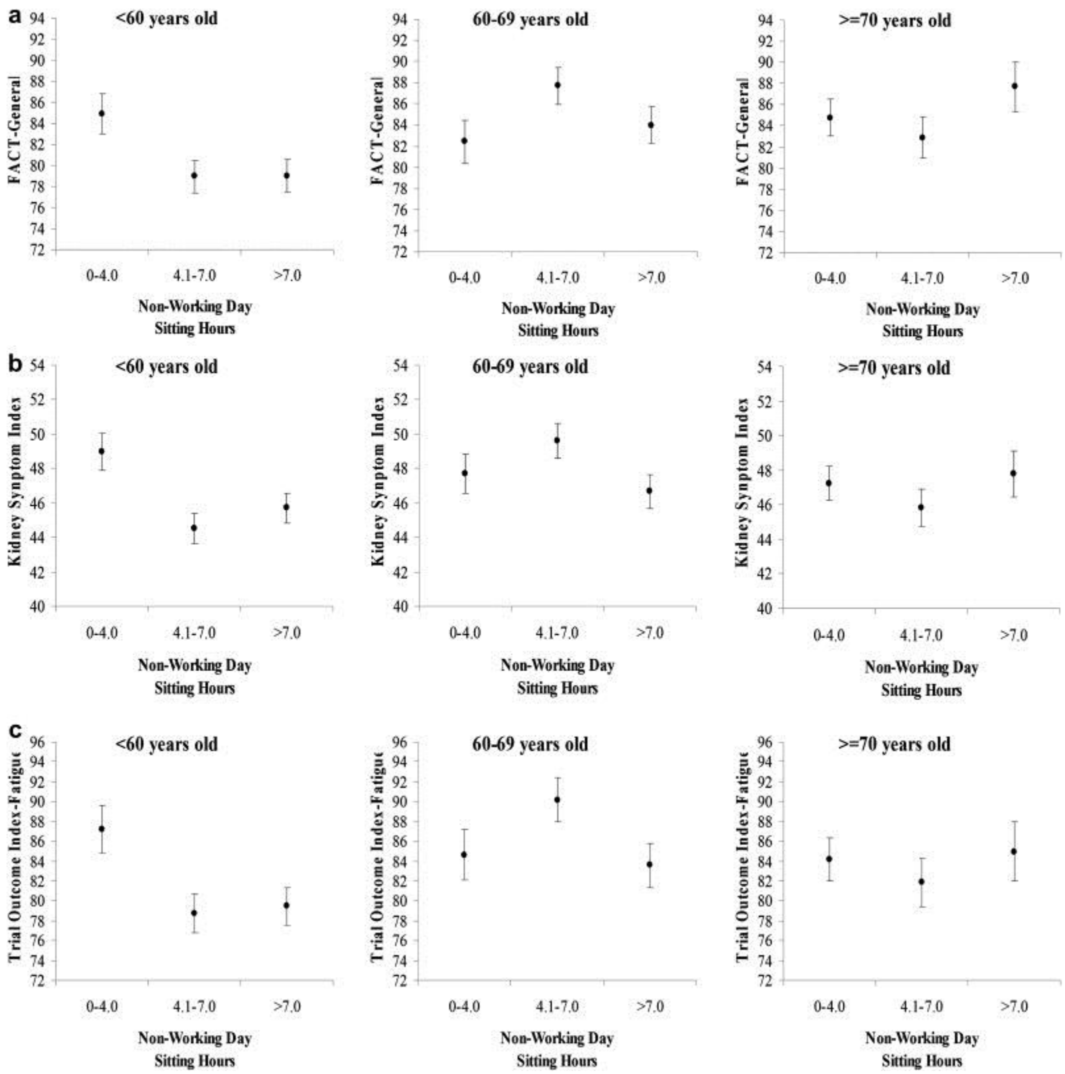

Figure 3-1.

a. Interaction between age and sitting time on a non-work day for the FACT-General in KCS in Alberta, Canada, May 2010 (N=540)

b. Interaction between age and sitting time on a non-work day for the kidney symptom index subscale in KCS in Alberta, Canada, May 2010 (N=540)

c. Interaction between age and sitting time on a non-work day for the TOI-Fatigue in KCS in Alberta, Canada, May 2010 (N=540)

REFERENCES

Amling, C. L. (2004). The association between obesity and the progression of prostate and renal cell carcinoma. *Urologic Oncology, 22*(6), 478-484. doi:10.1016/j.urolonc.2004.10.004

Balboa-Castillo, T., Leon-Munoz, L. M., Graciani, A., Rodriguez-Artalejo, F., & Guallar-Castillon, P. (2011). Longitudinal association of physical activity and sedentary behaviour during leisure time with health-related quality of life in community-dwelling older adults. *Health and Quality of Life Outcomes, 9*, 47. doi:10.1186/1477-7525-9-47

Bird, J., & Hayter, M. (2009). A review of the literature on the impact of renal cancer therapy on quality of life. *Journal of Clinical Nursing*, *18*(20), 2783-800. doi: 10.1111/j.1365-2702.2009.02875.x

Canadian Cancer Society's Steering Committee on Cancer Statistics. *Canadian Cancer Statistics 2012*. Toronto, ON: Canadian Cancer Society; 2012.

Cella, D. F., Tulsky, D. S., Gray, G., Sarafian, B., Linn, E., Bonomi, A., . . . Brannon, J. (1993). The Functional Assessment of Cancer Therapy scale: development and validation of the general measure. *Journal of Clinical Oncology*, *11*(3), 570-579.

Cella, D., Eton, D. T., Lai, J., Peterman, A. H., & Merkel, D. E. (2002). Combining anchor and distribution-based methods to derive minimal clinically important differences on the Functional Assessment of Cancer Therapy (FACT) anemia and fatigue scales. *Journal of Pain and Symptom Management*, *24*(6), 547-561.

Cella, D., Yount, S., Du, H., Dhanda, R., Gondek, K., Langefeld, K., . . . Bukowski, R. (2006). Development and validation of the Functional Assessment of Cancer Therapy-Kidney Symptom Index (FKSI). *The Journal of Supportive Oncology, 4*(4), 191-199.

Chau, J. Y., Van der Ploeg, H. P., Dunn, S., Kurko, J., & Bauman, A. E. (2011). A tool for measuring workers' sitting time by domain: the Workforce Sitting Questionnaire. *British Journal Of Sports Medicine, 45*(15), 1216-1222. doi:10.1136/bjsports-2011-090214

Clark, P. E., Schover, L. R., Uzzo, R. G., Hafez, K. S., Rybicki, L. A., & Novick, A. C. (2001). Quality of life and psychological adaptation after surgical treatment for localized renal cell carcinoma: impact of the amount of remaining renal tissue. *Urology, 57*(2):252-256.

Dillman, D. A. (2000). *Mail and Internet Surveys: The Tailored Design Method*. New York: Wiley.

Fong, D. Y., Ho, J. W., Hui, B. P., Lee, A. M., Macfarlane, D. J., Leung, S. S., . . . Cheng, K. K. (2012). Physical activity for cancer survivors: meta-analysis of randomised controlled trials. *BMJ (Clinical Research Ed.), 344,* e70. doi:10.1136/bmj.e70

Friedenreich, C. M., Bryant, H. E., Alexander, F., Hugh, J., Danyluk, J., Page, D. L. (2001). Risk factors for benign breast biopsies: A nested case-control study in the Alberta breast screening program. *Cancer Detection and Prevention, 25*(3), 280-291.

George, S. M., Alfano, C., Smith, A. W., Irwin, M., McTiernan, A., Bernstein, L.,…Ballard-Barbash, R. (in press). Sedentary behaviour, health-related quality of life and fatigue among breast cancer survivors. *Journal of Physical Activity & Health,* 2012 Jul 9. [Epub ahead of print]. Retrieved from http://journals.humankinetics.com/jpah-in-press/jpah-in-press/sedentary-behaviour-health-related-quality-of-life-and-fatigue-among-breast-cancer-survivors

George, S. M., Moore, S. C., Chow, W. H., Schatzkin, A., Hollenbeck, A. R., & Matthews, C. E. (2011). A prospective analysis of prolonged sitting time and risk of renal cell carcinoma among 300,000 older adults. *Annals of Epidemiology, 21*(10), 787-790. doi:10.1016/j.annepidem.2011.04.012

Godin, G., & Shephard, R. J. (1985). A simple method to assess exercise behaviour in the community. *Canadian Journal of Applied Sport Sciences, 10*(3), 141-146.

Hamer, M., Stamatakis, E., & Mishra, G. D. (2010). Television- and screen-based activity and mental well-being in adults. *American Journal of Preventive Medicine, 38*(4), 375-380. doi:10.1016/j.amepre.2009.12.030

Hardy, S. E., & Studenski, S. A. (2010). Qualities of fatigue and associated chronic conditions among older adults. *Journal of Pain and Symptom Management, 39*(6), 1033-1042. doi:10.1016/j.jpainsymman.2009.09.026

Hu, J., Mao, Y., & White, K. (2003). Overweight and obesity in adults and risk of renal cell carcinoma in Canada. *Sozial- Und Präventivmedizin, 48*(3), 178-185.

Katzmarzyk, P. T., Church, T. S., Craig, C. L., & Bouchard, C. (2009). Sitting time and mortality from all causes, cardiovascular disease, and cancer. *Medicine and Science in Sports and Exercise, 41*(5), 998-1005. doi:10.1249/MSS.0b013e3181930355

Lynch, B. M. (2010). Sedentary behaviour and cancer: a systematic review of the literature and proposed biological mechanisms. *Cancer Epidemiology, Biomarkers & Prevention, 19*(11), 2691-2709. doi:10.1158/1055-9965.EPI-10-0815

Lynch, B. M., Cerin, E., Owen, N., Hawkes, A. L., & Aitken, J. F. (2011). Television viewing time of colorectal cancer survivors is associated prospectively with quality of life. *Cancer Causes & Control, 22*(8), 1111-1120. doi:10.1007/s10552-011-9786-8

Lynch, B. M., Dunstan, D. W., Healy, G. N., Winkler, E., Eakin, E., & Owen, N. (2010). Objectively measured physical activity and sedentary time of breast cancer survivors, and associations with adiposity: findings from NHANES (2003-2006). *Cancer Causes & Control, 21*(2), 283-288. doi:10.1007/s10552-009-9460-6

Lynch, B. M., Dunstan, D. W., Winkler, E., Healy, G. N., Eakin, E., & Owen, N. (2011). Objectively assessed physical activity, sedentary time and waist circumference among prostate cancer survivors: findings from the National Health and Nutrition Examination Survey (2003-2006). *European Journal of Cancer Care, 20*(4), 514-519. doi:10.1111/j.1365-2354.2010.01205.x; 10.1111/j.1365-2354.2010.01205.x

Marshall, A. L., Miller, Y. D., Burton, N. W., & Brown, W. J. (2010). Measuring total and domain-specific sitting: a study of reliability and validity. *Medicine and Science in Sports and Exercise, 42*(6), 1094-1102. doi:10.1249/MSS.0b013e3181c5ec18

Matthews, C. E., George, S. M., Moore, S. C., Bowles, H. R., Blair, A., Park, Y., . . . Schatzkin, A. (2012). Amount of time spent in sedentary behaviours and cause-specific mortality in US adults. *The American Journal of Clinical Nutrition, 95*(2), 437-445. doi:10.3945/ajcn.111.019620

Miller, R., & Brown, W. (2004). Steps and sitting in a working population. *International Journal of Behavioural Medicine, 11*(4), 219-224. doi:10.1207/s15327558ijbm1104_5

Pate, R. R., O'Neill, J. R., & Lobelo, F. (2008). The evolving definition of "sedentary". *Exercise and Sport Sciences Reviews, 36*(4), 173-178. doi:10.1097/JES.0b013e3181877d1a

Patel, A. V., Bernstein, L., Deka, A., Feigelson, H. S., Campbell, P. T., Gapstur, S. M., . . . Thun, M. J. (2010). Leisure time spent sitting in relation to total mortality in a prospective cohort of US adults. *American Journal of Epidemiology, 172*(4), 419-429. doi:10.1093/aje/kwq155

Pereira, M. A., FitzerGerald, S. J., Gregg, E. W., Joswiak, M. L., Ryan, W. J., Suminski, R. R., . . . Zmuda, J. M. (1997). A collection of Physical Activity Questionnaires for health-related research. *Medicine and Science in Sports and Exercise, 29*(6), S1-S205.

Proper, K. I., Singh, A. S., Van Mechelen, W., & Chinapaw, M. J. (2011). Sedentary behaviours and health outcomes among adults: a systematic review of prospective studies. *American Journal of Preventive Medicine, 40*(2), 174-182. doi:10.1016/j.amepre.2010.10.015

Rhodes, R. E., Mark, R. S., & Temmel, C. P. (2012). Adult sedentary behaviour: a systematic review. *American Journal of Preventive Medicine, 42*(3), e3-28. doi:10.1016/j.amepre.2011.10.020

Rock, C. L., Doyle, C., Demark-Wahnefried, W., Meyerhardt, J., Courneya, K. S., Schwartz, A. L.,…Gansler, T. (2012), Nutrition and physical activity guidelines for cancer survivors. *CA: A Cancer Journal for Clinicians, 62*(4), 242–274. doi: 10.3322/caac.21142

Rogers, L. Q., Markwell, S. J., Courneya, K. S., McAuley, E., & Verhulst, S. (2011). Physical activity type and intensity among rural breast cancer survivors: patterns and associations with fatigue and depressive symptoms. *Journal of Cancer Survivorship, 5*(1), 54-61. doi:10.1007/s11764-010-0160-8

Schmitz, K. H., Courneya, K. S., Matthews, C., Demark-Wahnefried, W., Galvao, D. A., Pinto, B. M., . . . American College of Sports Medicine. (2010). American College of Sports Medicine roundtable on exercise guidelines for cancer survivors. *Medicine and Science in Sports and Exercise, 42*(7), 1409-1426. doi:10.1249/MSS.0b013e3181e0c112

Teychenne, M., Ball, K., & Salmon, J. (2010). Sedentary behaviour and depression among adults: a review. *International Journal of Behavioural Medicine, 17*(4), 246-254. doi:10.1007/s12529-010-9075-z

Trinh, L., Plotnikoff, R. C., Rhodes, R. E., North, S., & Courneya, K. S. (2011). Associations Between Physical Activity and Quality of Life in a Population-Based Sample of Kidney Cancer Survivors. *Cancer Epidemiology, Biomarkers & Prevention, 20*(5), 859-868.

US Department of Health and Human Services (USDHHS). (2008). 2008 physical activity guidelines for Americans. USDHHS, Washington, D.C.

Valentine, R. J., Woods, J. A., McAuley, E., Dantzer, R., & Evans, E. M. (2011). The associations of adiposity, physical activity and inflammation with fatigue in older adults. *Brain, Behaviour, and Immunity, 25*(7), 1482-1490. doi:10.1016/j.bbi.2011.06.002

Van Dijk, B.,A.C., Schouten, L. J., Kiemeney, L. A. L. M., Goldbohm, R. A., & Van den Brandt, P. A. (2004). Relation of height, body mass, energy intake, and physical activity to risk of renal cell carcinoma: results from the Netherlands Cohort Study. *American Journal of Epidemiology, 160*(12), 1159-1167.

Yellen, S. B., Cella, D. F., Webster, K., Blendowski, C., & Kaplan, E. (1997). Measuring fatigue and other anemia-related symptoms with the Functional Assessment of Cancer Therapy (FACT) measurement system. *Journal of Pain and Symptom Management, 13*(2), 63-74.

Yost, K. J., & Eton, D. T. (2005). Combining distribution- and anchor-based approaches to determine minimally important differences: the FACIT experience. *Evaluation & the Health Professions,28*(2), 172-191.

4: CHAPTER 4

Study 1: Paper 3

Physical Activity Preferences in a Population-Based Sample of Kidney Cancer Survivors

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4-1. INTRODUCTION

Kidney cancer is the 9th most common cancer in Canada with 5,100 new cases in 2011 [1]. Renal cell carcinoma (RCC) is the most common type of kidney cancer accounting for 80% of all tumors [1]. Despite increasing incidence rates, the survival rates have improved [1] which places greater emphasis to promote healthy lifestyles in kidney cancer survivors (KCS).

Substantial evidence indicates that physical activity (PA) may be useful for improving aerobic fitness, muscular strength, fatigue, depression, functional ability, and overall QoL in cancer survivors [2]. We previously reported a meaningful dose-response association between PA and QoL in KCS that showed benefits even for a small amount of PA [3]. Unfortunately, we also reported that over half of KCS are completely sedentary and only a quarter are meeting PA guidelines [3].

PA promotion efforts may be enhanced by targeting interventions based on the specific needs, interests, and preferences of the group [4]. Although a number of studies have successfully explored PA preferences in other cancer survivor groups [5, 6-16], no study to date has focused on KCS. The primary purpose of the present study was to identify the PA preferences of KCS. The secondary purpose was to explore the associations between select demographic/medical variables and key preferences. Based on previous research in other cancer survivor groups [6,9-12,15-17], and the older age of KCS, we hypothesized that KCS would have a strong interest in home-based PA, moderate intensity PA, starting PA after treatment, and walking. Associations of preferences with select demographic and medical variables were considered exploratory.

4-2. METHODS

Study Population

The design and methods of the survey have been reported elsewhere [3]. Briefly, a cross-sectional, population-based study design with a mailed, self-administered survey was employed. Ethical approval was granted by the Alberta Cancer Board Research Ethics Board and the University of Alberta Health Research Ethics Board. Eligibility for the study included: (a) 18 years or older, (b) ability to understand English, (c) currently residing in Alberta, and (d) diagnosed with kidney cancer in Alberta between 1996 and 2010. The Registry was searched in February 2010 and the survey was conducted between May and September 2010. There were 1,985 KCS from the Alberta Cancer Registry who met our eligibility and all were mailed the survey.

Eligible survivors were mailed a study package containing: (a) an invitation letter from the registry explaining its role, (b) a letter from the researchers explaining the study intent, (c) the survey booklet, and (d) a postage paid return envelope. Participants were asked to return the completed survey. The survey protocol followed a modified version of the Total Design Method [18] wherein prospective participants were mailed: (a) the initial survey package, (b) a postcard reminder 3-4 weeks later to nonresponders, and (c) a second survey package 3-4 weeks later to those who had not responded to the initial survey and reminder.

Measures

Demographic and medical information. Demographic variables were assessed using self-report and included age, sex, education level, marital status, annual income, employment status, ethnicity, and height and weight to compute body mass index (BMI). Medical variables were also assessed using self-report and included time since diagnosis, type of kidney cancer, lymph node involvement, disease stage, previous and current treatments, previous recurrence, and current disease status. Smoking and drinking status were assessed by single-items that asked participants to describe their current habits. Comorbidities were assessed by asking participants to check all of the conditions (e.g., high blood pressure, heart attack, diabetes) listed that apply to them.

Physical activity. PA was assessed using a modified version of the validated Leisure Score Index (LSI) from the Godin Leisure-Time Exercise Questionnaire (GLTEQ) [19,20]. Participants were asked to recall the average number of times per week and average duration they performed light (minimal effort, no perspiration), moderate (not exhausting, light perspiration), and vigorous (heart beats rapidly, sweating) PA for a minimum of 10 minutes per session during free time in the past month. The percentage of participants meeting the public health aerobic PA guidelines was calculated based on the 2008 Physical Activity Guidelines for Americans [21] which have also been recommended for cancer survivors by the American Cancer Society [22] and the American College of Sports Medicine [23]. These guidelines recommend that individuals obtain 75 minutes of vigorous aerobic PA per week, 150 minutes of moderate aerobic PA per week or an equivalent combination. Thus, we calculated "PA minutes" as moderate minutes plus two times the vigorous minutes. These PA minutes were then transformed into the following three categories: (1) completely sedentary (no PA minutes), (2) insufficiently active (1-149 PA minutes), and (3) meeting guidelines (≥150 PA minutes).

Physical activity preferences. Preference items were drawn from previous studies in cancer survivors [10,12,16,17] and are provided in Table 1. Briefly, PA counseling preferences included three closed-ended items. The first question addressed interest in receiving PA information at some point after the cancer diagnosis (i.e., yes, no, maybe). Even if the participants answered 'no' to this question, they were asked to complete the other preferences. The remaining two items allowed participants to respond to more than one choice and asked about whom they would prefer to receive the PA information from, and the preferred method of receiving PA counseling.

The PA programming preference items were designed to tap the preferred specifics of a PA program (see Table 1). Participants were asked if they would have been interested or able to participate in a PA program designed for KCS, and interested in a program to increase their PA level. The remaining seven closed-ended questions asked about their preferred time to start the PA program, preferred company, location, time of the day, intensity, structure, and PA type. Two additional questions asked participants about home PA equipment and current membership at a fitness centre. Two open-ended questions asked about what types of PA they were most interested in doing in the summer and winter.

For each open-ended question, participants were able to list up to three top preferences.

Statistical Analyses

All statistical analyses were performed using PASW Statistics 18 (PASW Inc., Chicago, IL). PA preferences were summarized by calculating frequencies and percentages for each response. Chi-square analysis examined the associations between each demographic and/or medical variable (e.g., age) with each PA preference (e.g., when to start PA program). All demographic and medical variables were either dichotomized or trichotomized to ensure adequate numbers per cell based either on clinically relevant cutpoints or balanced statistical splits. The demographic variables included age (<60 versus 60-69 versus ≥70 years), sex, and BMI [healthy weight (18.5-24.9) versus overweight (25.0-29.9) versus obese (≥30.0)]. The medical variables included months since diagnosis (<60 months versus ≥60 months), disease stage (localized versus metastasized), drug therapy treatment (yes versus no), and current treatment status (not receiving treatment versus receiving treatment). PA guidelines (completely sedentary versus insufficiently active versus meeting guidelines) were also examined. These demographic and medical variables were chosen based on subgroups of interest that might be targeted in PA interventions for KCS.

4-3. RESULTS

Participant flow through the study is presented elsewhere [3]. Briefly, of the 1,985 mailed surveys, 331 were returned to sender because of wrong address, no history of kidney cancer, or deceased. Of the remaining 1,654 surveys, 703 were returned, resulting in a 35.4% completion rate (703/1,985) and a 42.5% response rate (703/1,654) excluding the return to sender surveys. Although 703 KCS completed the survey, there was variability in the sample size for each PA preference because not all items were answered

We previously compared responders (n=703) and nonresponders (n=1,282) and found that they did not differ in terms of age, sex, or surgery rate [3]. Responders were about one year closer to their date of diagnosis compared to nonresponders and had a slightly higher rate of treatment with systemic therapy. Moreover, responders were less likely to have RCC and more likely to have clear cell carcinoma.

Demographic and medical information for the entire sample of 703 are presented elsewhere [3]. In brief, the mean age was 65.0±11.1, 62.9% were male, 73.6% were married, 38.0% were employed full/part-time, and 27.6% completed university/college. The mean BMI was 28.5±5.2, with 43.7% being overweight and 31.6% being obese. The mean number of months since diagnosis was 69.0±55.5, 86.8% were disease-free, 97.3% had received surgery, and 81.8% had localized kidney cancer. Overall, 183 (26.0%) were meeting public health aerobic PA guidelines.

Physical Activity Preferences

Descriptive statistics for the PA preferences are presented in Table 1. Briefly, results indicated that 75.2% of KCS were interested or maybe interested in receiving information about PA and 55.7% would prefer to receive that information from a fitness expert at a cancer centre. The preferred modes of PA information delivery included brochures/print materials (50.0%), face-to-face (34.0%), and e-mail (19.5%). Furthermore, over 80% of KCS felt they were able or maybe able to do a PA program. Other common preferences were to commence a PA program 3-6 months after treatment (36.5%), to exercise with a spouse (39.6%), at home (52.0%), and in the morning (58.3%). The majority of KCS (84.0%) indicated that they would be interested in a program to increase PA levels. The preferred type of PA was walking in both the summer (69.4%) and winter (48.2%). Many KCS owned home PA equipment (59.7%) with treadmill (52.2%) being the most common. Few KCS had a current fitness centre membership (15.3%).

Associations between Demographic and Medical Variables and Physical Activity Preferences

A summary of the significant associations between PA and demographic and medical variables are presented in Tables 2 and 3 respectively. The most consistent associations between demographic variables and PA preferences were age, sex, and current PA. The largest age differences (Figure 1a) showed that older KCS had less interest in doing a PA program (58.1% vs. 74.1% vs. 81.6%; $p<0.001$), were less likely to prefer doing PA outside in the neighborhood (36.4% vs. 48.9% vs. 53.4%; $p=0.003$), and less likely to prefer moderate/vigorous PA (43.8% vs. 69.1% vs. 77.5%; $p<0.001$). The largest sex differences (Figure 1b) showed that female KCS were more likely to prefer PA with friends (49.6% vs. 28.5%; $p<0.001$), less likely to prefer doing PA with their spouse (30.7% vs. 45.2%; $p<0.001$), and more likely to prefer supervised/instructed PA (55.5% vs.

31.8%; p<0.001). Finally, the largest differences based on current PA (Figure 1c) showed that sedentary KCS were more likely to prefer doing PA at home (57.1% vs. 51.4% vs. 42.9%; p=0.014), less likely to prefer doing PA at a community fitness centre (24.6% vs. 34.9% vs. 45.4%; p<0.001), and less likely to prefer moderate/vigorous intensity PA (46.3% vs. 77.7% vs. 90.8%; p<0.001).

The medical variables most consistently associated with PA preferences were months since diagnosis, disease stage, and current treatment status. The largest differences were observed for months since diagnosis (Figure 2) with KCS <60 months postdiagnosis being more interested in doing PA (76.4% vs. 66.6%; p=0.006), more likely to prefer engaging in PA at home (54.0% vs. 42.0%; p=0.004), and more interested in a program to help them increase PA (87.1% vs. 80.9%; p=0.036).

4-4. DISCUSSION

In the present study, we identified a number of important PA preferences that may inform PA interventions for KCS. The majority of KCS expressed a definite or possible interest in doing a PA program and most felt that they were able. Studies in other cancer survivor populations including endometrial [10], brain [11], non-Hodgkin lymphoma [9], ovarian [15], bladder [17], breast [7], head and neck [6], mixed cancer [12-14], and young adults [16] have reported similar high levels of interest in receiving PA programming.

The most common preference for PA information was to receive it from a fitness expert associated with a cancer centre (55.7%). This finding is slightly lower than other studies in brain cancer survivors [11] and a mixed group of breast, colorectal, prostate, or lung cancer [12], but higher than bladder cancer survivors [17], endometrial cancer survivors [10], a mixed cancer group [13,14], and young adult cancer survivors [16]. This highlights the need for fitness experts to have knowledge in oncology and kidney cancer in particular in order to provide PA programming for KCS. Moreover, this finding supports the recent development of the Cancer Exercise Trainer certification by the American College of Sports Medicine [24].

The most preferred mode of delivery for PA information was through brochures/print material (50.0%) followed by face-to-face (34.0%). Previous cancer survivor studies have indicated a strong preference for PA counseling to be conducted face-to-face (40-95%) [7,10,12,13,17]. However, print materials are advantageous when coupled with face-to-face delivery as they may be used to reinforce and expand on PA information delivered during face-to-face sessions. Furthermore, tailored print materials have been shown to be effective for increasing motivation and PA among other cancer survivor groups [25].

We also found that KCS were most interested in starting a PA program following treatment. This finding is similar to other cancer survivor studies that have also indicated a preference for beginning a PA program after treatment [10,15-17], although the magnitude of the preference in our study was lower than in other cancer survivor groups [9,12-14]. Since surgery is the principal treatment for kidney cancer, few KCS would receive systemic therapy or radiation therapy which may have more difficult side effects and strengthen the desire for posttreatment PA programs.

Similar numbers of KCS had a preference for doing PA alone (39.1%) or with their spouse (39.6%). Preference for doing PA alone has been found for bladder cancer survivors [17], ovarian cancer survivors [15], endometrial cancer survivors [10], mixed cancer survivors [12], and head and neck cancer survivors [6]. On the other hand, exercising with others was preferred by non-Hodgkin lymphoma [9], young adult [16], endometrial [10], ovarian cancer [15], and brain cancer [11] survivors. The preference for doing PA with others appears to be more prevalent in female and younger cancer survivors. Among older adults, social networks including family and friends, leads to increased participation and satisfaction with leisure and long-term exercise adherence [26,27]. Based on these findings, it seems reasonable to offer both individual and group-based PA programs to KCS.

As hypothesized, over half of KCS indicated a preference for engaging in a home-based PA program. This finding is similar to previous cancer survivor studies [6,9-12,15,17]. The greater preference for cancer survivors to engage in PA at home highlights the need for PA prescriptions that can be performed with minimal amount of PA equipment and supervision. However, individuals who have little or no experience with PA may benefit from supervised PA sessions, since many aspects of a PA program can be demonstrated (e.g., heart rate monitoring). Given that over half of KCS are completely sedentary, a home-based program may not be the best approach, but rather PA interventions that include supervised PA initially, and then tapered to a home-based program may be more effective and safe [6,7].

Walking was the preferred modality of KCS in both the summer and winter. This is consistent with many other cancer survivor groups [6,9,11-13,16] and appears more pronounced in older cancer survivor groups including bladder cancer [17], endometrial cancer [10], and ovarian cancer survivors [15]. This finding is consistent with the literature on older adults in the general population [28,29]. Given that the large majority of KCS prefer a home-based PA program, walking programs which require little cost, equipment, or supervision, are promising interventions for achieving PA guidelines.

Age, sex, and current PA were the demographic variables most consistently associated with PA preferences. Specifically, older KCS were less interested in engaging in PA, which is not surprising given that many older KCS may have existing comorbidities. This finding is consistent across many cancer survivor groups [6,9,11-13,15,17]. Older KCS were also less likely to prefer a PA program outside in the neighborhood which is consistent with previous findings where older adults in other cancer survivor groups are more likely to prefer home-based PA programs [6,9-12,15,17]. Furthermore, older KCS were more likely to prefer light intensity PA.

Female KCS had stronger preferences for doing PA with friends and doing supervised/instructed PA. This is consistent with previous studies in other cancer survivor groups [9-11]. Research has consistently revealed that women desire encouragement and support for PA from important people in their lives including spouses, family, and friends [30]. This suggests the importance of developing and implementing gender-tailored PA interventions to increase PA levels among KCS.

As mentioned previously, KCS who were not meeting public health PA guidelines were more likely to prefer engaging in PA at home, less likely to prefer doing PA at a community fitness centre, and less likely to prefer moderate/vigorous intensity PA. Pronounced differences were observed for preferred location of PA where KCS who were meeting PA guidelines were less likely to prefer doing PA at a community fitness centre compared to KCS who were meeting PA guidelines. Consistent with other cancer survivor groups such as bladder cancer survivors [17], KCS who have low activity levels may feel self-conscious about engaging in PA in the presence of others. Also, other perceived barriers including the lack of knowledge of the type of exercises to perform and the use of PA equipment may be daunting to KCS, and therefore they may prefer to exercise in the privacy of their own homes. The most notable difference was that KCS who were not meeting PA guidelines were less likely to prefer moderate/vigorous PA. This suggests that KCS who have lower activity levels prefer light intensity PA, possibly due to physical limitations and physical health barriers [17].

Smaller differences were observed in terms of the associations between medical variables and PA preferences in KCS. Only months since diagnosis was associated with several PA preferences. KCS who were less than 60 months postdiagnosis were more interested in doing PA compared to survivors beyond 60 months. This may reflect differences in PA motivation in both of these groups. For example, survivors who are less than 60 months postdiagnosis may still have cancer on their minds and worry about recurrence. Therefore, these survivors may be interested in a PA program to prevent cancer recurrence, return to a normal lifestyle, and improve overall physical and psychological well-being. On the other hand, survivors beyond 60 months postdiagnosis may feel that PA will not be helpful to them at this point as they are already in remission and feel that they have resumed normal activities. In addition, survivors within 60 months of diagnosis compared with survivors beyond 60 months were more likely to prefer doing PA at home. Survivors within 60 months of diagnosis may still be experiencing treatment-related side effects that may require that exercise be completed in private [31]. Consequently, it may be that PA programs are best targeted to KCS based on demographic and behavioral variables rather than medical variables.

Despite the high interest of KCS in initiating a PA program and the majority having PA equipment available at home, over half of KCS are completely sedentary. This suggests that beginning a PA program may be difficult for this population, especially given the treatment-related side effects. Some KCS may find PA discouraging due to the lack of knowledge of proper technique associated with the use of PA equipment, and/or the benefits of PA in alleviating some of the treatment-related side effects. Therefore, PA programs designed for KCS should focus on teaching proper technique, and how to progress PA safely and effectively to achieve the public health PA guidelines [32]. Also, including behavioral strategies (e.g., overcoming barriers, benefits of PA) in these programs may promote long-term adoption and adherence to PA [33,34].

To the best of our knowledge, our study is the first to examine PA preferences in KCS. Furthermore, we sampled all KCS diagnosed between 1996 and 2010 from a comprehensive Registry in Alberta, Canada. The main limitation of our study is the inherent selection biases due to the transparent purpose of the study. KCS who were more interested in PA were perhaps more likely to participate in the study. Our study also relied on a self-report measure of PA which, although validated, can introduce measurement error. Finally, KCS in this study were residing in either rural or urban communities which may influence PA preferences. Unfortunately, our study did not have the data available (i.e., zipcodes) to conduct this analysis. Future studies should consider examining PA preferences in cancer survivors between rural and urban communities.

In conclusion, KCS expressed an interest in receiving PA programming at some point after their diagnosis. KCS reported an interest in starting a PA program after treatment that is home-based and done alone or with a spouse. Additional preferences include moderate intensity PA that is unsupervised such as walking. Many of these preferences were strongly influenced by age, sex, and current PA and these variables might be considered when developing PA interventions for KCS. Our findings can be used in the design of PA interventions for KCS in general or for underserved subgroups of KCS. Future studies are needed to examine if targeted PA programs based on preferences are able to facilitate improved long-term PA adherence and health outcomes in KCS.

Table 4-1. Descriptive statistics for physical activity preferences of kidney cancer survivors in Alberta, Canada, May, 2010.

Preference variable	Number Responded	Percent (%)
Like to receive information about PA at some point after diagnosis? (n=650)		
Yes	286	44.0
No	161	24.8
Maybe/Unsure	203	31.2
* Who to receive PA information from? (n=540)		
Fitness expert from cancer centre	301	55.7
Oncologist	118	21.9
Cancer support group	106	19.6
Community fitness expert	103	19.1
Nurse	66	12.2
* How to receive information about PA? (n=570)		
Brochures/print material	285	50.0
Face-to-face	194	34.0
By e-mail	111	19.5
On the internet	79	13.9
Self-help video	77	13.5
Telephone	35	6.1
Able to do a PA program for kidney cancer survivors? (n=644)		
Yes	309	48.0
No	122	18.9
Maybe	213	33.1
Interested in doing a PA program for kidney cancer survivors? (n=649)		
Yes	222	34.2
No	185	28.5
Maybe	242	37.3
When to start a PA program? (n=513)		
At the time of diagnosis	87	17.0
During treatment	24	4.7
Right after treatment	115	22.4
3-6 months after treatment	187	36.5
At least 1 year after treatment	107	20.9
*Who to do PA with? (n=593)		
Spouse	235	39.6
Alone	232	39.1
Other cancer survivors	122	20.6
Family	114	19.2
Friends	96	16.2
*Where to do a PA program? (n=573)		
At home	298	52.0
Outside around my neighborhood	268	46.8
At a community fitness centre	186	32.5
At a cancer centre	42	7.3
*When to do a PA program? (n=568)		
Morning	331	58.3
Evening	172	30.3
Afternoon	147	25.9

Table 4-1. cont'd

Interested in a program that would increase your PA level? (n=612)	268	43.8
Yes	98	16.0
No	246	40.2
Maybe		
Prefer the same or different activities each time? (n=529)		
Different activities each PA session	342	64.7
Same activity each PA session	187	35.3
Prefer supervised/instructed or unsupervised/self-paced PA sessions? (n=566)		
Unsupervised/self-paced	335	59.2
Supervised/instructed	231	40.8
Prefer spontaneous/flexible or scheduled PA sessions? (n=549)		
Scheduled	279	50.8
Spontaneous/flexible	270	49.2
Favorite types of PA in the summer? (listed as top 3) (n=509)		
Walking	353	69.4
Biking	121	23.8
Swimming	86	16.9
Favorite types of PA in the winter? (listed as top 3) (n=465)		
Walking	224	48.2
Swimming	80	17.2
Resistance training/weights	73	15.7
PA equipment in your home? (n=650)		
Yes	388	59.7
No	262	40.3
Type of PA equipment? (listed as top 3) (n=362)		
Treadmill	189	52.2
Weights	110	30.4
Stationary bike	68	18.8
Current member of fitness centre? (n = 653)		
No	553	84.7
Yes	100	15.3

* could check more than one response. PA=physical activity.

Table 4-2. Summary of the associations between demographic variables and physical activity preferences in kidney cancer survivors in Alberta, Canada, May, 2010

Demographic variable	Physical activity preferences with significant associations
Kidney cancer survivors older than 70 years compared with survivors between 60-69 years and younger than 60 years of age were:	• Less interested in doing PA (58.1% vs. 74.1% vs. 81.6%; χ^2=31.8, p<0.001) • More likely to prefer to start PA post-treatment (90.0% vs. 83.6% vs. 80.1%; χ^2=9.3, p=0.009) • Less likely to prefer walking in the winter (25.5% vs. 35.7% vs. 34.7%; χ^2=6.8, p=0.034) • Less likely to prefer doing PA with family (12.6% vs. 18.7% vs. 24.6%; χ^2=9.4, p=0.009) • Less likely to prefer doing PA with spouse (29.7% vs. 45.1% vs. 42.8%; χ^2=10.4, p=0.005) • Less likely to prefer PA information on the internet (12.7% vs. 15.8% vs. 18.7%; χ^2=14.5, p=0.001) • Less likely to prefer PA information by e-mail (10.9% vs. 21.1% vs. 24.9%; χ^2=12.6, p=0.002) • Less likely to do a PA program in the neighborhood (36.4% vs. 48.9% vs. 53.4%; χ^2=11.9, p=0.003) • Less likely to do a PA program at a community fitness centre (25.6% vs. 37.9% vs. 33.6%; χ^2=6.3, p=0.042) • Less interested in a program to increase PA (75.4% vs. 85.2% vs. 90.2%; χ^2=7.6, p<0.001) • Less likely to prefer moderate/vigorous intensity PA (43.8% vs. 69.1% vs. 77.5%; χ^2=52.1, p<0.001)
Female survivors compared to male survivors were:	• More interested in doing PA (79.5% vs. 66.8%; χ^2=11.9, p=0.001) • More likely to prefer walking in the summer (43.7% vs. 33.3%; χ^2=7.6, p=0.006) • Less likely to prefer doing PA alone (33.3% vs. 42.7%; χ^2=5.2, p=0.022) • More likely to prefer doing PA with other cancer survivors (28.1% vs. 15.9%; χ^2=12.7, p<0.001) • More likely to prefer doing PA with family (25.9% vs. 15.1%; χ^2=10.6, p=0.001) • More likely to prefer doing PA with friends (49.6% vs. 28.5%; χ^2=26.8, p<0.001) • Less likely to prefer doing PA with spouse (30.7% vs. 45.2%; χ^2=12.3, p<0.001) • More likely to prefer PA information by telephone (9.4% vs. 4.0%; χ^2=6.8, p=0.009) • More likely to prefer to do PA at a community fitness centre (39.0% vs. 28.5%; χ^2=6.8, p=0.009) • More likely to prefer to do PA at a cancer centre (10.1% vs. 5.6%; χ^2=4.0, p=0.047) • More interested in a program to increase PA (90.1% vs. 80.2%; χ^2=10.6, p=0.001) • More likely to prefer supervised/instructed PA (55.6% vs. 31.8%; χ^2=0.1, p<0.001)
Obese survivors compared to overweight and healthy weight survivors were:	• More likely to prefer doing PA with other cancer survivors (24.3% vs. 21.9% vs. 13.2%; χ^2=6.8, p=0.035)

Survivors who are completely sedentary compared to those who are insufficiently active and meeting PA guidelines were:	• More likely to prefer to start PA post-treatment (88.4% vs. 87.1% vs. 74.3%; χ^2=19.7, p<0.001) • More likely to prefer doing PA with other cancer survivors (25.0% vs. 15.5% vs. 16.2%; χ^2=7.5, p=0.024) • Less likely to prefer doing PA with friends (29.6% vs. 36.2% vs. 39.2%; χ^2=18.1, p<0.001) • Less likely to prefer PA information on the internet (9.1% vs. 21.3% vs. 17.6%; χ^2=12.6, p=0.002) • Less likely to prefer to receive PA information by e-mail (14.8% vs. 21.3% vs. 26.7%; χ^2=9.8, p=0.008) • Less likely to prefer doing PA in the neighborhood (41.5% vs. 53.2% vs. 52.1%; χ^2=7.0, p=0.030) • More likely to prefer doing PA at home (57.1% vs. 51.4% vs. 42.9%; χ^2=8.6, p=0.014) • Less likely to prefer doing PA at a community fitness centre (24.6% vs. 34.9% vs. 45.4%; χ^2=21.2, p<0.001) • Less likely to prefer moderate/vigorous intensity PA (46.3% vs. 77.7% vs. 90.8%; χ^2=102.8, p<0.001)

Table 4-3. Summary of the associations between medical variables and physical activity preferences in kidney cancer survivors in Alberta, Canada, May, 2010

Medical Variables	Physical activity preferences with significant associations
Survivors within 60 months of diagnosis compared with survivors beyond 60 months were:	• More interested in doing PA (76.4% vs. 66.6%; χ^2=7.7, p=0.006) • More likely to prefer doing PA at home (54.0% vs. 42.0%; χ^2=8.3, p=0.004) • More interested in a program to increase PA (87.1% vs. 80.9%; χ^2=4.4, p=0.036)
Survivors with localized kidney cancer compared to survivors with metastatic kidney cancer were:	• More likely to prefer walking in the summer (39.0% vs. 28.7%; χ^2=4.8, p=0.028) • More likely to prefer moderate/vigorous intensity PA (66.4% vs. 55.6%; χ^2=3.9, p=0.048)
Survivors treated with drug therapy compared to survivors not treated with drug therapy were:	• Less likely to prefer to start PA post-treatment (77.2% vs. 85.6%; χ^2=4.3, p=0.037)
Survivors currently receiving cancer treatment compared to survivors not currently receiving cancer treatment were:	• Less likely to prefer to start PA post-treatment (77.2% vs. 85.6%; χ^2=15.2, p=0.037) • More likely to prefer PA information on the internet (23.1% vs. 12.9%; χ^2=4.1, p=0.044)

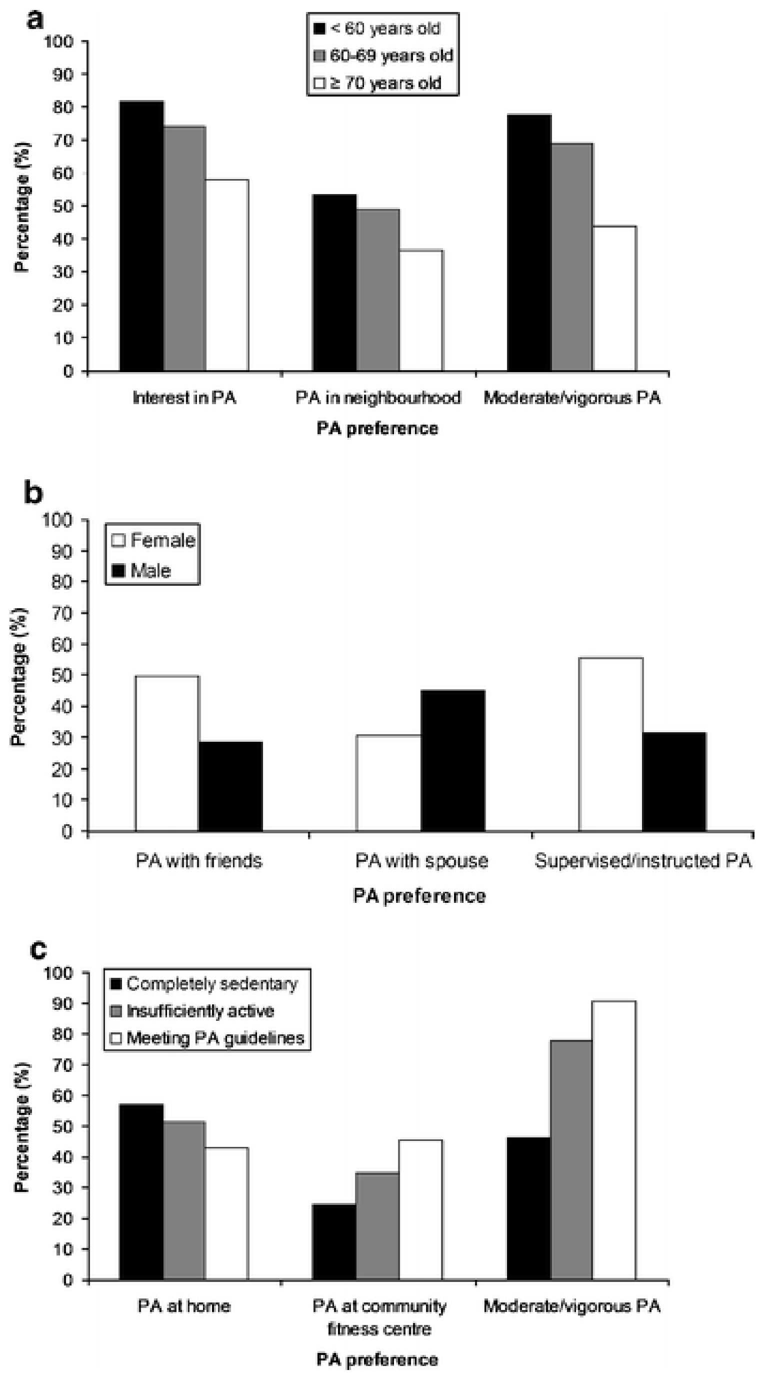

Figure 4-1. *A.* Selected significant physical activity preferences of kidney cancer survivors by age in Alberta, Canada, May, 2010. *B.* Selected significant physical activity preferences of kidney cancer survivors by sex in Alberta, Canada, May, 2010. *C.* Selected significant physical activity preferences of kidney cancer survivors by current physical activity in Alberta, Canada, May, 2010.

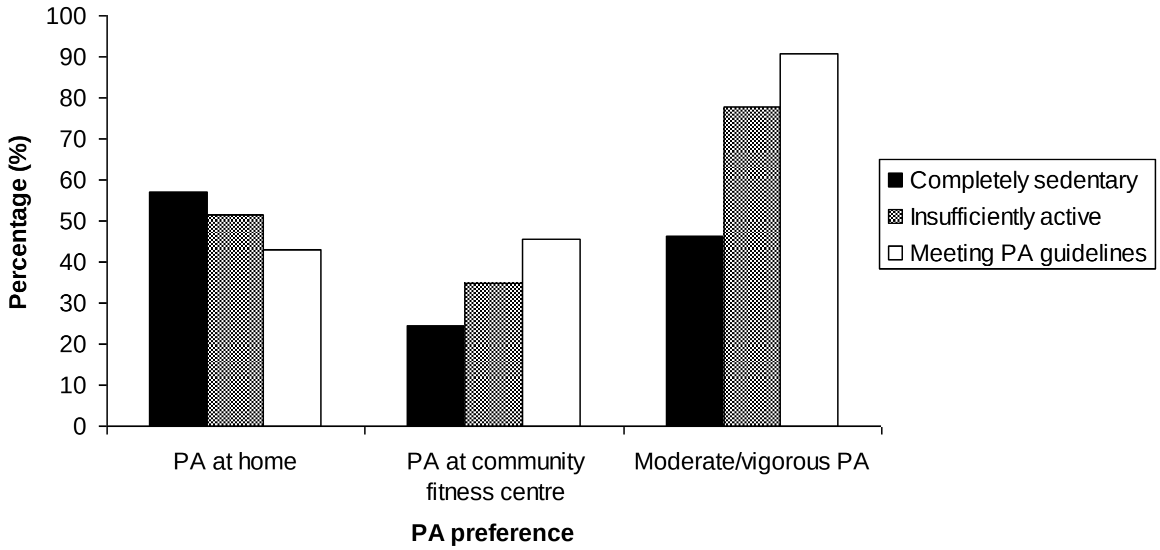

Figure 4-2. Significant physical activity preferences of kidney cancer survivors by months since diagnosis in Alberta, Canada, May, 2010.

REFERENCES

1. Canadian Cancer Society's Steering Committee on Cancer Statistics (2011) Canadian cancer statistics 2011. Canadian Cancer Society, Toronto.

2. Courneya KS, Friedenreich CM (2007) Physical activity and cancer control. Semin Oncol Nurs 23:242-252.

3. Trinh L, Plotnikoff RC, Rhodes RE, North S, Courneya KS (2011) Associations between physical activity and quality of life in a population-based sample of kidney cancer survivors. Cancer Epidemiol Biomarkers Prev. doi:10.1158/1055-9965

4. Latimer A, Brawley L, Bassett R (2010) A systematic review of three approaches for constructing physical activity messages: what messages work and what improvements are needed? Int J Behav Nutr Phys Act. doi:10.1186/1479-5868-7-36

5. Karvinen KH, Courneya KS, Plotnikoff RC, Spence JC, Venner PM, North S (2009) A prospective study of the determinants of exercise in bladder cancer survivors using the theory of planned behavior. Support Care Cancer 17:171-179.

6. Rogers LQ, Malone J, Rao K, Courneya KS, Fogleman A, Tippey A, et al (2009) Exercise preferences among patients with head and neck cancer: prevalence and associations with quality of life, symptom severity, depression, and rural residence. Head Neck 31:994-1005.

7. Rogers LQ, Markwell SJ, Verhulst S, McAuley E, Courneya KS (2009) Rural breast cancer survivors: exercise preferences and their determinants. Psychooncology 18:412-421.

8. Whitehead S, Lavelle K (2009) Older breast cancer survivors' views and preferences for physical activity. Qual Health Res 19:894-906.

9. Vallance JKH, Courneya KS, Jones LW, Reiman T (2006) Exercise preferences among a population-based sample of non-Hodgkin's lymphoma survivors. Eur J Cancer Care 15:34-43.

10. Karvinen KH, Courneya KS, Campbell KL, Pearcey RG, Dundas G, Capstick V, et al (2006) Exercise preferences of endometrial cancer survivors: a population-based study. Cancer Nurs 29:259-265.

11. Jones LW, Guill B, Keir ST, Carter K, Friedman HS, Bigner DD, et al (2007) Exercise interest and preferences among patients diagnosed with primary brain cancer. Support Care Cancer 15:47-55.

12. Jones LW, Courneya KS (2002) Exercise counseling and programming preferences of cancer survivors. Cancer Pract 10:208-215.

13. Gjerset GM, Fosså ,S.D., Courneya KS, Skovlund E, Jacobsen AB, Thorsen L (2011) Interest and preferences for exercise counselling and programming among Norwegian cancer survivors. Eur J Cancer Care 20:96-105.

14. Demark-Wahnefried W, Peterson B, McBride C, Lipkus I, Clipp E (2000) Current health behaviors and readiness to pursue life-style changes among men and women diagnosed with early stage prostate and breast carcinomas. Cancer 88:674-684.

15. Stevinson C, Capstick V, Schepansky A, Tonkin K, Vallance JK, Ladha AB, et al (2009) Physical activity preferences of ovarian cancer survivors. Psychooncology 18:422-428.

16. Bélanger LJ, Plotnikoff RC, Clark A, Courneya KS (in press) A survey of physical activity programming and counseling preferences in young adult cancer survivors. Cancer Nurs.

17. Karvinen KH, Courneya KS, Venner P, North S (2007) Exercise programming and counseling preferences in bladder cancer survivors: a population-based study. J Cancer Surviv 1:27-34.

18. Dillman DA (2000) Mail and internet surveys: the tailored design method. Wiley, New York.

19. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community (1985) Can J Appl Sport Sci 10:141-146.

20. Pereira MA, FitzerGerald SJ, Gregg EW, Joswiak ML, Ryan WJ, Suminski RR, et al (1997) A collection of physical activity questionnaires for health-related research. Med Sci Sports Exerc 29:S1-S205.

21. US Department of Health and Human Services (USDHHS) (2008) 2008 physical activity guidelines for Americans. USDHHS, Washington.

22. American Cancer Society (2010) Cancer facts & figures 2010. American Cancer Society, Atlanta.

23. Doyle C, Kushi LH, Byers T, Courneya KS, Demark-Wahnefried W, Grant B, et al (2006) Nutrition and physical activity during and after cancer treatment: an American cancer society guide for informed choices. CA Cancer J Clin. 56: 323–353.

24. American College of Sports Medicine (2007) ACSM/ACS Certified Cancer Exercise Trainer (CET).

http://www.acsm.org/AM/Template.cfm?Section=ACSM_ACS_Certified_Cancer_Exercise_Trainer. Accessed 28 February 2011

25. Vallance JK, Courneya KS, Plotnikoff R, Mackay JR (2007) Randomized controlled trial of the effects of print materials and step pedometers on physical activity and quality of life in breast cancer survivors. J Clin Oncol 25:2352–2359.

26. Cress ME, Buchner DM, Prohaska T, Rimmer J, Brown M, Macera C, et al (2006) Best practices for physical activity programs and behavior counseling in older adult populations. Eur Rev Aging Phys Act 3:34-42.

27. Sasidharan V, Payne L, Orsega-Smith E, Godbey G (2006) Older adults' physical activity participation and perceptions of wellbeing: examining the role of social support for leisure. Manag Leisure 11:164-185.

28. Eyler AA, Brownson RC, Bacak SJ, Housemann RA (2005) The epidemiology of walking for physical activity in the United States. Med Sci Sports Exerc 35:1529-1536.

29. Brown DS, Finkelstein EA, Brown DR, Buchner DM, Johnson FR (2009) Estimating older adults' preferences for walking programs via conjoint analysis. Am J Prev Med 36:201-207.

30. Vrazel J, Saunders RP, Wilcox S (2008) An overview and proposed framework of social-environmental influences on the physical activity behavior of women. Am J Health Promot 23:2-12.

31. Courneya KS, Karvinen, KH, Vallance, JKH (2007) Exercise motivation and behavior change. In: Feuerstein M (ed) Handbook of cancer survivorship. Springer, New York, pp 113-132.

32. McNeely M, Courneya K (2010) Exercise programs for cancer-related fatigue: evidence and clinical guidelines. J Natl Compr Canc Netw. 8:945-953.
33. Rogers LQ, Hopkins-Price P, Vicari S, Pamenter R, Courneya KS, Markwell S, et al (2009) A randomized trial to increase physical activity in breast cancer survivors. Med Sci Sports Exerc. 41:935-946.
34. Courneya KS (2010) Efficacy, effectiveness, and behavior change trials in exercise research. Int J Behav Nutr Phys Act. doi: 10.1186/1479-5868-7-81.

5: CHAPTER 5

Study 1: Paper 4

Correlates of Physical Activity in Population-Based Sample of Kidney Cancer Survivors: An Application of the Theory of Planned Behavior

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5-1. INTRODUCTION

Physical activity (PA) improves quality of life (QoL) in cancer survivors [1-3] including kidney cancer survivors (KCS) [4]. Most cancer survivors, however, are not meeting PA guidelines and little is known about the correlates of PA in this population [5, 6]. Moreover, the correlates of PA may vary by cancer survivor group [5]. Previous studies have focused on colorectal [7], young adult [8], breast [9], prostate [9], non-Hodgkin lymphoma [10], multiple myeloma [11], endometrial [12], and bladder cancer survivors [13] and have demonstrated important differences in the determinants of PA, but no study to date has focused on KCS. KCS have unique disease and treatment-related factors that may influence the correlates of PA. Since there are numerous demographic and medical differences between survivor groups, it is important to collect data on individual cancer groups, rather than attempt to generalize the results from other cancer populations. In a population-based survey, we previously reported that PA was associated with improved QoL and fatigue in KCS, but only 25% were meeting PA guidelines [4]. Here, we report the correlates of PA in KCS using the Theory of Planned Behavior (TPB) and structural equation modeling (SEM).

The TPB proposes that a person's intention to perform a behavior is the immediate determinant of that behavior as it reflects the level of motivation a person is willing to exert to perform the behavior [14]. Intention is theorized to mediate the influence of three main constructs on behavior: attitude, subjective norm, and perceived behavioral control (PBC). Attitude reflects a positive or negative evaluation of performing the behavior, and has both instrumental (e.g., harmful/beneficial) and affective (e.g., boring/enjoyable) components. Subjective norm is defined as the perceived social pressure to perform the behavior, and includes both injunctive (e.g., what significant others think the person should do) and descriptive (e.g., what significant others themselves do) components. PBC is an evaluation of how easy or difficult it will be to perform a behavior. Empirical evidence has demonstrated the superiority of the two-component TPB model over the traditional single component model for attitude and subjective norm but not for PBC [15-18]. Moreover, integration of a planning construct into the TPB may be an important pathway for translating intentions into behavior. Furthermore, the TPB also proposes that attitude, subjective norm, and PBC are determined by salient behavioral, normative, and control beliefs [14].

Previous studies in cancer survivors examining the correlates of PA using the TPB have employed multivariate statistical procedures such as path analyses or hierarchical regression, but the process of obtaining this analysis is simply a function of running a series of regressions. This statistical approach does not estimate the overall theoretical model, but instead examines sections of the theoretical model. Therefore, the evaluation of the overall fit of the TPB model to the data cannot be obtained [23]. On the other hand, in our study, we employed SEM to examine the correlates of PA, which is a major advantage over other statistical procedures. The benefit of SEM is the ability to test of the hypothesized relationships among observable and latent variables in the TPB completely and simultaneously [23, 24]. Modeling TPB constructs as latent variables allows researchers to take into account measurement error which may influence the relationships in the model [23, 24].

The purposes of this study are to: (a) test the utility of the modified TPB (i.e., the inclusion of the planning construct) in KCS, and to determine the most important social cognitive correlates of PA intentions and behavior; (b) determine if the TPB operates equivalently across commonly selected demographic (i.e., age, sex) and medical [i.e. body mass index (BMI), number of comorbidites, months since diagnosis, type of surgery, type of incision, disease stage) variables; and (c) identify the most common behavioral, control, and normative beliefs of KCS. Based on the theoretical tenets of the TPB [14] and previous studies in cancer survivors [7, 8, 12, 13, 25], we hypothesized that PBC, affective and instrumental attitude, and descriptive norm would be the most important correlates of PA intentions in KCS. We also hypothesized that intention, PBC, and planning will be the most important correlates of PA. The assessment of whether the TPB operates equivalently across commonly selected demographic and medical characteristics was considered exploratory.

5-2. METHODS

Participants and Procedures

The current study is from a dataset examining PA and health in KCS, where previous analyses included QoL and PA among KCS [4], as well as examining PA preferences among KCS [26]. Ethical approval was obtained through the Alberta Cancer Board Research Ethics Board and the University of Alberta Health Research Ethics Board. The methods of the survey have been reported elsewhere [4]. Briefly, a population-based, cross-sectional, mailed survey of KCS was utilized. Eligibility status included: (a) at least 18 years old, (b) provided written informed consent in English, and (c) diagnosed with kidney cancer. All 1,985 KCS diagnosed between 1996 and 2010 were drawn from the Alberta Cancer Registry. Eligible survivors were mailed a survey package that included: (a) an invitation letter from the registry; (b) a letter from the researchers explaining the study purpose, (c) the survey booklet, and (d) a postage paid return envelope. The survey protocol followed a modified version of the Total Design Method [27] wherein prospective participants were mailed: (a) the initial study package, (b) a postcard reminder 3-4 weeks later to nonresponders, and (c) a second survey package 3-4 weeks later to nonresponders from the initial survey and reminder.

Measures

Demographic and medical information. Demographic variables were measured using self-report and included age, sex, education level, marital status, annual income, employment status, ethnicity, and height and weight to calculate BMI. Medical variables were also measured using self-report and included time since diagnosis, type of kidney cancer, lymph node involvement, disease stage, previous and current treatments, previous recurrence, current disease status, smoking and drinking status, and comorbidities.

Physical activity. A modified version of the Leisure Score Index (LSI) from the Godin Leisure-Time Exercise Questionnaire (GLTEQ), that has been extensively validated [28, 29], was used to assess PA. Participants were asked to report their average weekly frequency and duration of light (minimal effort, no perspiration), moderate (not exhausting, light perspiration), and vigorous (heart beats rapidly, sweating) PA behavior that lasted at least 10 minutes per session in the past month. The PA guidelines established by the 2008 Physical Activity Guidelines for Americans [30] which have also been recommended for cancer survivors by the American Cancer Society [31] and the American College of Sports Medicine [32] suggest that individuals obtain 75 minutes of vigorous aerobic PA per week, 150 minutes of moderate aerobic PA per week or an equivalent combination. Therefore, “PA minutes” was computed using moderate minutes plus two times the vigorous minutes. Four categories were then computed based on the guidelines for PA minutes: (1) completely inactive (no PA minutes), (2) insufficiently active (1-149 PA minutes), (3) within guidelines (150 to 299 PA minutes), and (4) above guidelines (≥ 300 PA minutes).

Theory of planned behavior variables. Prior to completing the TPB measures, we defined regular PA for participants as “moderate intensity PA (e.g., brisk walking) performed for at least 150 minutes per week (2.5 hours), OR vigorous intensity PA performed at least 75 minutes per week (1.25 hours).” These definitions were based on the public health PA guidelines. The TPB items were developed based on guidelines recommended by Ajzen [14, 17], as well as previous studies with cancer survivors [10, 11].

Intention. Intention was assessed by two items. The first item, “Do you intend to do regular PA over the next month,” was rated on a 7-point Likert scale from 1 (*strongly intend*) to 7 (*no, not really*). The second item, “How motivated are you to do regular PA over the next month," was rated on a 7-point Likert scale from 1 (*not at all motivated*) to 7 (*extremely motivated*). Cronbach's alpha (α) coefficients for internal consistency for this scale was 0.94.

Attitude. Attitude was measured by four items using a 7-point bipolar adjective scale that

taps both instrumental (beneficial/harmful, important/unimportant) and affective (enjoyable/unenjoyable, fun/boring) aspects of attitude. The verbal descriptors were *extremely* (Points 1 and 7), *quite* (Points 2 and 6), and *slightly* (Points 3 and 5). The stem that preceded the adjectives was: "I think that for me to participate in regular PA over the next month would be…". Separate scores for affective and instrumental attitudes were computed as they were applied as separate variables for analyses. Cronbach's alpha (α) for the instrumental and affective attitude subscales were 0.77 and 0.81, respectively.

Subjective norm. Subjective norm was measured by three items rated on a 7-point Likert scale. The two items that measured injunctive norm were preceded by the stem: "I think that if I participated in regular PA over the next month, most people who are important to me would be…" followed by the scales 1=*extremely discouraging* to 7=*extremely encouraging*, and 1=*extremely unsupportive* to 7=*extremely supportive*. There was one item tapping into descriptive norm, which was "I think that over the next month, most people who are important to me will themselves participate regularly in PA" (1=*strongly disagree* to 7=*strongly agree*). Cronbach's alpha (α) for injunctive norm was 0.91.

Perceived behavioral control. PBC was determined by two items on a 7-point Likert scale based on the guidelines from Rhodes and Courneya [33, 34] that motivation should be held as a positive constant when measuring PBC. The specific items were: (a) "If you were really motivated, how much control would you have over doing regular PA over the next month" (1 = *very little control* to 7 = *complete control*); (b) "If you were really motivated, how confident would you be that you could do regular PA over the next month?" (1=*not at all confident* to 7=*extremely confident*). Cronbach's alpha (α) for this scale was 0.83.

Underlying accessible beliefs. Underlying accessible beliefs were solicited for behavioral, control beliefs, and normative beliefs using six open-ended questions. For behavioral beliefs, participants were asked "What would be the most important benefits for you if you participated in a regular PA program and what would make PA fun or enjoyable for you (list up to three each)." For control beliefs, participants were asked to list "what factors make it easier or more difficult for you to stick with a regular PA program." In terms of normative beliefs, participants were asked "which people or groups that are important to you would support you participating in a regular PA program or currently do regular PA themselves."

Planning. Planning was measured using four items rated using a 7-point Likert scale ranging from 1 (no plans) to 7 (detailed plans) [21]. The items were: (1) "I have made plans concerning 'when' I am going to engage in regular PA over the next month;" (2) "I have made plans concerning 'where' I am going to engage in regular PA over the next month;" (3) "I have made plans concerning ‘what’ kind of regular PA I am going to engage in over the next month;” and (4) “I have made plans concerning ‘how’ I am going to get to a place to engage in regular PA over the next month.” Cronbach’s alpha (α) for this scale was 0.97.

Data Analyses

All statistical analyses were performed using PASW Statistics 19 (PASW Inc., Chicago, IL) and AMOS 19.0 (Small Waters Corp., Chicago, IL). Descriptive statistics were calculated to determine the distribution of the variables. Bivariate correlations were computed to examine the relationship between TPB variables and PA intention and behavior. The underlying accessible TPB beliefs of the sample were determined by calculating frequencies and percentages for each of the behavioral, normative, and control beliefs. The most common underlying beliefs were reported based on the premise that each belief was solicited from at least 10% of the sample.

SEM with maximum likelihood estimation was used to allow for both an assessment of overall model fit and statistical significance tests for the size of each theoretical relation in the model (i.e., TPB). The measurement and structural models were constructed separately. For latent concept specification, the loading for each concept's first indicator was pre-set to 1.0 in the model to create a metric scale. For the single item indicators (i.e., descriptive norm, PA), a fixed error estimate of 10% and 25% was assigned to descriptive norm and PA, respectively. Model fit was assessed using a number of indices, including chi-square index, goodness-of-fit index (GFI), adjusted goodness-of-fit (AGFI), root mean square of approximation (RMSEA) and comparative fit index (CFI).

While a non-significant chi-square result ($p > .05$) indicates that the model is a good fit, it is too sensitive to sample size [23], as a result additional measures are often used. GFI and AGFI scores range from 0 to 1, a score exceeding .9 indicates a good fit. RMSEA of .08, .05 and 0 indicates adequate, close and exact fits, respectively [35]. CFI and IFI have a model acceptability cut-point of >.94 [35].

When the theory underlying the model indicates that a moderating relationship among predictors may vary by specific population sub-groups (e.g., gender, age, months since diagnosis, disease stage), multi-group structural equation modeling (MSEM) using a series of models, starting from unrestricted to fully constrained is recommended [36]. A chi-square index, goodness-of-fit index (GFI) evaluates a set of complex models - one for each group. Before the invariance models are estimated, it must be established that the model is without any invariances (i.e., a model that is different in each group) is acceptable. The constraints were placed in a sequence of nested models: Model 1 was the unrestricted model: noninvariant, unconstrained model (no constrains at all) where the relationships between variables are allowed to vary as a function of the proposed moderator and will be used as a basis for comparison; Model 2 was the measurement equivalent model: equal factor loading across the sub-groups (additional constraints that the interrelationships of attitude, subjective norm, and PBC would be equal across groups); Model 3 included Model 2 constraints plus equal factor variance and covariances (additional constraints that the interrelations of attitude, subjective norm and PBC would be equal across all groups and all factor variances); Model 4 included Model 3 constraints plus equal paths (additional constraints that the interrelations of attitude–intention, subjective norm–intention and PBC–intention, PBC–behavior and intention–behavior would be equal across all groups); Model 5 included Model 4 constraints plus equal factor residuals ("fully constrained"). Models 4 and 5 examined the latent construct level, and takes into account the hypotheses about how the sub-groups may differ and are similar, in terms of their perception of variables' relationships. Therefore, the most parsimonious model that does not vary significantly from the unrestricted model was used when comparing the paths [23].

Traditionally, evidence of invariance is determined using the χ^2 difference test ($\Delta\chi^2$), however this test represents an excessively stringent test of invariance [23]. There are various ΔGFIs that are superior to $\Delta\chi^2$ as tests of invariance because they are independent of both model complexity and sample size, and are not correlated with the overall fit measures. To compare the models, change in CFI (ΔCFI) was used [37]. Cheung and Rensvold [37] proposed critical values to indicate measurement invariance, which are robust for testing multi-group invariance. A $\Delta\text{CFI} \leq -.01$ indicates that the null hypothesis of invariance should not be rejected.

5-3. RESULTS

Descriptives

Flow of participants through the study has been presented elsewhere [4]. In brief, of the 1,985 mailed surveys, 331 were returned to sender due to wrong address, no history of kidney cancer, or deceased. Based on the remaining 1,654 surveys, 703 were returned, generating a 35.4% completion rate (703/1,985) and a 42.5% response rate (703/1,654). For the present analyses, we had 651 of 703 (92.6%) KCS provide evaluable data for the TPB analyses.

We previously compared responders (n=703) and nonresponders (n=1,282) and found no differences in terms of age, sex, or surgery rate [4]. Compared to nonresponders, however, responders were approximately one year closer to their date of diagnosis, had a slightly higher rate of treatment with systemic therapy, and less likely to have renal cell carcinoma and more likely to have clear cell carcinoma [4].

Demographic and medical information for the entire sample of 703 are outlined elsewhere [4]. For the 651 participants who completed TPB data, the mean age was 64.4±10.9, 62.4% were male, 79.1% were married, and the mean BMI was 28.6±5.2. The mean number of months since diagnosis was 68.6±56.0, 87.1% were disease-free, 97.5% had received surgery, and 83.3% had localized kidney cancer. Overall, 179 (27.4%) were meeting public health PA guidelines. Descriptive statistics and bivariate correlations for the TPB variables are reported in Table 1.

Evaluation of the Measurement and Structural Models

The measurement model provided a good fit to the data based on the fit statistics [χ^2=147.80, p<0.001; TLI=0.96; CFI=0.98; RMSEA=0.07, 90% CI=0.06-0.08]. The measurement model also suggested good measurement of all the TPB constructs with significant factor loadings (p<.001). Assessment of normality was conducted to examine multivariate kurtosis. The multivariate kurtosis value represented by Mardia's coefficient was above the recommended value of 3 [23]. Consequently, the Bollen-Stine bootstrap procedure was used to test model fit and bias corrected regression coefficients are reported for the structural model [23]. While the Bollen-Stine p-value was significant (χ^2=256.88, p<.001), other fit indices suggested that the structural model was an adequate-to-good fit to the data [TLI=0.97; CFI=0.98; RMSEA=0.06, 90% CI=0.05-0.06].

Associations of the Theory of Planned Behavior with Intention and Physical Activity

Standardized, direct effect coefficients for the associations of the TPB variables on intention and PA are shown in Figure 1. There were significant pathways to PA from PBC (ß=0.18, p=0.02), planning (ß=0.22, p<0.01), and intention (ß=0.31, p<0.01). There were significant pathways to planning from intention (ß=0.81, p<0.01). In addition, there were significant model pathways to intention from instrumental attitude (ß=0.28, p=0.03), descriptive norm (ß=0.09, p=0.01), and PBC (ß=0.52, p<0.01). Due to non-normality, bootstrap standard errors can be larger than would be expected under normal theory assumptions, thereby influencing the significance level in the model pathways. Therefore, a larger beta coefficient may be less significant than a smaller beta coefficient [23].

Moreover, there were strong significant total effects of PBC (ß=0.43, p<0.01) and intention (ß=0.49, p<0.01) on PA. There were also significant total effects of instrumental attitude (ß=0.14, p=0.02), descriptive norm (ß=0.04, p=0.01), and planning (ß=0.22, p<0.01) on PA. In terms of the indirect effects on

PA, PBC had the strongest indirect effect on PA (ß=0.25, $p<0.01$). There were also small indirect effects from descriptive norm (ß=0.04, $p<0.01$), instrumental attitude (ß=0.14, $p=0.02$), and intention (ß=0.18, $p<0.01$) on PA. Overall, the TPB accounted for 69%, 63%, and 42% of the variance in intention, planning, and PA behavior, respectively.

Testing Invariance of Selected Demographic and Medical Variables

Table 2 provides the goodness of fit indices for selected demographic and medical variables for the multi-sample nested models. The structural model was tested separately for selected demographic variables including gender (males vs. females) and age (<60 years vs. 60-69 years vs. ≥70 years). In both variables and across groups, the model provided an adequate-to-good fit to the data based on the AGFI, RMSEA, and CFI fit statistics. Given that the models offered a good fit for the sub-samples, a MSEM was conducted to determine which parameters could be considered invariant across groups. By examining the differences between the constrained models and the unconstrained models in both gender and age, the ΔCFI was $\leq -.01$, indicating that the factor loadings, factor variances and covariances, interrelations between attitude, subjective norm, and PBC, planning, intention and PA behavior, and factor residuals are invariant.

In addition, the structural model was tested separately for selected medical variables including BMI (healthy vs. overweight vs. obese), number of comorbidities (<3 vs. ≥3), months since diagnosis (<60 vs. ≥60), type of surgery (partial vs. radical), type of incision (laparoscopic vs. open cut), and disease stage (localized vs. metastatic). These sub-groups were created based on meaningful cut-points that are considered important targets in PA interventions, and have been used in previous studies in the cancer population [38-41]. The models for all of the medical variables represented adequate-to-good fit to the data based on the AGFI, RMSEA, and CFI fit statistics. The ΔCFI was $\leq -.01$ between the constrained and unconstrained models, indicating that the factor loadings, factor variances and covariances, interrelations between attitude, subjective norm, and PBC, planning, intention and PA behavior, and factor residuals are invariant in all of the medical variables listed above.

It is important to note that age and BMI did not achieve a ΔCFI was $\leq -.01$ for Model 5 suggesting that the variances and covariances of the measurement errors are not invariant across the groups. However, the testing of Model 5 is considered an excessively stringent test of multigroup invariance because measurement error variances are rarely constrained equal across groups [23].

Most Common Accessible Beliefs

Table 3 presents the most common behavioral, control, and normative beliefs of KCS. The nine most common behavioral beliefs regarding the advantages of PA were: (a) lose weight, (b) improve fitness, (c) improve strength, (d) feel good/better about oneself, (e) improve energy levels, (f) improve health, (g) increase flexibility, (h) improve sleep quality, and (i) lower blood pressure. The nine most common behavioral beliefs regarding what makes PA fun/enjoyable were: (a) exercise with other people, (b) exercise outdoors for fresh air/scenery, (c) do an activity that is fun/enjoyable, (d) do a variety of activities, (e) participate in team sports, (f) exercise to music, (g) exercise in good weather,

(h) seeing results/benefit, and (i) do an activity that is pain-free. The 9 most common control beliefs regarding barriers to PA were: (a) other medical/health problems, (b) lack of time, (c) pain/soreness, (d) fatigue/too tired, (e) other commitments, (f) long work hours, (g) poor weather conditions, (h) lack of motivation, and (i) limited or no access to recreation facilities. The eight most common normative beliefs regarding important people that support PA involvement were: (a) family members, (b) spouse/partner, (c) friends, (d) recreation club/teammates, (e) coworkers, (f) medical team, (g) neighbors, and (h) church group.

5-4. DISCUSSION

This study is the first to examine the correlates of PA in KCS and the first to use SEM to test a two-component model of the TPB for PA in any cancer survivor group. The TPB model demonstrated an adequate-to-good fit to the data. There were significant model pathways to PA from PBC, intention, and planning, where intention emerged as the strongest correlate. In terms of planning, there was a significant pathway to planning from intention. In addition, there were significant model pathways to intention for which PBC was the strongest correlate followed by instrumental attitude and descriptive norm. Overall, the TPB accounted for 69%, 63% and 42% of the variance in intention, planning and PA, respectively. These findings are in line with previous TPB studies with cancer survivors where 21-38% of the variance was accounted for in PA behavior and 23-62% in PA intention [7-13, 25, 42], as well as with a recent meta-analysis in the general population where 43.7% and 21.2% of the variance was accounted for in PA intention and behavior, respectively [43]. With regards to planning, our study findings are in line with previous studies where 67% of the variance was explained by the TPB in young adult cancer survivors [8], and 71% of the variance was explained in colorectal cancer survivors [7].

In our study, PBC, intention, and planning were direct correlates of PA in KCS. The majority of studies in cancer survivors have demonstrated that intention is one of the main predictors of PA behavior [7, 8, 12, 25], however, few of these studies have included planning. Our analyses suggest that the association of intention with PA is partially mediated by planning. A number of previous studies in the general population have also shown planning to mediate the impact of intentions on behavior and to contribute to additional variance to the prediction of behavior [17, 21, 44-46]. Within cancer populations, there is some evidence to suggest some implied mediation of planning for the intention-behavior relationship, where planning demonstrated independent contributions to PA among bladder cancer survivors [13], colorectal cancer survivors [7], and young adult cancer survivors [8]. This highlights that intenders may potentially benefit from formulating detailed plans to engage in PA.

Previous studies have also shown that PBC is a direct correlate of PA [13, 42], however, these studies have not included planning. Our data suggest a direct association of PBC with PA even after accounting for planning. In addition, there were strong significant total effects of PBC and intention on PA. This finding may be due to age-related barriers that KCS may experience since they tend to be older than survivors of other cancers. Therefore, they may have other existing comorbidities that may contribute to poorer health. This suggests that PBC is an important correlate of PA in older populations including cancer survivors. Moreover, intention was found to be the sole direct correlate of planning which is consistent with the few studies that have examined the correlates of planning in cancer survivors [7, 8]. This suggests that forming an intention is a necessary condition for the development of a detailed plan to initiate PA.

With regards to intention, the key correlates in our study were PBC followed by instrumental attitude and descriptive norm. These data suggest that KCS will form intentions to engage in PA if they view it to be easy to perform, beneficial, and that important others will perform the behavior. Moreover, when examining the indirect effects of the TPB constructs on PA, PBC had the strongest indirect effect, with descriptive norm, instrumental attitude, and intention having smaller trivial effects on PA. Similarly, previous studies in cancer survivors have also found PBC and instrumental attitude to be significant correlates of intention, with PBC being the strongest correlate [7, 8, 12, 13, 25, 42]. In our study, affective attitude did not emerge as a significant correlate of intention, which is inconsistent with our hypothesis and previous research that suggests that affective attitude is a strong correlate of intention [7, 8, 12, 13, 25, 42]. This finding is unique because it suggests that instrumental attitude may be more important for KCS when forming an intention to engage in PA. This may be due to differences in health and age. KCS are more likely to be overweight or obese, and have other comorbidities due to their older age compared to many other survivor groups. Therefore, KCS may be more likely to intend to engage in PA if they feel it would be beneficial rather than fun/enjoyable.

Subjective norm is typically a very weak correlate of intention after controlling for attitude and PBC [16]. In our study, descriptive norm emerged as a significant correlate of intention, but the direct effect of descriptive norm on intention was trivial, with the indirect effect on PA being small and trivial as well. Subjective norm has generally not been a significant correlate of intention in previous studies [12, 25, 42]. This suggests that enlisting important others to engage in PA behavior themselves and enlisting support and encouragement may not be as important among KCS compared to other TPB constructs such as attitude and PBC, or it may also indicate that normative constructs have their influence on PA through other TPB constructs (e.g., PBC, instrumental attitude, affective attitude).

A secondary purpose of this study was to examine if the TPB operated equivalently across sub-groups which consisted of common demographic and medical variables. In terms of demographic variables, the interrelationships of the TPB constructs with intention and PA behavior were invariant across age groups and sex. Similarly, invariance was also observed for medical sub-groups such as BMI, number of comorbidites, months since diagnosis, type of surgery, type of incision, and disease stage. Our finding of invariance is inconsistent with previous studies with cancer survivors that have found select demographic and medical variables to moderate associations within the TPB [13]. For example, Karvinen et al. [12] found that age and BMI moderated the associations of the

TPB, where control constructs were more important correlates of PA and intention in older and obese endometrial cancer survivors compared to younger and healthy/overweight survivors. In addition, Karvinen et al. [13] found age and adjuvant therapy to be significant moderators of the TPB with bladder cancer survivors. The discrepancies in findings may be due to the differences in statistical techniques employed. In previous studies examining moderators of the TPB among cancer survivors, path analysis and multiple regression techniques were used, whereas in our study, we employed a more powerful multivariate technique of SEM which tests the TPB model overall, rather than coefficients individually [23]. These differences may also be due to the medical and demographic differences among cancer survivor groups. Our findings suggest that PA interventions for KCS based on the TPB do not need to be targeted to specific subgroups.

Our study also solicited the underlying behavioral, normative, and control beliefs for future PA interventions in KCS. The analyses of individual beliefs provide an understanding of key targets for the development of interventions designed to increase PA levels. Behavioral beliefs were separated into instrumental and affective beliefs, which is a novel feature of the elicitation of salient beliefs in cancer survivor groups. For instrumental beliefs, KCS reported weight loss, improved fitness, and improved strength as the most common anticipated benefits of PA. These findings are similar to other cancer survivor groups including young adult [8], adolescent [42], ovarian [25], endometrial [12], and non-Hodgkin lymphoma [47] cancer survivors. For affective beliefs, KCS indicated that exercising with other people, exercising outdoors, and doing a specific activity are aspects that make PA enjoyable. These beliefs are also consistent with a previous study in young adult cancer survivors [8]. Targeting these key beliefs in PA interventions is essential when attempting to influence affective and instrumental attitudes of KCS.

In terms of control beliefs, KCS reported other medical/health problems, lack of time, and pain/soreness as the most common barriers to PA. These beliefs were also reported in other cancer survivor groups [8, 12, 25, 42, 47]. Similar to our findings, Karvinen et al. [12] reported poor health to be the most common barrier to PA among endometrial cancer survivors. Given the high obesity rate and the number of comorbidites present in older cancer survivors, it is important to develop PA programs that are appropriate for people with poor health. Since PBC has been shown to be a strong correlate of intention and PA, and contribute to both total and indirect effects on PA, it is essential for PA interventions to focus extensively on control beliefs in KCS.

For normative beliefs, KCS reported that family members, spouse/partner, and friends to be the most important people to provide support. This is in line with previous research with other cancer survivor groups [8, 12, 25, 42, 47]. With older cancer survivors such as endometrial [12] and ovarian [25], family, spouse/partner, and the medical team are important sources of support which is consistent with our findings among KCS. Even though descriptive and injunctive norm had trivial and/or non-significant effects on intention, it may be important to include support and encouragement in PA interventions for KCS because of their potential influence on other TPB constructs (i.e., PBC, instrumental attitude, affective attitude).

Our study should be interpreted within the context of important strengths and limitations. To the best of our knowledge, our study is the first to examine the correlates of PA in KCS and one of the first to use SEM to examine the TPB for PA in any cancer survivor group. This study is also one of the few studies that have tested a two-component model of the TPB among cancer survivors and included planning. Furthermore, we sampled all KCS diagnosed between 1996 and 2010 from a comprehensive Registry in Alberta, Canada. One limitation of our study is the inherent selection biases due to the transparent purpose of the study. KCS who were more interested in PA were perhaps more likely to participate in the study, and thus overestimate the number of KCS meeting PA guidelines and have higher scores on the TPB variables. The modest response rate of a 42.5% may also limit the generalizability of the findings. The study design was cross-sectional in nature in which causation cannot be implied. Our study also relied on a self-report measure of PA which, although validated, can introduce measurement error.

In conclusion, our results support the utility of the TPB to explain PA among KCS. Our study provided evidence that PA is strongly associated with planning and intention which, in turn, are strongly associated with PBC, instrumental attitude, and descriptive norm. Our findings identified important targets for informing PA interventions among KCS. These interventions would need to implement strategies in regards to planning for PA and how to anticipate and overcome barriers to PA. Also, strategies can be used to address attitudes toward PA, where messages can be focused around the benefits of PA and factors that would make participating in PA important. In addition, salient PA beliefs were identified that are essential to the development of PA interventions. Based on these beliefs, PA interventions should target the benefits of PA such as weight loss and improvement in fitness and strength. The enjoyable aspects of PA should also be highlighted including exercising with others, engaging in a fun activity, and exercising outdoors. However, addressing barriers to PA such as the presence of health problems and pain/soreness, as well as lack of time should be the main target for influencing PA levels of KCS. Finally, demographic and medical variables remained invariant in the TPB model suggesting that similar intervention strategies can be implemented among different subgroups of KCS. Developing theory-driven PA interventions for KCS may lead to important improvements in health and QoL.

Table 5-1. Descriptive statistics and correlations among the Theory of Planned Behavior variables in kidney cancer survivors

Variable	1	2	3	4	5	6	7	8	Mean	SD
1. Affective attitude	-								5.02	1.27
2. Instrumental attitude	.60***	-							5.68	1.16
3. Descriptive norm	.34***	.32***	-						5.05	1.65
4. Injunctive norm	.42***	.54***	.37***	-					5.90	0.96
5. Perceived behavioral control	.40***	.58***	.24***	.43***	-				4.78	1.56
6. Intention	.55***	.63***	.33***	.43***	.69***	-			4.25	1.83
7. Planning	.42***	.50***	.27***	.34***	.54***	.78***	-		3.73	2.11
8. Physical activity categories	.30***	.34***	.15***	.19***	.40***	.50***	.47***	-	1.89	1.65

Note: *** $p < .001$

Physical activity (PA) categories: [1] completely sedentary (0 PA minutes), [2] insufficiently active (1-149 PA minutes), [3] within guidelines (150 to 299 PA minutes), and [4] above guidelines (≥ 300 PA minutes).

Table 5-2. Goodness of fit indices for multi-sample nested models in kidney cancer survivors in Alberta, Canada

Model	n	χ^2	*df*	p^a	AGFI	RMSEA	CFI	ΔCFI
Demographic variables								
Gender								
Male	406	238.32	86	.001	.89	.07	.97	-
Female	245	184.23	86	.010	.87	.07	.97	-
Model 1		422.54	172	<.001	-	.05	.97	-
Model 2		430.74	180	<.001	-	.05	.97	<.01
Model 3		453.33	195	<.001	-	.05	.97	<.01
Model 4		463.49	205	<.001	-	.04	.97	<.01
Model 5		486.38	219	.001	-	.04	.97	<.01
Age								
<60 years	246	243.51	87	<.001	.84	.09	.95	-
60-69 years	196	149.55	87	.095	.87	.06	.98	-
≥70 years	209	146.73	87	.116	.87	.06	.98	-
Model 1		539.79	261	<.001	-	.04	.97	-
Model 2		567.94	277	<.001	-	.04	.97	<.01
Model 3		616.18	307	<.001	-	.04	.97	<.01
Model 4		665.14	323	<.001	-	.04	.96	.01
Model 5		801.81	353	.001	-	.04	.95	.02
Medical variables								
Body mass index								
Healthy	161	125.66	87	.196	.86	.05	.99	-
Overweight	281	190.35	87	.004	.88	.07	.97	-
Obese	209	161.20	87	.038	.86	.06	.97	-
Model 1		477.21	261	.002	-	.04	.98	-
Model 2		500.79	277	.003	-	.04	.98	<.01
Model 3		571.39	307	.001	-	.04	.97	.01
Model 4		593.54	323	.001	-	.04	.97	.01
Model 5		693.75	353	.014	-	.04	.96	.02
Number of comorbidities								
<3	327	216.76	86	.001	.88	.07	.97	-
≥3	324	196.18	86	.002	.88	.06	.98	-
Model 1		412.94	172	<.001	-	.05	.97	-
Model 2		423.41	180	<.001	-	.05	.97	<.01
Model 3		449.88	195	<.001	-	.05	.97	<.01
Model 4		464.45	205	<.001	-	.04	.97	<.01
Model 5		522.58	219	.002	-	.05	.97	<.01

Table 5-2. cont'd

Model	n	χ^2	*df*	p^a	AGFI	RMSEA	CFI	ΔCFI
Months since diagnosis								
<60	324	213.04	86	.003	.88	.07	.97	-
≥60	327	180.98	86	.007	.90	.06	.98	-
Model 1		394.02	172	<.001	-	.05	.98	-
Model 2		399.41	180	<.001	-	.04	.98	<.01
Model 3		423.62	195	<.001	-	.04	.98	<.01
Model 4		435.68	205	<.001	-	.04	.98	<.01
Model 5		505.22	219	.002	-	.05	.97	.01
Type of surgery								
Partial nephrectomy	115	136.21	86	.149	.81	.07	.97	-
Radical nephrectomy	520	234.71	86	<.001	.92	.06	.98	-
Model 1		370.92	172	.001	-	.04	.98	-
Model 2		386.20	180	.002	-	.04	.98	<.01
Model 3		401.98	195	.002	-	.04	.98	<.01
Model 4		411.37	205	.002	-	.04	.98	<.01
Model 5		431.09	219	.028	-	.04	.98	<.01
Type of incision								
Laparoscopic	194	197.71	86	.005	.83	.08	.96	-
Open cut	441	173.14	86	.012	.93	.05	.99	-
Model 1		370.84	172	<.001	-	.04	.98	-
Model 2		386.76	180	<.001	-	.04	.98	<.01
Model 3		421.54	195	<.001	-	.04	.97	.01
Model 4		429.54	205	<.001	-	.04	.97	.01
Model 5		466.30	219	.015	-	.04	.97	.01
Disease stage								
Localized	542	242.62	86	.004	.91	.06	.98	-
Metastatic	109	130.53	86	.098	.80	.07	.98	-
Model 1		373.15	172	<.001	-	.04	.98	-
Model 2		383.43	180	<.001	-	.04	.98	<.01
Model 3		415.43	195	.001	-	.04	.98	<.01
Model 4		442.56	205	<.001	-	.04	.97	.01
Model 5		505.53	219	.001	-	.05	.97	.01

Note. Model 1-unrestricted model: noninvariant, unconstrained model; Model 2 measurement equivalent model- equal factor loadings; Model 3-model 2 constraints plus equal factor variance and covariances; Model 4-model 3 constraints plus equal paths; Model 5-model 4 constraints plus equal factor residuals ("fully constrainted").

ΔCFI = Change in comparative fit index. A value of ΔCFI ≤ .01 indicates that the null hypothesis of invariance should not be rejected.

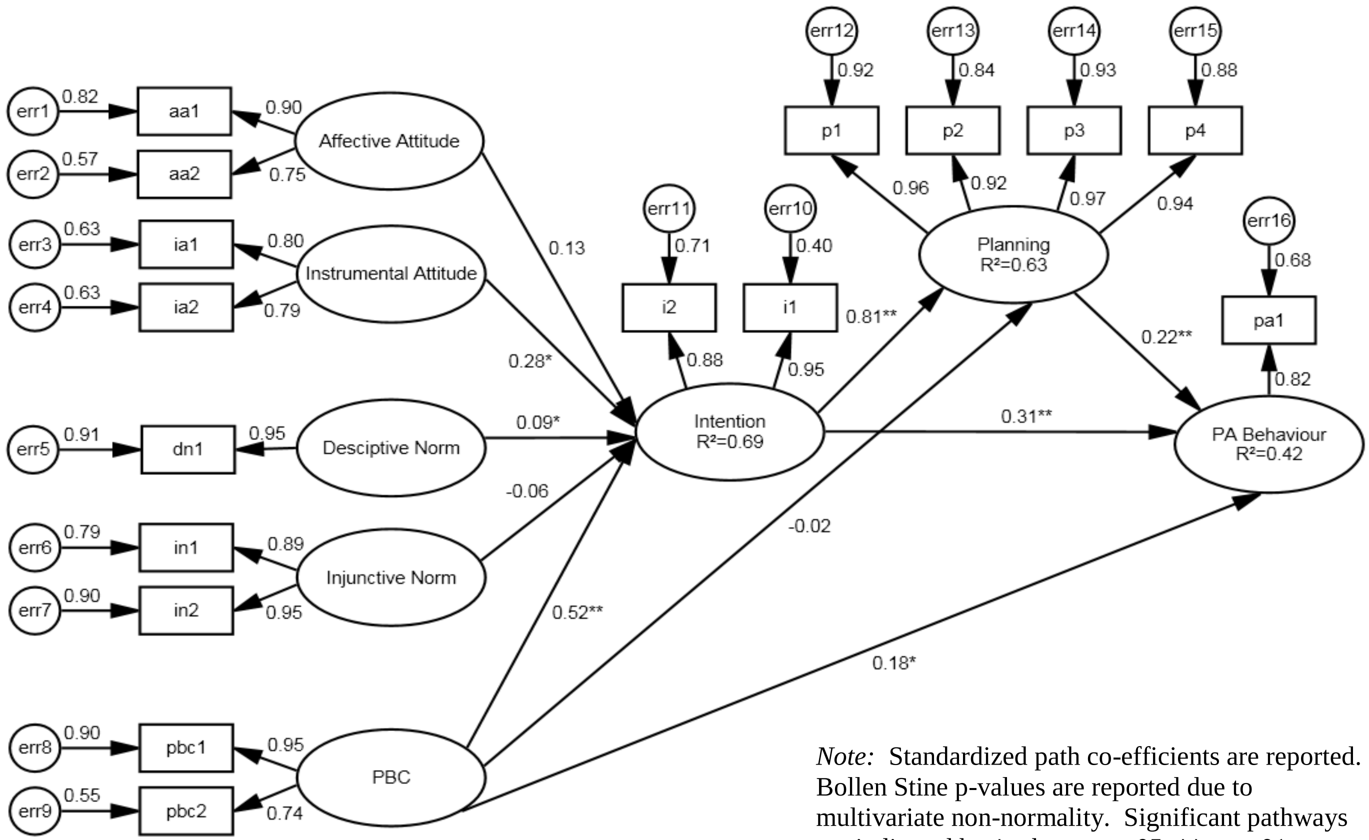
[a]Bollen Stine p-value reported due to multivariate non-normality.

KCS that indicated "don't know" to type of surgery and incision were excluded from the analysis.

Table 5-3. Most common behavioral, control, and normative beliefs of kidney cancer survivors in Alberta, Canada

Beliefs	n	% Survivors[1]	% Respondents[2] (n=482)
Most Common Behavioral Beliefs			
Benefits (n=419)			
Lose weight	207	31.8	49.4
Improve fitness	110	16.9	26.3
Improve strength	105	16.1	25.1
Feel good/better about oneself	100	15.4	23.9
Improve energy levels	95	14.6	22.7
Improve health	91	14.0	21.7
Increase flexibility	15	2.3	3.6
Improve sleep quality	14	2.2	3.3
Lower blood pressure	8	1.2	1.9
Fun/Enjoyable (n=334)			
Exercise with other people	197	30.3	47.0
Exercise outdoors for fresh air/scenery	41	6.3	9.8
Do an activity that is fun/enjoyable	28	4.3	6.7
Do a variety of activities	23	3.5	5.5
Participate in team sports	22	3.4	5.3
Exercise to music	22	3.4	5.3
Exercise in good weather	14	2.2	3.3
Seeing results/benefit	15	2.3	3.6
Do an activity that is pain-free	10	1.5	2.4
Most Common Control Beliefs (Barriers)			
(n=482)	115	17.7	23.9
Other medical/health problems	104	16.0	21.6
Lack of time	98	15.1	20.3
Pain/soreness	94	14.4	19.5
Fatigue/too tired	90	13.8	18.7
Other commitments	77	11.8	16.0
Long work hours	70	10.8	14.5
Poor weather conditions	66	10.1	13.7
Lack of motivation	38	5.8	7.9
Limited or no access to recreation facilities			
Most Common Normative Beliefs (Support)			
(n=409)	275	42.2	67.2
Family members	230	35.3	56.2
Spouse/partner	145	22.3	35.5
Friends	20	3.1	4.9
Recreation club/teammates	16	2.5	3.9
Coworkers	13	2.0	3.2
Medical team	7	1.1	1.7
Neighbors	7	1.1	1.7
Church group			

[1]Percentage of response from all participants (N=651)
[2]Percentage of responses from participants who answered to the questions



Note: Standardized path co-efficients are reported. Bollen Stine p-values are reported due to multivariate non-normality. Significant pathways are indicated by * where $p < .05$, ** $p < .01$.

Figure 5-1. Standardized parameter estimates for pathways among the Theory of Planned Behavior in kidney cancer survivors

REFERENCES

1. Ferrer RA, Huedo-Medina T, Johnson BT, Ryan S, Pescatello LS: **Exercise interventions for cancer survivors: A meta-analysis of quality of life outcomes.** *Ann Behav Med* 2011, **41:**32-47.

2. Speck RM, Courneya KS, Mâsse L,C., Duval S, Schmitz KH: **An update of controlled physical activity trials in cancer survivors: A systematic review and meta-analysis.** *J Cancer Surviv* 2010, 4:87-100.

3. Brown JC, Huedo-Medina T, Pescatello LS, Pescatello SM, Ferrer RA, Johnson BT: **Efficacy of exercise interventions in modulating cancer-related fatigue among adult cancer survivors: A meta-analysis.** *Cancer Epidemiol Biomarkers Prev,* 2011, **20:**123-133.

4. Trinh L, Plotnikoff RC, Rhodes RE, North S, Courneya KS: **Associations between physical activity and quality of life in a population-based sample of kidney cancer survivors.** *Cancer Epidemiol Biomarkers Prev* 2011, **20:**859-868.

5. Courneya KS, Karvinen, KH, Vallance, JKH: **Exercise motivation and behavior change.** *In Handbook of Cancer Survivorship.* Edited by Feuerstein M. New York: Springer; 2007:113-132.

6. Pinto BM, Ciccolo JT: **Physical activity motivation and cancer survivorship.** *Recent Results Cancer Res* 2011, **186:**367-387.

7. Speed-Andrews A, Rhodes RE, Blanchard CM, Culos-Reed SN, Friedenreich CM, Bélanger LJ, Courneya KS: **Medical, demographic, and social cognitive correlates of physical activity in a population-based sample of colorectal cancer survivors.** *Eur J Cancer Care* 2011, **21:** 187-196.

8. Bélanger LJ, Plotnikoff RC, Clark A, Courneya KS: **Determinants of physical activity in young adult cancer survivors.** *Am J Health Behav*, in press.

9. Blanchard CM, Courneya KS, Rodgers WM, Murnaghan DM: **Determinants of exercise intention and behavior in survivors of breast and prostate cancer: An application of the theory of planned behavior.** *Cancer Nurs* 2002, **25:**88-95.

10. Courneya KS, Vallance JKH, Jones LW, Reiman T: **Correlates of exercise intentions in non-hodgkin's lymphoma survivors: An application of the theory of planned behavior.** *J Sport Exercise Psychol* 2005, **27:**335-349.

11. Jones LW, Courneya KS, Vallance JKH, Ladha AB, Mant MJ, Belch AR, Reiman T: **Understanding the determinants of exercise intentions in multiple myeloma cancer survivors: An application of the theory of planned behavior.** *Cancer Nurs* 2006, **29:**167-175.

12. Karvinen KH, Courneya KS, Campbell KL, Pearcey RG, Dundas G, Capstick V, Tonkin KS: **Correlates of exercise motivation and behavior in a population-based sample of endometrial cancer survivors: An application of the theory of planned behavior.** *Int J Behav Nutr Phys Act* 2007, doi: 10.1186/1479-5868-4-21.

13. Karvinen KH, Courneya KS, Plotnikoff RC, Spence JC, Venner PM, North S: **A prospective study of the determinants of exercise in bladder cancer survivors using the theory of planned behavior.** *Support Care Cancer* 2009, **17:**171-179.

14. Ajzen I: **The theory of planned behavior.** *Organ Behav Hum Decis Process* 1991, **50:**179-211.

15. Courneya KS, Conner M, Rhodes RE: **Effects of different measurement scales on the variability and predictive validity of the "two-component" model of the theory of planned behavior in the exercise domain.** *Psychol Health* 2006, **21:**557-570.

16. Rhodes RE, Nigg CR: **Advancing physical activity theory: A review and future directions.** *Exerc Sport Sci Rev* 2011, **39:**113-119.

17. Connor M, Sparks P: **The theory of planned behavior and health behaviors.** *In Predicting Health Behavior.* 2nd edition. Edited by Conner M, Norman P. New York: Open University Press; 2005:170-222.

18. Ajzen I: **Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior.** *J Appl Soc Psychol* 2002, **32:**665-683.

19. Hagger MS, Chatzisarantis NLD, Biddle SJH: **A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and the contribution of additional variables.** *J Sport Exercise Psychol* 2002, **24:**3-32.

20. Sheeran P, Milne S, Webb TL, Gollwitzer PM: **Implementation intentions and health behavior.** *In Predicting Health Behavior.* 2nd edition. Edited by Conner M, Norman P. New York: Open University Press; 2005:276-323.

21. Conner M, Sandberg T, Norman P: **Using action planning to promote exercise behavior.** *Ann Behav Med* 2010, **40:**65-76.

22. Rhodes RE, Plotnikoff RC, Courneya KS: **Predicting the physical activity intention-behavior profiles of adopters and maintainers using three social cognition models.** *Ann Behav Med* 2008, **36:**244-252.

23. Bryne BM: S*tructural Equation Modeling With AMOS: Basic Concepts, Applications, and Programming.* 2nd edition. New York: Routledge Academic; 2009.

24. Bollen KA: *Structural Equations With Latent Variables.* New York: Wiley-Interscience; 1989.

25. Stevinson C, Tonkin K, Capstick V, Schepansky A, Ladha AB, Vallance JKH, Faught W, Steed H, Courneya KS: **A population-based study of the determinants of physical activity in ovarian cancer survivors.** *J Phys Act Health* 2009, **6:**339-346.

26. Trinh L, Plotnikoff RC, Rhodes RE, Scott N, Courneya KS: **Physical activity preferences in a population-based sample of kidney cancer survivors.** *Support Care Cancer* 2011, doi: 10.1007/s00520-011-1264-z.

27. Dillman DA: *Mail and Internet Surveys: The Tailored Design Method.* New York: Wiley-Interscience; 2000.

28. Godin G, Shephard RJ: **A simple method to assess exercise behavior in the community.** *Can J App Sport Sci* 1985, **10:**141-146.

29. Pereira MA, FitzerGerald SJ, Gregg EW, Joswiak ML, Ryan WJ, Suminski RR, Utter AC, Zmuda JM: **A collection of physical activity questionnaires for health-related research.** *Med Sci Sports Exerc* 1997, **29:**1-205.

30. US Department of Health and Human Services (USDHHS). **2008 physical activity guidelines for Americans.** Washington, DC: USDHHS; 2008.

31. Doyle C, Kushi LH, Byers T, Courneya KS, Demark-Wahnefried W, Grant B, McTiernan A, Rock CL, Thompson C, Gansler T, Andrews KS: **Nutrition and**

physical activity during and after cancer treatment: An American cancer society guide for informed choices. *CA Cancer J Clin* 2006, **56:**323-353.

32. Haskell WL, Lee I, Pate RR, Powell KE, Blair SN, Franklin BA, Macera CA, Heath GW, Thompson PD, Bauman A: **Physical activity and public health: Updated recommendation for adults from the American college of sports medicine and the American heart association.** *Med Sci Sports Exerc* 2007, **39:**1423-1434.

33. Rhodes RE, Courneya KS: **Investigating multiple components of attitude, subjective norm, and perceived control: An examination of the theory of planned behavior in the exercise domain.** *Brit J of Soc Psychol* 2003, **42:**129-146.

34. Rhodes RE, Courneya KS: **Differentiating motivation and control in the theory of planned behavior.** *Psychol Health Med* 2004, **9:**205-215.

35. Hu L, Bentler PM: **Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives.** *Struct Equ Modeling* 1999, **6:**1-55.

36. Nigg CR, Lippke S, Maddock JE: **Factorial invariance of the theory of planned behavior applied to physical activity across gender, age, and ethnic groups.** *Psychol Sport Exerc* 2009, **10:**219-225.

37. Cheung GWR, Roger B: **Evaluating goodness-of-fit indexes for testing measurement invariance.** *Struct Equ Modeling* 2002, **9:**233-255.

38. Courneya KS, Karvinen KH, Campbell KL, Pearcey RG, Dundas G, Capstick V, Tonkin KS: **Associations among exercise, body weight, and quality of life in**

a population-based sample of endometrial cancer survivors. *Gynecol Oncol* 2005, **97:**422-430.

39. Vallance JKH, Courneya KS, Jones LW, Reiman T. **Differences in quality of life between non-hodgkin's lymphoma survivors meeting and not meeting public health exercise guidelines.** *Psychooncology* 2005, **14:**979-991.

40. Jones LW, Courneya KS, Vallance JKH, Ladha AB, Mant MJ, Belch AR, Reiman T: **Association between exercise and quality of life in multiple myeloma cancer survivors.** *Support Care Cancer* 2004, **12:**780-788.

41. Bélanger L, Plotnikoff R, Clark A, Courneya K. **Physical activity and health-related quality of life in young adult cancer survivors: A Canadian provincial survey.** *J Cancer Surviv* 2011, **5:**44-53

42. Keats MR, Culos-Reed S, Courneya KS, McBride M. **Understanding physical activity in adolescent cancer survivors: An application of the theory of planned behavior.** *Psychooncology* 2007, **16:**448-457.

43. McEachan RRC, Conner M, Taylor NJ, Lawton RJ. **Prospective prediction of health-related behaviors with the theory of planned behavior: A meta-analysis.** *Health Psychology Review* 2011, **5:**97-144.

44. Scholz U, Schüz B, Ziegelmann JP, Lippke S, Schwarzer R. **Beyond behavioral intentions: Planning mediates between intentions and physical activity.** *Brit J Health Psychol* 2008, **13:** 479-494.

45. Schwarzer R, Schuz B, Ziegelmann JP, Lippke S, Luszczynska A, Scholz U. **Adoption and maintenance of four health behaviors: Theory-guided**

longitudinal studies on dental flossing, seat belt use, dietary behavior, and physical activity. *Ann Behav Med 2*007, **33:**156-166.

46. Sniehotta FF, Scholz U, Schwarzer R. **Bridging the intention–behavior gap: Planning, self-efficacy, and action control in the adoption and maintenance of physical exercise.** *Psychol Health* 2005, **20:**143-160.

47. Vallance JKH, Courneya KS, Jones LW, Reiman T. **Differences in quality of life between non-hodgkin's lymphoma survivors meeting and not meeting public health exercise guidelines.** *Psychooncology* 2005, **14:**979-991.

6: CHAPTER 6

Study 2: Paper 1

Feasibility and Preliminary Efficacy of Adding Behavioral Counseling to Supervised Physical Activity in Kidney Cancer Survivors: A Randomized Controlled Trial

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Scott North, MD, and Kerry S. Courneya, PhD

Clinical Trial Registration: ClinicalTrials.gov Identifier NCT01571401

6-1. INTRODUCTION

Kidney cancer is the 8th most common cancer in Canada with renal cell carcinoma (RCC) representing 80% of all tumors.[1] The five-year relative survival rate is 67%,[1] resulting in a growing number of kidney cancer survivors (KCS). Surgery and adjuvant treatments can influence quality of life (QoL), therefore, supportive care interventions are needed. Physical activity (PA) has beneficial effects on overall QoL, cancer-specific concerns, body image/self-esteem, emotional well-being, sexuality, sleep disturbance, social functioning, anxiety, fatigue, and pain across many cancer survivor groups.[2] However, research focused on KCS remains limited. A recent study by our group demonstrated a positive dose response association between PA and overall QoL, physical functioning, fatigue, and kidney cancer symptoms in this population.[3] PA has also been shown to have protective effects with kidney function[4] with individuals with KCS

Despite the reported benefits of PA, the majority of cancer survivors are not meeting public health guidelines (i.e., 150 minutes of moderate PA per week or 75 minutes of vigorous PA per week or an equivalent combination).[5,6] In our study of KCS, over half (56.3%) were completely sedentary and only a quarter (26.0%) were meeting public health PA guidelines.[3] Moreover, maintenance of PA is essential for long-term health benefits. The majority of RCTs in cancer survivors have included a supervised PA component, which is considered the 'gold standard'.[7] A supervised PA program may have many advantages in that cancer survivors can be taught exercise techniques and principles, decrease risk of injury, and also improve adherence.[8] These studies have also found, however, that PA declines significantly after the supervised intervention is completed.[7,9] These data suggest that while supervised PA interventions provide an excellent start to a PA program, they do not by themselves ensure longer-term adherence. Consequently, interventions are needed to supplement short-term supervised PA interventions. Behavioral strategies may improve the adoption and long-term maintenance of PA.

To facilitate the adoption and maintenance of PA, interventions are more effective when they are theoretically-based. Application of behavioral theories provides a foundation to understand the mechanisms that influence behavior change. Behavior change interventions can improve effectiveness by including program elements and techniques on changing the underlying cognitive variables known to be associated PA. The Theory of Planned Behavior (TPB) is a widely used theory to predict and explain PA motivation and behavior in cancer survivors.[10] Overall, studies have provided promising evidence that the TPB may be a useful model for developing PA interventions for various cancer survivor groups.[10]

There have been a handful of studies examining PA interventions among breast cancer survivors that have incorporated theory-based counseling using the transtheoretical model (TTM),[11-13] the social cognitive model (SCT),[14-16] and adolescent cancer survivors using the TPB.[17] Furthermore, Bennett et al.[18] evaluated the effect of a motivational interviewing (MI) intervention to increase PA and health outcomes in a mixed group of cancer survivors. Many of these studies employed telephone counseling and did not have a supervised PA component.[11,12,14,18]

Other studies have incorporated a counseling component along with an exercise intervention among breast cancer survivors, however the counseling addressed having cancer and its implications rather than promoting PA.[19-21] The primary outcome of these studies was on improving quality of life among breast cancer survivors rather than increasing PA levels.[19,20] Similarly, May et al.[21] examined the effects of physical training versus physical training combined with cognitive behavioral therapy (CBT) among 147 mixed cancer survivors to examine changes in quality of life.

Although several behavior change interventions have supported positive increases in PA, no study to date has examined the effects of adding behavioral counseling to a standard supervised exercise program and no study has focused on KCS. Here, we report the feasibility and preliminary efficacy of the Trying Activity in Kidney Cancer Survivors (TRACKS) Trial which, to the best of our knowledge, is the first RCT of a PA intervention in KCS. The TRACKS Trial was informed by the theoretical determinants [22] and PA preferences of KCS.[23] The advantages of adding behavioral counseling are that it confronts participants with their own personal reason and barriers to implementing PA, and also assists participants in exploring their own strategies in participating in PA, compared to offering generic educational materials.

In addition, KCS have unique disease and treatment-related factors that may influence PA participation. There are numerous demographic and medical differences between survivor groups, it is important to tailor interventions to individual cancer groups, rather than attempt to generalize the results from other cancer populations. For example, the determinants of PA among KCS found that interventions would need to implement strategies in regards to planning for PA and how to anticipate and overcome barriers to PA. Also, strategies can be used to address attitudes toward PA, where messages can be focused around the benefits of PA and factors that would make participating in PA important.[22] In other cancer survivor groups, theoretical determinants have been found to differ by cancer type. Among ovarian cancer survivors,[24] endometrial cancer survivor,[25] and colorectal cancer survivors,[26] affective attitude was a strong correlate of intention, whereas instrumental attitude emerged as a strong correlate of intention among KCS. This may be due to differences in health and age. KCS are more likely to be overweight or obese, and have other comorbidities due to their older age compared to many other survivor groups.[22] Therefore, KCS may be more likely to intend to engage in PA if they feel it would be beneficial rather than the enjoyable aspects. Furthermore, KCS are an older survivor population, which presents its own unique challenges. Older cancer survivors are faced with coping with cancer along with age-related disabilities, such as deterioration in mobility, vision, and strength.[27] As a result, the most important outcomes will likely be physical functioning and overall QoL compared to younger cancer survivor groups such as breast cancer survivors.[27]

The primary purpose of this study was to evaluate the feasibility and preliminary efficacy of a supervised physical activity program plus standard exercise counseling (SPA+EC) versus a supervised physical activity plus motivationally-enhanced behavioral counseling (SPA+BC) on changes in self-reported moderate/vigorous PA between baseline, post-intervention (4 weeks), and 12-week follow-up among KCS, with 12-week follow-up being the primary timepoint. The secondary outcomes were to examine changes in self-reported QoL, body composition (anthropometric measures), cardiorespiratory fitness, and physical function. We hypothesized that KCS receiving the SPA+BC intervention would report greater increases in self-reported PA compared with KCS receiving the SPA+EC intervention. Furthermore, we also hypothesized that KCS receiving SPA+BC would experience improvements in objective physical functioning, objective health-related fitness, QoL, and fatigue in comparison with the SPA group.

6-2. METHODS

Setting and Participants

The TRACKS Trial was conducted at the Behavioral Medicine Fitness Centre at the University of Alberta in Edmonton, Canada. Ethical approval was obtained by the Alberta Cancer Board Research Ethics Board and the University of Alberta Research Health Ethics Board. Participants were recruited based on their interest indicated on a previous survey study conducted between May and September 2010. [3] Eligibility criteria for the original survey included being: (a) 18 years or older, (b) ability to understand English, (c) currently residing in Alberta, and (d) diagnosed with kidney cancer in Alberta between 1996 and 2010. At the end of the survey, participants were asked to provide their full contact details (i.e., name, address, phone, e-mail) if they were interested in participating in a future PA study. In May of 2012, interested participants living in the Edmonton area were mailed a study information package containing a cover letter and information brochure about the TRACKS Trial. Eligibility criteria for the trial included the following: a) between the ages of 18 to 80 years of age; b) histologically confirmed kidney cancer (Stage I-IIIa) but are now cured or in remission; c) ability and willingness to effectively communicate with the study co-ordinator and complete all questionnaires involved in the study in English; d) able to attend the supervised PA sessions and not planning to be away for three consecutive days for the duration of the program; and e) interested in increasing their PA by at least 60 minutes of moderate PA or 30 minutes of vigorous PA.

Design and Procedures

Interested participants contacted the research co-ordinator for further details regarding the study. The research co-ordinator followed a telephone script to further determine the participant's eligibility. If the participant met the eligibility criteria, a second study information package was mailed containing a cover letter from the investigators explaining forms that need to be completed and a consent form. The participants were also asked to complete the Physical Activity Readiness Questionnaire (PAR-Q) to determine the suitability for beginning a PA program. If the participant indicated a 'yes' to one or more questions, s/he was advised to speak to his/her doctor to gain medical clearance before participating in the TRACKS Trial. Interested participants scheduled an appointment with the research co-ordinator for baseline exercise testing and questionnaire completion.

Following the screening procedure and prior to randomization, consenting participants deemed eligible completed submaximal exercise testing to ensure they were able to exercise safely at a moderate-to-vigorous intensity. Two stages of the treadmill test needed to be successfully completed with acceptable heart rate and blood pressure responses before any remaining baseline tests were conducted, including a physical function test, anthropometric testing, and PA behavior, QoL and determinants questionnaire.

The TRACKS Trial piloted a two-armed, single blind, randomized controlled trial comparing SPA+EC to SPA+BC. Randomization occurred after all baseline measurements were completed. Participants were randomly assigned with equal allocation (1:1 ratio) to one of two groups using a computer-generated random numbers list. A research assistant generated the group assignments concealed from the research co-ordinator, and conducted in the order in to which participants completed baseline assessments to prevent bias in group allocation. All participants were blinded to group assignment because they were only informed they would receive one of two types of counseling.

Elements of the Intervention Common to Both Groups

The goal of the intervention, based on current public health recommendations, was to gradually increase all participants' PA levels by at least 60 minutes of moderate intensity PA or 30 minutes of vigorous intensity PA to a minimum of 150 minutes of moderate intensity PA or 75 minutes of vigorous intensity PA per week. Participants in both arms were provided with six individual supervised PA sessions with a PA specialist that tapered to an unsupervised home-based program by the end of the intervention. The focus of the supervised PA sessions was on aerobic activity only. Over the 4-week period, both groups were asked to attend two sessions per week for weeks 1-2, and one session per week for weeks 3-4 at the Behavioral Medicine Fitness Centre at the University of Alberta. To achieve the PA guidelines established by the current public health recommendations, additional unsupervised sessions were prescribed, where one home-based session was requested for week 2 and two home-based sessions were requested for weeks 3-4. Supervised aerobic PA sessions were completed on treadmills, elliptical trainers, cycle ergometers, rowing ergometers, or combination. The supervised PA program was 4 weeks in duration and participants were asked to exercise on their own for 8 weeks for the home-based portion, for a total of 12 weeks.

Participants assigned to both groups were given an individualized prescription at a moderate-to-vigorous intensity where the duration and intensity that accounts for the participant's baseline fitness test results, PA history, and PA-related preferences. The supervision of the PA sessions was one-on-one format. The frequency, duration, and intensity of the PA sessions were gradually increased over the 4-week program to prevent injuries and to acclimatize participants to frequent PA. Heart rate monitors were used to ensure the target intensity of 65-75% of heart rate reserve (HRR) was achieved, which is equivalent to 'moderate-to-vigorous intensity' PA. For example, a typical PA progression over the 4-week program may include 15-20 minutes of PA at an intensity of 40-55% HRR in weeks 1-2, and 20-25 minutes of PA at an intensity of 55-65% HRR in weeks 3-4. Participants were instructed to progress their PA prescription on their own post-intervention to a minimum of 5 days a week for at least 30 minutes in duration, at an intensity of 65-75% of HRR. Each PA session included a 5 minute warm-up, aerobic activity of choice, 5-minute cool-down, and stretching.

The participants were closely supervised by an on-site PA specialist, who worked individually with the participants to design appropriate activities for both the facility-based and home-based components. To ensure quality control between the SPA+EC and SPA+BC groups, the same PA specialist delivered the intervention to participants in both groups. The PA specialist was a certified personal trainer and had experience in PA behaviour change interventions for cancer survivors. The fitness facility also had certified exercise physiologists to enhance the safety and monitoring of cancer survivors and worked alongside with the PA specialist. The participants were expected to attend the exercise facility at their scheduled times, and work towards at least 3 days per week of PA by the end of the program. Follow-up on any missed PA sessions and/or PA counseling sessions was used to help increase adherence. Table 1 outlines the delivery schedule and type of counseling received by both the SPA+EC and SPA+BC groups.

Upon completion of the 4-week supervised PA program, all participants were given an individualized PA prescription based on their fitness level to continue reaching the PA intervention goal for the 8-week home-based component. Moreover, upon completion of the study, participants were offered a detailed explanation and comparison of their study results across the study time points (i.e., fitness test scores, physical function scores, anthropometric measures).

Missed Sessions

Follow-up on any missed PA sessions and/or PA counseling sessions was used to help increase adherence. All PA sessions and/or PA counseling sessions were scheduled with the PA specialist. In the event the participant could not make their scheduled time, s/he was asked to contact the PA specialist. If the participant called because of an inability to make the scheduled time, attempt was made to reschedule for a different time on the same day. If the session could not be made up on the same day (e.g., illness, emergency, work, out-of-town), the next session was booked to make up for the missed session. Participants were allowed to make up a minimum of two out of the six sessions given the limited number of sessions in the trial. If the participant missed a session and did not contact the PA specialist, a phone call was made on the same day to determine the reason for missing the session and to reschedule for a time that was convenient. The reason for missing a session was also recorded in a 'missed session' log.

Supervised Physical Activity plus Standard Exercise Counseling Group (SPA+EC)

In addition to the supervised PA sessions, the SPA+EC received standard exercise counseling to teach proper PA technique, how to monitor intensity, and to progress PA safely and effectively to achieve the public health PA guidelines. A PA manual was also distributed to each participant assigned to this group as an ongoing resource. The manual, which was developed specifically for KCS, contained topics and materials (e.g., how to monitor PA intensity, rating of perceived exertion, safety considerations) that the PA specialist used to reinforce and expand upon during counseling sessions. Approximately one hour was allotted to deliver the session components for participants in this group, and the intervention content was delivered while the participant was exercising, if possible.

Supervised Physical Activity plus Behavioral Counseling Group (SPA+BC)

In addition to the supervised PA sessions, the SPA+EC group received six individual face-to-face behavioral counseling sessions with a PA specialist. These counseling sessions were combined with the supervised PA sessions, and were provided directly following the supervised PA session. The behavioral counseling component of the intervention was based on a previous study identifying the theoretical determinants [22] and PA preferences of KCS. [23] These behavioral counseling sessions included training in behavioral strategies to promote the adoption and long-term maintenance of PA. Counseling strategies were based on the TPB and targeted (a) the benefits of PA for KCS including the general benefits for PA and unique benefits of PA for KCS; (b) strategies for making PA enjoyable including their personal reasons for participating in PA, as well as ideas for making PA fun; (c) overcoming barriers including the common barriers that KCS face, personal barriers to PA, and how to anticipate possible barriers to PA; (d) stimulus control including how to how it affects behavior and how to establish personalized stimuli; (e) identifying and obtaining social support from family and friends; and (f) goal setting and planning where participants were encouraged to formulate short- and long-term goals, as well as creating a detailed plan for achieving PA guidelines. Handouts were used to supplement the counseling sessions where necessary. In addition to the behavioral counseling sessions, a PA manual was also distributed to each participant assigned to this group as an ongoing resource. The PA manual was modeled after a guidebook originally developed for breast cancer survivors, which has been shown to be effective for increasing motivation, PA, and QoL in breast cancer survivors.[28,29] The PA manual for KCS was developed separately for each of the two groups, with the behavioral counseling group containing more content (i.e., theory-based counseling). Approximately one hour and a half was allotted to deliver the session components for participants in this group. However, the intervention material was delivered while the participant was exercising and most of the sessions averaged one hour and fifteen minutes in length.

Measures

The primary measure was self-reported PA. The secondary measures were QoL, cardiorespiratory fitness, physical function, and anthropometric measures. Both primary and secondary outcomes were assessed at baseline and 12 weeks. TPB variables were also assessed at 4 weeks (data not presented). Program evaluation variables were measured at 12 weeks (primary timepoint).

Demographic and medical information. Demographic variables were assessed using self-report and included age, sex, education level, marital status, annual income, employment status, and ethnicity. Medical variables were also assessed using self-report and included time since diagnosis, type of kidney cancer, lymph node involvement, disease stage, previous and current treatments, previous recurrence, and current disease status, which have been used previously in studies with cancer survivors. [29,30]

Feasibility Outcomes

Feasibility was determined through recruitment rate, measurement completion rate, loss-to-follow-up, adherence to the intervention, adverse events, and program evaluation items assessing burden and satisfaction. Recruitment rate was defined as the number of participants recruited from the number of eligible participants. Measurement completion rate was defined as the number of participants able to complete each outcome measure at baseline and 12-week follow-up. Loss to follow-up was defined as participants who were withdrawn or dropped out of the study. Adherence to the PA intervention was assessed by the number of sessions attended out of six. Adverse events during or following exercise testing and training were also monitored.

Acceptability was measured through a program satisfaction survey [31] completed at 12-week follow-up that assessed the burden of exercise testing and questionnaire completion assessing participant's perception regarding the PA manual, individual counseling sessions (only for the SPA+BC group), and the overall impression of the trial. These items were scored on a 7-point Likert-type scale with various endpoints, open-ended response options, and dichotomous and trichotomous response options.

Preliminary Efficacy Outcomes

Primary Endpoint

Physical activity. A modified version of the validated Leisure Score Index (LSI) from the Godin Leisure-Time Exercise Questionnaire (GLTEQ), that has been extensively validated, [32,33] was used to assess PA behavior. Participants were asked to recall their average weekly frequency and duration of light (minimal effort, no perspiration), moderate (not exhausting, light perspiration), and vigorous (heart beats rapidly, sweating) PA that lasted at least 10 minutes and was done during free time in the past month. We computed "PA minutes" as moderate minutes plus two times the vigorous minutes. The percentage of participants meeting the public health PA guidelines was also calculated.

Secondary Endpoints

Quality of life. Disease-specific QoL was assessed by the well-validated Functional Assessment of Cancer Therapy-Fatigue (FACT-F) scale which included the 27 items from the FACT-General (FACT-G) scale plus the 13 item fatigue subscale. [34,35] The FACT-G consisted of physical well-being (PWB), functional well-being (FWB), emotional well-being (EWB), and social well-being (SWB). The PWB, FWB, and fatigue scale were summed to form the Trial Outcome Index-Fatigue (TOI-F). We also used the validated Functional Assessment of Cancer Therapy-Kidney Symptom Index-15 item (FKSI-15), which contained a combination of questions from the FACT-G subscales including PWB, FWB, and EWB, as well as questions that assessed the most important targeted symptoms and concerns for KCS. [36] On all scales, higher scores indicate better QoL.

Generic QoL was assessed using the Short-Form-36 (SF-36)[37] designed to assess perceived health and functioning, which contained 36 items that yielded eight health domains with multi-item scales. Twenty of the items were administered using the past 4 weeks' as the reporting interval. Physical functioning (10 items) assessed limitations in physical activities, such as walking and climbing stairs. Role limitations due to physical health conditions (4 items) and emotional health conditions (3 items) measured problems with work or other daily activities. Bodily pain (2 items) assessed limitations due to pain, and vitality (4 items) measures energy and tiredness. The social functioning domain (2 items) examined the effect of physical and emotional health on normal social activities, and mental health (5 items) assessed happiness, nervousness and depression. The general health perceptions domain (5 items) examined personal health and the expectation of changes in health. An additional single item assessed change in perceived health during the last year. All items were rated on a Likert-type scale of varying points. These subscales were then computed into norm-based scoring according to the specifications of Quality Metric, publisher of the SF-36.[37] The standardized, norm-based subscales were then used to create summary scores for a physical component (physical functioning, role physical, bodily pain and general health perceptions) and a mental component (vitality, social functioning, mental health and role emotional) was computed. Scores for each scale ranged from 0–100 and were computed to norm-based scoring, with higher scores indicating higher function or well-being.

Cardiorespiratory Fitness

Participants performed a sub-maximal aerobic test to assess aerobic fitness and estimate VO2max from simple heart rate measurements. The test was a modified Balke Test [38] performed on a treadmill to 85% of their maximal heart rate or exhaustion, and was also used to determine eligibility into the study. Participants who completed at least two stages of the test and exhibited exercising blood pressure and heart rate in an acceptable range, were considered to have met the aerobic exercise test for eligibility. This test consists of a continuous multi-stage procedure where a standard speed was maintained throughout the test and the grade was raised every two minutes until the participant reached volitional fatigue or until 85% of their maximal heart rate was attained.

Physical Function

The Seniors' Fitness Test (SFT)[39] was used to assess physical fitness/function in older adults aged 60 to 90+ years old. The SFT consisted of a battery of six assessment items used to determine mobility-related fitness parameters. The 30-second chair stand test assessed lower body strength. Each participant completed two practice repetitions and one 30-second test trial, where the score was the total number of stands executed correctly within that time frame. The arm curl test assessed upper body strength. Each participant completed two practice repetitions and one 30-second test trial, where the score was the total number of hand weight curls through the full range of motion in the allotted time frame. The chair sit-and-reach test assessed lower body flexibility (primarily hamstring). Each participant completed two practice trials and two test trials. The score was based the best distance achieved between the extended fingers and the tip of the toe. The back scratch test assessed upper body (shoulder) flexibility. Each participant completed two practice trials and two test trials. The score was based on the best distance of overlap or distance between the tips of the middle fingers. The 8-foot up-and-go test assessed agility and dynamic balance. Each participant completed one practice trial and two test trials. The score was based on the shortest time to rise from a seated position, walk 8 feet, turn, and return to the seated position. The six-minute walk test assessed aerobic endurance. Each participant completed one test trial. The score was based on the total distance walked in six minutes along a 30-meter course.

Anthropometric Measures

Measurements of height, weight, and waist circumference were used to estimate body composition. Height was assessed using a stadiometer to the nearest 0.1 cm. Height and weight were used to calculate body mass index (BMI) [weight per height squared (kg/m^2)]. The waist circumference was measured using a horizontal measure taken directly above the iliac crest.

Data Analyses and Sample Size Calculations

We did not conduct an a priori sample size calculation because part of the feasibility component of this trial was to estimate the recruitment rate. A post hoc calculation with 16 participants per group, revealed that our trial had 80% power to detect only a large standardized effect size of 1.0 for our primary and secondary outcomes using a two-tailed test with $\alpha=0.05$.[40] Given this was a feasibility study with a small sample size, no adjustment was made for multiple testing and the efficacy results were interpreted for both statistical and clinical significance. When examining difference or change scores, an interest in clinical rather than statistical significance may be warranted. For QoL measures, an effect size of 0.33 or one third standard deviation appears to be a benchmark for potentially meaningful differences.[41] All statistical analyses were performed using SPSS 20 (SPSS Inc., Chicago, IL). For all analyses, the intention-to-treat approach was adopted to include all participants in their randomized condition who provided 12-week data.

Baseline comparisons were performed using analysis of variance (ANOVAs) for continuous variables and χ^2 analyses for categorical variables. Analyses of covariance (ANCOVAs) were used to assess change in primary and secondary outcomes in the SPA+EC versus the SPA+BC group from baseline to 12-week follow-up. Due to the small sample size, only the baseline value of the outcome measure was used as a covariate for change scores.

6-3. RESULTS

Participant flow through the trial is outlined in Figure 1. The sample for the TRACKS trial was drawn from a previous study conducted by our research group.[3] Briefly, of the original 1,985 mailed surveys, 331 were returned to sender. Of the remaining 1,654 surveys, 703 were returned completed and 380 KCS expressed interest in participating in a future PA study. From the 380 interested participants, 105 participants resided in Edmonton, Alberta and were contacted about the TRACKS Trial. Of the 105 KCS mailed recruitment packages, 14 were returned to sender due to wrong address or deceased. Of the 91 recruitment packages, 32 KCS were interested and randomized in the trial (16 in each group), generating a 35.2% response rate (32/91). Baseline demographic and medical profile of the participants are reported in Table 2 and 3, respectively. Overall, participants had a mean age of 61.8 ± 9.8, 50.0% were male, 71.9% were married, and the mean BMI was 29.1 ± 5.6. The mean number of months since diagnosis was 74.0 ± 38.9, 96.9% were disease-free, 96.9% had received surgery, and 93.8 % had localized kidney cancer. Overall, 53% were meeting public health PA guidelines.

To assess the representativeness of our sample, we compared KCS interested in future research (n=380) to those not interested in future research (n=323) on selected demographic and medical variables. KCS interested in future research and those not interested in future research did not differ in terms of general health status (3.2% poor health status vs. 5.0% poor health status; p=.33), fatigue levels (82.4 vs. 82.8; p=.80), months since diagnosis (67 vs. 71; p=.34), BMI (28.4 vs. 28.6; p=.74), number of comorbidities (3 vs. 3; p=.19), or systemic therapy (12.4% vs. 16.7%; p=.10). KCS interested in future research were about 4 years younger compared to those not interested in future research (mean age=63 vs. 67 months; p<0.001) and more likely to be female (42.6% vs. 30.7%; p=.001). Moreover, there was a difference in disease stage (p<0.001) with KCS interested in future research having more localized kidney cancer (86.6% vs. 75.9%).

We also assessed the representativeness of the TRACKS trial sample by comparing those who participated in the trial (n=32) with those who declined participation in the trial (n=73). Participants in the TRACKS trial did not differ in terms of age (p=.10), sex (50.0% male vs. 61.6% male; p=.27), fatigue levels (p=.53), number of comorbidities (p=.18), disease stage (87.5% localized vs. 90.4% localized; p=.66), systemic therapy (6.2% vs. 11.0%; p=.45), and months since diagnosis (52 vs. 57; p=.64). Participants in the TRACKS trial were less likely to rate their general health as good (28.1% vs. 46.6%; p=.046) and had a lower BMI (26.9 vs. 28.8; p=.036). In addition, participants in the TRACKS trial were more likely to be meeting PA guidelines (56.2% vs. 35.6%; p=.049).

Feasibility Outcomes

Of the 32 KCS enrolled in the study, 30 completed the PA intervention, representing a 6% attrition rate, or conversely, a 94% retention rate. Measurement completion rates were between 88% and 94% for fitness testing and questionnaires, respectively. Two participants were lost-to-follow-up (6%) (one SPA+EC group, one SPA+BC group) for the fitness test measures due to illness, but agreed to complete the questionnaires at 12-week follow-up. Two participants dropped out after 1 week (one SPA+EC group, one SPA+BC group) for personal reasons, but one of the participants in the SPA+BC group agreed to complete the post-intervention questionnaire at 4 weeks. Within each of the intervention groups, 15 out of 16 participants in the SPA+EC and SPA+BC group attended 6 out of 6 supervised PA sessions, representing a 94% adherence rate. No adverse events related to exercise were observed or reported.

Preliminary Efficacy Outcomes

Mean number of minutes for total PA, moderate PA, vigorous PA, and percentage meeting PA guidelines for baseline and 12-weeks follow-up are displayed in Table 4. Change in PA minutes favored the SPA+BC group by +34 minutes (95% CI= -62 to 129) which was a small effect size (d=+.21) but did not reach statistical significance (p=.47). A borderline significant change was observed in the percentage of participants meeting PA guidelines between the groups, with the SPA+BC group having 32% more participants achieve the guidelines compared to the SPA+EC group [95% confidence interval (CI)= -0% to 64%; d=+.64, p=.052]. Overall, a total of 18 participants from both the SPA+EC group (n=9) and SPA+BC group (n=9) achieved the PA goal to increase PA by 60 minutes of moderate PA and/or 30 minutes of vigorous PA by the end of 12 weeks.

Table 5 provides the change in objective measures of fitness from baseline to 12-weeks follow-up for the SPA+EC versus SPA+BC group. A significant large effect size increase was noted in the 6-minute walk for the SPA+BC group compared to the SPA+EC group (mean change= +48; 95% CI=1 to 95; d=+.64; p=.046). Although not statistically significant, small effect size increases were noted in VO2max (mean change= +1.0; 95% CI= -4.3 to 6.3; d=+.12, p=.71) and back scratch (mean change= +1.1; 95% CI= -2.7 to 4.8; d=+.09; p=.55) that favored the SPA+BC group. There was a slight reduction in waist circumference for the SPA+BC group compared to the SPA+EC group (mean change= -0.6; 95% CI= -3.5 to 2.2; d=-.01; p=.65).

Tables 6 and 7 provide the change in generic QoL and cancer-specific QoL, respectively, at baseline to 12-weeks follow-up for the SPA+EC versus SPA+BC group. There were no significant differences between the groups from baseline to 12-weeks follow-up in the eight health domains and physical and mental health component scores for generic QoL. There were positive group differences from baseline to 12-week follow-up that favored the SPA+BC group where there was 2.5 point difference for general health, 0.5 point difference for vitality, 0.6 point difference for social functional, and 0.3 point difference for the mental health component. Group differences were also noted for physical functioning where the SPA+BC group decreased their score by -2.5 points more than the SPA+EC group that were potentially meaningful. Moreover, there were no significant differences between the groups from baseline to 12-weeks follow-up in the cancer-specific QoL scales. The overall group differences from baseline to 12-week follow-up that favored the SPA+BC group were 1.9 points for SWB, 0.5 points for FWB, and 1.0 points for the FACT-G, which were considered to be positive changes. Potentially meaningful group differences were also noted for physical well-being and fatigue subscale where the SPA+BC group decreased their score by -0.8 points and -3.1 points more than the SPA+EC group, respectively.

Program Evaluation and Satisfaction

Program evaluation and satisfaction with the TRACKS trial is presented in Table 8. Overall, trial satisfaction was high with both the SPA+EC and SPA+BC groups indicating both intervention components were rewarding, useful for research helping others, useful for them personally, and a program that they would recommend to other KCS. The burden of testing was also quite low in terms of the questionnaires, fitness testing assessments, supervised PA and counseling sessions. In terms of the PA manual, many participants rarely read the manual after the first read. However, many participants found the manual to be somewhat helpful in increasing PA levels, quite easy to read, the right amount of page length, quite interesting to read with clear topics, learned a fair bit of new information, and satisfied with the topics covered in the manual. In addition, participants would highly recommend the manual to other KCS. Participants also found the supervised PA and overall counseling sessions to be quite helpful in increasing PA levels, with the SPA+BC group reporting a slightly higher rating compared to the SPA+EC group (mean=6.2 vs 5.5 for the supervised PA sessions and mean=6.3 vs. 5.3 for the overall counseling sessions). In addition, the SPA+BC group found all of the individual counseling sessions to be quite helpful in increasing PA.

6-4. DISCUSSION

Our RCT is noteworthy given it differed from standard approaches to supervised PA interventions in that we included a behavioral counseling component in addition to supervised PA. To our knowledge, this is the first study to pilot a PA behavior change intervention with a sample of KCS, and the first to compare the effects of a SPA+EC versus SPA+BC on changes in moderate-to-vigorous PA. The TRACKS trial was feasible and well-received by the participants. Given the rigorous comparison group, the SPA+BC group was successfully able to increase PA by 34 minutes more than the SPA+EC group. Moreover, the SPA+BC group significantly improved their 6-minute walk scores and percentage meeting PA guidelines (borderline significant) compared to the SPA+EC group. Although not statistically significant, small effect size increases in PA minutes were reported for total, moderate, and vigorous PA favoring the SPA+BC group. Although not statistically significant, small effect size increases were also observed for VO2max and back scratch parameters. The intervention did not significantly change any of the anthropometric measures or cancer-specific and generic QoL parameters.

Overall, the TRACKS trial was an acceptable and feasible intervention for KCS, with a program adherence rate of 88% in both the SPA+EC and SPA+BC groups. The recruitment rate was 35.2%, similar to that of previous PA interventions in other cancer survivor groups (29-34%) [11,15,18] although our recruitment was from a motivated subsample of previous study participants. Over half of the participants in the TRACKS trial were already meeting public health PA guidelines, which may explain their interest in this type of program. The measurement completion rates were also very high which is comparable to other cancer survivor groups. [11,15,18] This was coupled by the low participant ratings of testing burden with both the objective and subjective health and fitness assessments. Measurement completion rates were between 88% and 94% for fitness testing and questionnaires, respectively. Although there are no comparative figures in the literature to support a behavior change intervention in KCS, the adherence and completion rates were similar or higher than the adherence rates reported in other PA behavior change trials among cancer survivors. For example, the adherence rate in the TRACKS trial was similar or higher compared to feasibility trials in breast cancer survivors (99%),[15] ovarian cancer survivors (90%),[42] endometrial cancer survivors (73%),[43] colon cancer survivors (90%),[44] adolescent cancer survivors (81.5%),[17] and a mixed cancer group (83.5%).[21]

The high rate of adherence to the TRACKS trial may have been related to the close monitoring of the participants through face-to-face sessions with the PA specialist and personalized feedback and support. Moreover, the limited number of sessions over a short intervention period, and the flexibility to make up any missed sessions may have also contributed. The attrition rate was 6% in our study, which was similar between the study arms. Our attrition rate was lower than the average rate (13.3%) reported in a review of lifestyle intervention trials conducted in cancer survivors,[45] even though our follow-up was only 12 weeks. Further, there were also no reported adverse events related to exercise, indicating that individualized prescriptions based on the participant's fitness level was appropriate for preventing any injuries.

Furthermore, both intervention groups reported high trial satisfaction indicating that the trial was rewarding, useful for research helping others, useful for them personally, and a program that they would recommend to other KCS. The participants also indicated the counseling sessions and PA manual was helpful for increasing their PA levels. This is consistent with previous feasibility studies reporting positive evaluations of the trial content and materials in breast cancer survivors.[12,13,15,20]

In terms of our preliminary efficacy data, the SPA+BC group increased their PA by 34 minutes more than the SPA+EC group. Moreover, 32% more participants in the SPA+BC group achieved the PA guidelines at 12 weeks compared to the SPA+EC group. Although not statistically significant, these changes may be meaningful and provide preliminary support that our PA behavior change intervention may be effective. Moreover, these changes were achieved on top of the gold standard behavior change intervention—supervised exercise. Since our trial is unique in that it compares two groups that are receiving supervised PA and counseling sessions, there are no directly comparable behavior change studies to compare our results to. Many of the behavior change trials typically compare an exercise group with a usual care group. However, May et al.[21] did examine the effect of a 12-week group based physical training combined with CBT (PT+CBT) compared to the effects of physical training (PT) alone on changes in QoL. A secondary outcome of May et al.'s[21] trial was self-reported PA. The researchers found that changes in PA were not different between the PT+CBT and PT groups. Significant improvements in PT were found in the PT and in the PT+CBT groups immediately following the intervention at 3- and at 9-month post-intervention compared to pre-intervention. It is important to note that the differences between May's and our study, where May and colleagues [21] used CBT to focus on enhancing self-management in physical exercise and sports, employed QoL as the primary outcome, and did not distinguish between moderate and vigorous PA.

Nevertheless, there are a handful of studies among cancer survivors that have included components of behavioral counseling in the PA intervention and had PA as the primary outcome. Consistent with our findings, Rogers et al.[15] demonstrated a small effect size increase in self-reported moderate and vigorous PA minutes in a pilot study of breast cancer survivors that was not statistically significant. The researchers also reported only 60% of the individuals receiving the intervention were meeting current recommendations based on objective monitoring (i.e., accelerometry). Matthews et al.[14] reported an increase of 12 metabolic equivalent (MET)-h/week with the intervention group after a 12-week home-based walking intervention for breast cancer survivors. Similarly, Pinto et al.[11] based intervention among breast cancer survivors. Bennett et al.[18] also found significant group differences in PA with the MI intervention group by a mean of 1,556 kcal/wk compared to the mean increase of 397 kcal/week in the control group. Keats & Culos-Reed[17] reported a significant increase in total PA from baseline (16.1 total MET h/wk) to midprogram (40.8 total MET h/wk) across a 16-week PA intervention focusing on aerobic, core strength, and flexibility training among adolescent cancer survivors. Moreover, Basen-Engquist et al.[13] examined the effect of a pilot lifestyle PA intervention delivered over a 6-month period on changes in physical performance, QoL, and PA among 60 breast cancer survivors. There were no significant differences between the study conditions in the number of minutes spent in moderate or more intense PA, although both groups did report increases total PA minutes but it was not statistically significant. There was a significant difference for intervention participants where they did report greater motivational readiness for PA than the standard care group.

Although the findings from these studies are consistent with our results, it is noteworthy the research design, counseling methods, and cancer survivor group were very different. For example, Rogers et al.,[15] employed counseling techniques based on the SCT among breast cancer survivors; Bennett et al.,[18] used MI among a mixed cancer survivor group; Keats & Culos-Reed[17] employed a single-group design with adolescent cancer survivors; and both Matthews et al.,[14] and Pinto et al.[11] used the SCT and TTM, respectively to evaluate a home-based telephone counseling intervention among breast cancer survivors. Basen-Engquist et al.[13] examined a lifestyle intervention where participants attended group meetings to learn about cognitive and behavioral skills and ways to incorporate PA into their daily routine among breast cancer survivors. There was no supervised PA component and the comparison group was a standard care condition.

Our study was underpowered to detect changes in self-reported PA given the small sample size. Also, our study piloted a 12-week PA intervention, which may have been too short to detect any changes in PA. Despite not having a significant change in PA levels from baseline to 12-week follow-up, our study did demonstrate a significant improvement in the 6-minute walk. This is one of the few behavior change studies to use objective measures of physical fitness and function. KCS in the SPA+BC group reported a significant increase of 48 meters more in the 6-minute walk compared to the SPA+EC group at 12-week follow-up. This is consistent with three behavior change trials that have included a walking test in their assessment of aerobic fitness. Bennett et al.[18] found an increase in the 6-minute walk among a mixed cancer survivor group, but there were no between groups differences. Basen-Engquist et al.[13] found that the intervention group performed significantly better than the standard care group in the 6-minute walk test, walking 97 feet (29.6 meters) farther. Pinto et al.[11] found that the PA intervention group was able to walk 1 mile in significantly fewer minutes than the control group in the Rockport 1-mile walk test among breast cancer survivors. Keats & Culos-Reed[17] found that a 16-week PA intervention was able to improved scores on the 1-mile walk, but this was not maintained over the final 8 weeks.

The 6-minute walk is a measure of functional status in chronic disease populations such as chronic kidney disease [46,47] that has been shown to predict survival, morbidity, and mortality.[48] A 400 m threshold has been used in various other populations with chronic heart failure (CHF) and chronic obstructive pulmonary disease (COPD) patients to regularly assess their functional exercise capacity and the effects of a rehabilitation program, as well as lung cancer patients.[48] KCS in both PA intervention groups were above the threshold of 400 m both at baseline and at 12-week follow-up. However, the SPA+BC group demonstrated a significant increase in the distance covered from baseline to 12-week follow-up, whereas the SPA+EC reported a decrease in the distance covered. This finding is important given that greater scores achieved on the 6-minute walk can improve mobility and functional declines.

Additional objective fitness measures demonstrated a small effect size increase in VO2max and shoulder flexibility measures that favored the SPA+BC group more than the SPA+EC group. This is consistent with a previous study among breast cancer survivors, where there were no significant differences between the PA intervention group and usual care group for objective measures for strength and fitness.[13,15]

There were no significant changes in anthropometric measures including weight, BMI, and waist circumference, although there was a slight reduction in waist circumference favoring the SPA+BC group more than the SPA+EC group. This is consistent with previous behavior change trials that noted no differences in anthropometric measures and body composition.[11,13-15] These results are not surprising, given that the intervention focused on achieving public health PA guidelines and was not aimed at weight loss. The short-term follow-up of the intervention may have also contributed to the null findings. Changes in body composition would require that the intervention also target and monitor dietary intake, as well as include a larger volume of PA that could potentially lead to a favorable effect.

This study was underpowered to detect any changes in generic and cancer-specific QoL. Generic QoL including general health status, vitality, social functioning, and the mental health component did not reach meaningful group differences of 3 points,[37] but they were positively changing in the right direction, favoring the SPA+BC group. For cancer-specific QoL, scores for SWB, FWB, and the FACT-G scores were also positively changing in the right direction favoring the SPA+BC group, but they did not reach clinically meaningful group differences of 2-3 points.[41,49] The results were contrary to our hypothesis as we were expecting some modest changes in QoL following a PA intervention. A previous study with a mixed cancer survivor group found the PT+CBT group to report greater improvements in global quality of life, physical, role, emotional, cognitive, and social functioning and fatigue that were clinically relevant at post-intervention (12-weeks) and at 9-month post-intervention.[21] Basen-Engquist et al.[13] found only better QoL dimensions related to physical well-being reported by the intervention group (i.e., physical functioning, role limitations due to physical problems, bodily pain). Keats & Culos-Reed[17] also found significant improvements for physical and psychological health, overall QoL, and general fatigue across the 16-week intervention among adolescent cancer survivors, with improvements in emotional and social health at week 8. On the other hand, Rogers et al.[15] did not observe an intervention effect on QoL and fatigue among breast cancer survivors after 12 weeks.

The lack of meaningful differences in our study may be due to the rigorous comparison group since both intervention groups received supervised PA sessions that resulted in a 34 minute group difference for total PA. It is unlikely that a 34 minute difference between the two groups would induce significant changes in QoL. Also, the high QoL and low fatigue scores present at baseline generated a 'ceiling effect' effect, which may have also contributed to the lack of effect in QoL. For example, a scale score that is below 50 for generic QoL indicates that health status is below average,[37] but KCS exhibited scores that were either above average or slightly below average at baseline. There was also a selection bias in which participants with relatively good performance status and/or already meeting public health PA guidelines were more likely to participate in the TRACKS Trial. In addition, the greatest improvements in fatigue and QoL can be expected immediately after treatment, but many of the participants were at least 6 years post-diagnosis where QoL may have returned to baseline levels at pre-diagnosis.

Furthermore, the SPA+BC group demonstrated a decrease in physical functioning more than the SPA+EC group for generic QoL scale, which was promising. For cancer-specific QoL, scores, SPA+BC group reported a decrease in PWB and the fatigue subscale more than the SPA+EC group that was potentially meaningful. This finding suggests that at 12-week follow-up, KCS felt more fatigued possibly because there was more perceived expectation to meet the intervention goal. The SPA+BC group received counseling on behavioral strategies including how to anticipate and overcome barriers, and plan for PA and thus they may have felt the need to meet their planned prescriptions and goals for the home-based component despite having some barriers.

Our trial should be interpreted within the context of important strengths and limitations. To the best of our knowledge, our study is the first to pilot the effects of adding behavioral counseling to supervised PA for any cancer survivor group. Although, we acknowledge the limitation of using a self-report PA measure, which can introduce measurement error, a further study strength is the employment of objective measures of physical function and aerobic fitness. Other strengths of our study included the face-to-face supervised PA sessions, the theoretically-based intervention content, high rates of adherence and measurement completion rates, intention-to-treat analysis, trivial loss-to-follow-up, and the demographically homogeneous sample. The study limitations included the relatively short-term intervention with limited follow-up, and our multiple comparisons for the patient-reported outcomes, which may have resulted in an increased probability for chance findings.

In conclusion, the TRACKS trial provides preliminary evidence that adding behavioral counseling to supervised PA is feasible and may improve PA and physical functioning in KCS. Additional research is warranted to establish the maintenance of PA levels and patient-reported outcomes and the optimal length of the intervention and follow-up. For example, future studies should extend the length of the face-to-face counseling sessions over 12 weeks to increase the intensity of the behavioral strategies being delivered. Maintaining a tapered contact throughout the home-based component either through face-to-face and/or telephone counseling may contribute to longer-term PA maintenance. Moreover, future studies should consider excluding participants who are already meeting PA guidelines, and to develop strategies for recruiting those who are less motivated to participate in a PA program. Overall, the findings provide the necessary foundation in which, larger, randomized controlled trials may be developed to determine the implementation of this intervention at cancer centres and community-based fitness centres.

Table 6-1. Delivery and type of counseling sessions by group assignment in the TRACKS Trial, Edmonton, Alberta, Canada, June-November 2012.

Week #	**Session #**	**Counseling topics**	
		SPA+EC	**SPA+BC***
1	1	Introduction to program and facility (same for both groups)	
1	2	Components of a PA training session	Benefits of PA for cancer survivors
2	3	Heart rate training and PA intensity	Overcoming barriers
2	4	PA guidelines and what to wear for PA	Stimulus control
3	5	Safety considerations for PA	Making PA fun and social support
4	6	Cross training	Goal setting and planning for PA

Note: PA=physical activity; SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling.

*The SPA+BC group received the same counseling topics as the SPA+EC group, in addition to the behavioral counseling topics.

Table 6-2. Baseline demographic and medical characteristics of kidney cancer survivors overall and by group assignment in the TRACKS Trial, Edmonton, Alberta, Canada, June-November 2012.

Variable	Overall (N=32)	SPA+EC (n=16)	SPA+BC (n=16)
	No. (%)	No. (%)	No. (%)
Age (Mean ± SD)	61.8 ± 9.8	61.4 ± 9.7	62.3 ± 10.2
Sex			
Male	16 (50.0)	7 (43.8)	9 (56.2)
Female	16 (50.0)	9 (56.2)	7 (43.8)
Marital Status			
Married/common law	23 (71.9)	13 (81.2)	10 (62.5)
Not married	9 (28.1)	3 (18.8)	6 (37.5)
Education			
Some high school	4 (12.5)	1 (6.2)	3 (18.8)
Completed high school	5 (15.6)	3 (18.8)	2 (12.5)
Some university/college	9 (28.1)	5 (31.2)	4 (25.0)
Completed university/college	11 (34.4)	6 (5.5)	5 (31.2)
Some/completed graduate school	3 (9.4)	1 (6.2)	2 (12.5)
Annual Family Income			
$20 000-$59 999	7 (21.9)	3 (30.0)	4 (26.7)
$60 000-$99 999	7 (21.9)	5 (50.0)	2 (13.3)
>$100 000	11 (34.4)	2 (20.0)	9 (60.0)
Missing data	7 (21.9)		
Employment status			
Employed full-/part-time	16 (50.0)	7 (43.8)	9 (56.2)
Retired	13 (40.6)	7 (43.8)	6 (37.5)
Other	3 (9.4)	2 (12.5)	1 (6.2)
Ethnicity			
White	29 (90.6)	14 (87.5)	15 (93.8)
Other	3 (9.4)	2 (12.5)	1 (6.2)
Body mass index (Mean ± SD)	29.1 ± 5.6	29.9 ± 6.3	28.3 ± 4.9
Healthy weight	7 (21.9)	3 (18.8)	4 (25.0)
Overweight	16 (50.0)	7 (43.8)	9 (56.2)
Obese	9 (28.1)	6 (37.5)	3 (18.8)

Table 6-2. cont'd

Variable	Overall (N=32) No. (%)	SPA+EC (n=16) No. (%)	SPA+BC (n=16) No. (%)
Number of comorbidities			
None	1 (3.1)	0 (0.0)	1 (6.2)
1	11 (34.4)	6 (37.5)	5 (31.2)
2	9 (28.1)	6 (37.5)	3 (18.8)
≥3	11 (34.4)	4 (25.0)	7 (43.8)
*Most common comorbidities			
High cholesterol	16 (50.0)	8 (50.0)	8 (50.0)
High blood pressure	13 (40.6)	4 (25.0)	9 (56.2)
Arthritis	12 (37.5)	5 (31.2)	7 (43.8)
Other cancer	8 (25.0)	1 (6.2)	7 (43.8)
Diabetes	4 (12.5)	2 (12.5)	2 (12.5)
Smoking status			
Never smoked	11 (34.4)	6 (37.5)	5 (31.2)
Ex-smoker	11 (34.4)	6 (37.5)	5 (31.2)
Regular/occasional smoker	10 (31.3)	4 (25.0)	6 (37.5)
Drinking status			
Never drink	6 (18.8)	2 (12.5)	4 (25.0)
Social drinker	22 (68.8)	12 (75.0)	10 (62.5)
Regular drinker	4 (12.5)	2 (12.5)	2 (12.5)
General health rating			
Excellent	4 (12.5)	2 (12.5)	2 (12.5)
Very good	12 (37.5)	7 (43.8)	5 (31.2)
Good	12 (37.5)	4 (25.0)	8 (50.0)
Fair	4 (12.5)	3 (18.8)	1 (6.2)

*could check more than one response
Abbreviations: SPA+EC=Supervised physical activity plus exercise counseling
SPA+BC=Supervised physical activity plus behavioral counseling

Table 6-3. Cancer and treatment characteristics of kidney cancer survivors overall and by group assignment in the TRACKS Trial, Edmonton, Alberta, Canada, June-November 2012.

Variable	Overall (N=32)	SPA+EC (n=16)	SPA+BC (n=16)
	No. (%)	No. (%)	No. (%)
Months since diagnosis (Mean ± SD)	74.0 ± 38.9	67.5 ± 26.4	80.4 ± 48.4
Lymph nodes involved			
Yes	2 (6.3)	1 (6.2)	1 (6.2)
No	25 (78.1)	12 (75.0)	13 (81.2)
Don't know	5 (15.6)	3 (18.8)	2 (12.5)
Disease stage			
Localized	30 (93.8)	15 (93.8)	15 (93.8)
Metastatic	2 (6.3)	1 (6.2)	1 (6.2)
Surgery treatment			
Yes	31 (96.9)	16(100.0)	15 (93.8)
No	1 (3.1)	0 (0.0)	1 (6.2)
Type of surgery (N=31)			
Partial nephrectomy	11 (35.5)	6 (37.5)	5 (33.3)
Radical nephrectomy	20 (64.5)	10 (62.5)	10 (66.7)
Type of incision (N=31)			
Laparoscopic	16 (51.6)	7 (43.8)	9 (60.0)
Open incision	15 (48.4)	9 (56.2)	6 (40.0)
Radiation treatment			
Yes	1 (3.1)	1 (6.2)	0 (0.0)
No	31 (96.9)	15 (93.8)	16 (100.0)
Drug treatment			
Yes	1 (3.1)	0 (0.0)	1 (6.2)
No	31 (96.9)	16 (100.0)	15 (93.8)
Current treatment status			
Completed treatment	32 (100.0)	16 (100.0)	16 (100.0)
Recurrence			
Yes	1 (3.1)	0 (0.0)	1 (6.2)
No	31 (96.9)	16 (100.0)	15 (93.8)
Current disease status			
Disease-free	31 (96.9)	16 (100.0)	15 (93.8)
Existing disease	1 (3.1)	0 (0.0)	1 (6.2)

Abbreviations: SPA+EC=Supervised physical activity plus exercise counseling
SPA+BC=Supervised physical activity plus behavioral counseling

Table 6-4. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Physical Activity at 12-week Follow-up in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	12-week Follow-up	Mean Change	[1]Adjusted Between Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
Total PA minutes						
SPA+EC (n=15)	155 (159)	227 (166)	+72 [0 to 143]	+34 [-62 to 129]	.47	+.21
SPA+BC (n=15)	127 (163)	242 (164)	+115 [43 to 186]			
Moderate PA minutes						
SPA+EC (n=15)	69 (69)	92 (93)	+24 [-18 to 66]	+3 [-54 to 60]	.92	+.04
SPA+BC (n=15)	61 (92)	91 (91)	+29 [-13 to 71]			
Vigorous PA minutes						
SPA+EC (n=15)	43 (75)	67 (71)	+24 [-9 to 58]	+17 [-31 to 64]	.48	+.25
SPA+BC (n=15)	33 (60)	76 (91)	+43 [9 to 76]			
% Meeting PA guidelines						
SPA+EC (n=15)	53% (52%)	60% (51%)	+7% [-19% to 33%]	+32% [-0% to 64%]	.052	+.64
SPA+BC (n=15)	27% (46%)	80% (41%)	+53% [28% to 79%]			

Note: PA=physical activity; SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling.
[1]Difference in mean change adjusted for baseline value.

Table 6-5. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Objective Fitness Measures at 12-week Follow-up in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	12-week Follow-up	Mean Change	[1]Adjusted Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
VO2max (ml/kg/min)						
SPA+EC (n=14)	28.1 (8.5)	32.7 (8.6)	+4.6 [0.1 to 9.1]	+1.0 [-4.3 to 6.3]	.71	+.12
SPA+BC (n=12)	28.3 (9.0)	33.8 (5.8)	+5.5 [0.7 to 10.3]			
6-minute Walk (m)						
SPA+EC (n=14)	529 (72)	522 (98)	-7 [-38 to 24]	+48 [1 to 95]	.046	+.64
SPA+BC (n=12)	503 (79)	541 (102)	+38 [5 to 72]			
30-Second Chair Stands (#)						
SPA+EC (n=14)	17 (7)	19 (8)	+2 [0 to 4]	-1 [-4 to 1]	.28	-.19
SPA+BC (n=12)	15 (3)	16 (3)	+1 [-1 to 3]			
30-Second Arm Curls (#)						
SPA+EC (n=14)	17 (4)	19 (5)	+2 [1 to 4]	+0 [-2 to 2]	.86	+.04
SPA+BC (n=12)	16 (2)	18 (3)	+2 [1 to 4]			
Sit and Reach (cm)						
SPA+EC (n=14)	0.7 (15.3)	5.5 (8.3)	+4.8 [0.8 to 8.8]	-1.1 [-4.5 to 2.3]	.51	-.09
SPA+BC (n=12)	0.4 (9.2)	4.3 (7.4)	+3.8 [-0.5 to 8.2]			
Back Scratch (cm)						
SPA+EC (n=14)	-7.1 (14.3)	-5.9 (9.3)	+1.1 [-2.2 to 4.5]	+1.1 [-2.7 to 4.8]	.55	+.09
SPA+BC (n=12)	-2.0 (8.9)	-1.5 (8.7)	+0.5 [-3.2 to 4.1]			
8-foot Up & Go (sec)						
SPA+EC (n=14)	5.0 (1.2)	4.8 (1.4)	-0.1 [-0.4 to 0.2]	-0.2 [-0.6 to 0.3]	.41	-.17
SPA+BC (n=12)	5.1 (1.1)	4.8 (0.9)	-0.3 [-0.6 to 0.0]			
Weight (kg)						
SPA+EC (n=14)	84.3 (26.6)	84.1 (26.4)	-0.2 [-1.1 to 0.7]	+0.2 [-1.1 to 1.6]	.72	+.14
SPA+BC (n=12)	77.0 (12.7)	77.0 (13.1)	+0.1 [-0.9 to 1.0]			
Waist Circumference (cm)						
SPA+EC (n=14)	98.3 (20.7)	98.2 (17.7)	-0.1 [-2.3 to 2.1]	-0.6 [-3.5 to 2.2]	.65	-.01
SPA+BC (n=12)	93.0 (11.4)	93.0 (11.8)	-0.0 [-2.4 to 2.4]			
Body Mass Index						
SPA+EC (n=14)	29.7 (6.7)	29.5 (6.9)	-0.2 [-0.6 to 0.2]	+0.3 [-0.3 to 0.9]	.95	+.05
SPA+BC (n=12)	27.5 (3.8)	27.6 (3.9)	+0.1 [-0.4 to 0.5]			

Note: VO2max=maximal oxygen uptake; SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling. [1]Difference in mean change adjusted for baseline value.

Table 6-6. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Generic Quality of Life at 12-week Follow-up in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	12-week Follow-up	Mean Change	[1]Adjusted Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
Physical Functioning						
SPA+EC (n=15)	52.0 (8.3)	52.1 (7.9)	+0.1 [-3.4 to 3.7]	-2.5 [-7.6 to 2.6]	.33	-.31
SPA+BC (n=15)	49.7 (7.8)	47.8 (10.8)	-2.0 [-5.5 to 1.6]			
Role-Physical						
SPA+EC (n=15)	48.9 (9.3)	49.5 (10.4)	+0.7 [-4.0 to 5.4]	-0.7 [-6.9 to 5.5]	.81	-.08
SPA+BC (n=15)	50.6 (8.6)	49.8 (8.8)	-0.8 [-5.5 to 3.9]			
Bodily Pain						
SPA+EC (n=15)	51.1 (9.4)	51.7 (6.9)	+0.6 [-4.1 to 5.2]	-1.5 [7.7 to 4.7]	.62	-.17
SPA+BC (n=15)	51.6 (8.7)	50.5 (12.1)	-1.1 [-5.8 to 3.6]			
General Health						
SPA+EC (n=15)	52.6 (8.8)	51.7 (8.5)	-1.0 [-5.3 to 3.4]	+2.5 [-3.1 to 8.1]	.37	+.29
SPA+BC (n=15)	49.4 (8.5)	52.5 (8.4)	+3.1 [-1.3 to 7.5]			
Vitality						
SPA+EC (n=15)	52.3 (10.4)	55.6 (8.9)	+3.3 [-2.2 to 8.8]	+0.5 [-5.6 to 6.6]	.87	+.05
SPA+BC (n=15)	52.7 (10.0)	56.3 (8.5)	+3.5 [-2.0 to 9.1]			
Social Functioning						
SPA+EC (n=15)	48.8 (9.0)	48.8 (11.1)	+0.0 [-5.7 to 5.7]	+0.6 [-6.8 to 8.0]	.87	+.06
SPA+BC (n=15)	51.4 (10.1)	50.7 (10.1)	-0.7 [-6.4 to 5.0]			
Role-Emotional						
SPA+EC (n=15)	47.1 (11.7)	48.6 (10.0)	+1.6 [-4.4 to 7.5]	-1.9 [-9.8 to 5.9]	.62	-.18
SPA+BC (n=15)	51.2 (8.8)	48.9 (12.9)	-2.3 [-8.3 to 3.6]			
Mental Health						
SPA+EC (n=15)	50.9 (9.7)	53.0 (12.5)	+2.1 [-1.8 to 5.9]	-0.3 [-5.8 to 5.2]	.92	-.03
SPA+BC (n=15)	53.5 (8.3)	54.9 (7.9)	+1.4 [-2.4 to 5.3]			
Physical Health Component						
SPA+EC (n=15)	51.9 (6.1)	51.5 (8.3)	-0.4 [-4.4 to 3.6]	-0.5 [-6.3 to 5.2]	.86	-.08
SPA+BC (n=15)	49.5 (7.0)	49.1 (9.8)	-0.5 [-4.4 to 3.5]			
Mental Health Component						
SPA+EC (n=15)	49.0 (10.5)	51.3 (12.4)	+2.3 [-3.0 to 7.7]	+0.3 [-6.9 to 7.5]	.93	+.03
SPA+BC (n=15)	53.1 (9.6)	54.0 (9.4)	+0.9 [-4.4 to 6.3]			

Note: SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling. [1]Difference in mean change adjusted for baseline value.

Table 6-7. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Cancer-Specific Quality of Life at 12-week Follow-up in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	12-week Follow-up	Mean Change	[1]Adjusted Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
Physical Well-Being						
SPA+EC (n=15)	25.4 (1.9)	24.5 (4.1)	-0.9 [-2.9 to 1.2]	-0.8 [-3.4 to 1.9]	.55	-.35
SPA+BC (n=15)	25.3 (2.7)	23.6 (6.3)	-1.7 [-3.8 to 0.4]			
Social Well-Being						
SPA+EC (n=15)	18.6 (4.2)	18.1 (4.7)	-0.5 [-3.2 to 2.2]	+1.9 [-1.3 to 5.1]	.24	+.38
SPA+BC (n=15)	20.2 (5.8)	20.7 (4.7)	+0.5 [-2.2 to 3.1]			
Emotional Well-Being						
SPA+EC (n=15)	20.4 (3.7)	20.0 (4.4)	-0.4 [-2.2 to 1.4]	-0.0 [-2.6 to 2.6]	.99	-.00
SPA+BC (n=15)	21.9 (1.8)	21.0 (3.3)	-0.9 [-2.7 to 1.0]			
Functional Well-Being						
SPA+EC (n=15)	22.8 (4.1)	22.4 (5.1)	-0.4 [-3.0 to 2.2]	+0.5 [-2.8 to 3.9]	.75	+.13
SPA+BC (n=15)	23.9 (3.6)	23.4 (4.3)	-0.5 [-3.0 to 2.1]			
Fatigue subscale						
SPA+EC (n=15)	42.1 (10.5)	43.9 (9.8)	+1.9 [-3.1 to 6.6]	-3.1 [-10.0 to 3.7]	.36	-.35
SPA+BC (n=15)	42.2 (7.3)	40.8 (13.1)	-1.4 [-6.3 to 3.5]			
FACT-G						
SPA+EC (n=15)	87.2 (11.4)	85.1 (15.2)	-2.2 [-9.1 to 4.8]	+1.0 [-8.8 to 10.8]	.83	+.09
SPA+BC (n=15)	91.3 (10.6)	88.7 (13.8)	-2.6 [-9.5 to 4.4]			
FACT-F						
SPA+EC (n=15)	129.3 (20.1)	128.9 (24.1)	-0.4 [-11.5 to 10.6]	-2.6 [-18.4 to 13.1]	.73	-.14
SPA+BC (n=15)	133.5 (16.1)	129.5 (25.8)	-4.0 [-15.0 to 7.1]			
TOI-F						
SPA+EC (n=15)	90.3 (15.0)	90.8 (17.5)	+0.5 [-8.0 to 9.0]	-3.9 [-16.2 to 8.3]	.51	-.29
SPA+BC (n=15)	91.4 (12.7)	87.9 (22.7)	-3.6 [-12.1 to 4.9]			
FKSI-15						
SPA+EC (n=15)	51.5 (5.0)	50.3 (5.4)	-1.2 [-4.4 to 2.0]	-0.2 [-4.8 to 4.4]	.91	-.04
SPA+BC (n=15)	51.3 (5.7)	49.9 (9.2)	-1.4 [-4.6 to 1.8]			

Note: FACT=Functional Assessment of Cancer Therapy; FACT-G= Functional Assessment of Cancer Therapy-General; FACT-F= Functional Assessment of Cancer Therapy-Fatigue; TOI-F=Trial Outcome Index-Fatigue; FKSI-15=Kidney symptom index; SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling. [1]Difference in mean change adjusted for baseline value.

Table 6-8. Satisfaction of Kidney Cancer Survivors in the TRACKS Trial Overall and by Group Assignment at 12-week Follow-up, Edmonton, Alberta, Canada, June-November 2012.

Variable	Overall (N=29)	SPA+EC (n=15)	SPA+BC (n=14)
Overall Trial Participation [Mean (SD)]			
Rewarding	6.2 (1.5)	6.2 (1.4)	6.2 (1.6)
Waste of time	1.2 (0.7)	1.1 (0.5)	1.3 (0.8)
Useful for research helping others	6.0 (1.5)	6.1 (1.1)	5.9 (1.9)
Useful for me personally	6.3 (1.4)	6.4 (1.3)	6.3 (1.6)
Recommend to other kidney survivors	6.6 (1.2)	6.8 (0.4)	6.4 (1.6)
Burden of Testing [Mean (SD)]			
Treadmill fitness test	2.2 (1.8)	2.6 (2.3)	1.8 (1.1)
Physical function test	1.9 (1.7)	2.1 (2.1)	1.8 (1.1)
Questionnaires	2.1 (1.5)	2.3 (1.8)	1.9 (1.1)
Counseling sessions	1.7 (1.4)	1.7 (1.8)	1.6 (0.9)
Supervised PA sessions	1.7 (1.4)	1.9 (1.8)	1.5 (0.9)
Physical Activity Manual [Mean (SD)]			
Read manual often	2.1 (0.8)	2.2 (1.0)	2.1 (0.6)
Helped in increasing PA	3.3 (1.7)	3.1 (1.7)	3.4 (1.8)
Easy to read	5.5 (1.3)	5.0 (1.5)	6.1 (0.9)
Length of manual	1.8 (0.4)	1.8 (0.4)	1.8 (0.4)
Interesting to read	4.5 (1.5)	4.3 (1.2)	4.7 (1.7)
Clarity of topics	5.6 (1.2)	5.3 (1.3)	5.9 (1.0)
Recommend to other kidney survivors	5.6 (1.5)	5.3 (1.6)	5.9 (1.4)
Learned new information	5.0 (1.7)	4.9 (1.8)	5.1 (1.7)
Satisfied with topics covered	5.3 (1.6)	5.3 (1.6)	5.3 (1.6)
Supervised PA sessions [Mean (SD)]			
Helpful in increasing PA	5.8 (1.3)	5.5 (1.5)	6.2 (1.0)
Counseling sessions [Mean (SD)]			
Helpful in increasing PA	5.8 (1.3)	5.3 (1.5)	6.3 (0.8)
Intervention length [Mean (SD)]			
Preference for number of sessions	9 (9)	10 (12)	7 (2)
Preference for number of weeks	7 (9)	9 (13)	5 (2)
Helpfulness of SPA+BC sessions for increasing PA levels [Mean (SD)]			
Benefits of PA	--	--	6.0 (1.2)
Making PA fun/enjoyable	--	--	5.7 (1.4)
Obtaining Social support	--	--	5.4 (1.5)
Overcoming barriers	--	--	5.9 (1.3)
Stimulus control	--	--	5.9 (1.1)
Goal setting	--	--	5.9 (1.4)
Detailed planning	--	--	5.9 (1.7)

Note: PA=physical activity; SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling.

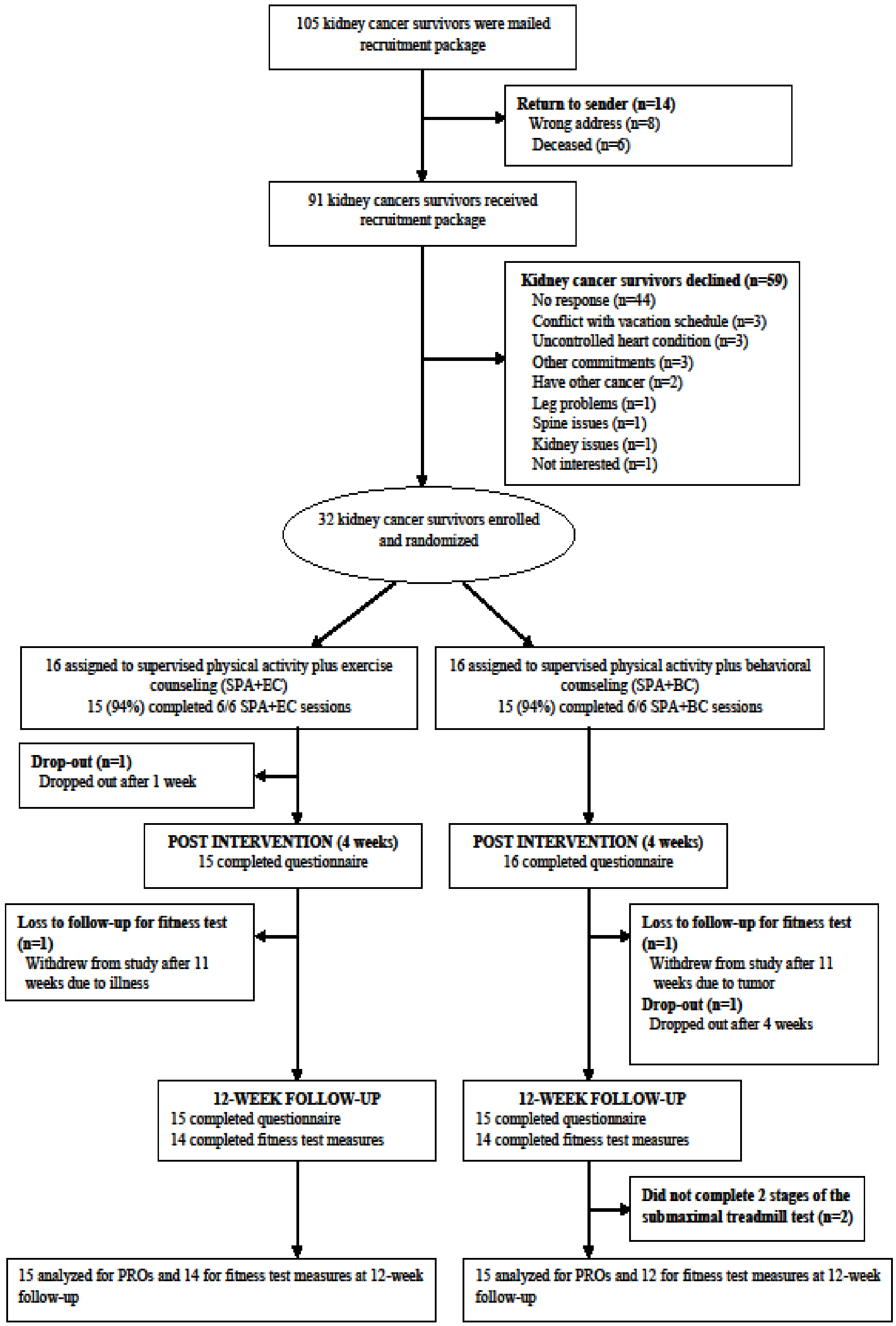

Figure 6-1. Flow of participants through the trial.

REFERENCES

1. Canadian Cancer Society's Steering Committee on Cancer Statistics. *Canadian Cancer Statistics 2012*. Toronto: Canadian Cancer Society; 2012.

2. Mishra SI, Scherer RW, Snyder C, Geigle PM, Berlanstein DR, Topaloglu O. Exercise interventions on health-related quality of life for people with cancer during active treatment. *Cochrane Database Syst Rev*. 2012;8:008465.

3. Trinh L, Plotnikoff RC, Rhodes RE, North S, Courneya KS. Associations between physical activity and quality of life in a population-based sample of kidney cancer survivors. *Cancer Epidemiol Biomarkers*. 2011;20(5):859-868.

4. Hawkins MS, Sevick MA, Richardson CR, Fried LF, Arena VC, Kriska AM. Association between physical activity and kidney function: National health and nutrition examination survey. *Med Sci Sports Exerc*. 2011;43(8):1457-1464.

5. Schmitz KH, Courneya KS, Matthews C, et al. American college of sports medicine roundtable on exercise guidelines for cancer survivors. *Med Sci Sports Exerc*. 2010;42(7):1409-1426.

6. Rock CL, Doyle C, Demark-Wahnefried W, et al. Nutrition and physical activity guidelines for cancer survivors. *CA Cancer J Clin*. 2012;62(4):242-274.

7. Courneya KS, Sellar CM, Stevinson C, et al. Randomized controlled trial of the effects of aerobic exercise on physical functioning and quality of life in lymphoma patients. *J Clin Oncol*. 2009;27(27):4605-4612.

8. Irwin ML. Physical activity interventions for cancer survivors. *Br J Sports Med*. 2009;43(1):32-38.

9. Courneya KS, Segal RJ, Mackey JR, et al. Effects of aerobic and resistance exercise in breast cancer patients receiving adjuvant chemotherapy: A multicenter randomized controlled trial. *J Clin Oncol*. 2007;25(28):4396-4404.

10. Pinto BM, Ciccolo JT. Physical activity motivation and cancer survivorship. *Recent Results Cancer Res*. 2011;186:367-387.

11. Pinto BM, Frierson GM, Rabin C, Trunzo JJ, Marcus BH. Home-based physical activity intervention for breast cancer patients. *J Clin Oncol*. 2005;23(15):3577-3587.

12. Kim SH, Shin MS, Lee HS, et al. Randomized pilot test of a simultaneous stage-matched exercise and diet intervention for breast cancer survivors. *Oncol Nurs Forum*. 2011;38(2):97-106.

13. Basen-Engquist K, Taylor CLC, Rosenblum C, et al. Randomized pilot test of a lifestyle physical activity intervention for breast cancer survivors. *Patient Educ Couns*. 2006;64(1-3):225-234.

14. Matthews CE, Wilcox S, Hanby CL, et al. Evaluation of a 12-week home-based walking intervention for breast cancer survivors. *Support Care Cancer*. 2007;15(2):203-211.

15. Rogers LQ, Hopkins-Price P, Vicari S, et al. A randomized trial to increase physical activity in breast cancer survivors. *Med Sci Sports Exerc*. 2009;41(4):935-946.

16. Basen-Engquist K, Carmack CL, Perkins H, et al. Design of the steps to health study of physical activity in survivors of endometrial cancer: Testing a social cognitive theory model. *Psychology of Sport & Exercise*. 2011;12(1):27-35.

17. Keats MR, Culos-Reed S. A community-based physical activity program for adolescents with cancer (project TREK): Program feasibility and preliminary findings. *J Pediatr Hematol Oncol*. 2008;30(4):272-280.

18. Bennett JA, Lyons KS, Winters-Stone K, Nail LM, Scherer J. Motivational interviewing to increase physical activity in long-term cancer survivors: A randomized controlled trial. *Nurs Res*. 2007;56(1):18-27.

19. Naumann F, Munro A, Martin E, et al. An individual-based versus group-based exercise and counselling intervention for improving quality of life in breast cancer survivors. A feasibility and efficacy study. *Psychooncology*. 2012;21(10):1136-1139.

20. Naumann F, Martin E, Philpott M, Smith C, Groff D, Battaglini C. Can counseling add value to an exercise intervention for improving quality of life in breast cancer survivors? A feasibility study. *J Support Oncol*. 2012;10(5):188-194.

21. May AM, Korstjens I, van Weert E, et al. Long-term effects on cancer survivors' quality of life of physical training versus physical training combined with cognitive-behavioral therapy: Results from a randomized trial. *Support Care Cancer*. 2009;17(6):653-663.

22. Trinh L, Plotnikoff RC, Rhodes RE, North S, Courneya KS. Correlates of physical activity in a population-based sample of kidney cancer survivors: An application of the theory of planned behavior. *Int J Behav Nutr Phys Act*. 2012;9:96.

23. Trinh L, Plotnikoff RC, Rhodes RE, North S, Courneya KS. Physical activity preferences in a population-based sample of kidney cancer survivors. *Support Care Cancer*. 2012;20(8):1709-1717.

24. Stevinson C, Tonkin K, Capstick V, et al. A population-based study of the determinants of physical activity in ovarian cancer survivors. *Journal of Physical Activity & Health*. 2009;6(3):339-346.

25. Karvinen KH, Courneya KS, Campbell KL, et al. Correlates of exercise motivation and behavior in a population-based sample of endometrial cancer survivors: An application of the theory of planned behavior. *Int J Behav Nutr Phys Act*. 2007;4:21-21.

26. Speed-Andrews A, Rhodes RE, Blanchard CM, Culos-Reed SN, Friedenreich CM, et al. Medical, demographic, and social cognitive correlates of physical activity in a population-based sample of colorectal cancer survivors. *Eur J Cancer Care*. 2011;21(2):187-196.

27. Courneya KS, Karvinen KH. Exercise, aging, and cancer. *Applied Physiology, Nutrition & Metabolism*. 2007;32(6):1001-1007.

28. Vallance JK, Courneya KS, Taylor LM, Plotnikoff RC, Mackey JR. Development and evaluation of a theory-based physical activity guidebook for breast cancer survivors. *Health Educ Behav*. 2008;35(2):174-189.

29. Vallance JKH, Courneya KS, Plotnikoff RC, Yasui Y, Mackey JR. Randomized controlled trial of the effects of print materials and step pedometers on physical activity and quality of life in breast cancer survivors. *J Clin Oncol*. 2007;25(17):2352-2359.

30. Karvinen KH, Courneya KS, North S, Venner P. Associations between exercise and quality of life in bladder cancer survivors: A population-based study. *Cancer Epidemiol Biomarkers*. 2007;16(5):984-990.

31. Courneya KS, Forbes CC, Trinh L, Sellar CM, Friedenreich CM, et al. Patient Satisfaction with Participation in a Randomized Exercise Trial: Effects of Randomization and Usual Care Cross-Over. *Clincial Trials.* Under submission.

32. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Sciences*. 1985;10(3):141-146.

33. Pereira MA, FitzerGerald SJ, Gregg EW, et al. A collection of physical activity questionnaires for health-related research. *Med Sci Sports Exerc*. 1997;29(6):1-205.

34. Cella DF, Tulsky DS, Gray G, et al. The functional assessment of cancer therapy scale: Development and validation of the general measure. *J Clin Oncol*. 1993;11(3):570-579.

35. Yellen SB, Cella DF, Webster K, Blendowski C, Kaplan E. Measuring fatigue and other anemia-related symptoms with the functional assessment of cancer therapy (FACT) measurement system. *J Pain Symptom Manage*. 1997;13(2):63-74.

36. Cella D, Yount S, Du H, et al. Development and validation of the functional assessment of cancer therapy-kidney symptom index (FKSI). *J Support Oncol*. 2006;4(4):191-199.

37. Ware JE, Kosinski M, Bjorner JB, et al. *User's manual for the SF-36v2 health survey*. Second ed. Lincoln: QualityMetric Inc; 2007.

38. American College of Sports Medicine. *ACSM's guidelines for exercise testing and prescription.* Eighth ed. Philadelphia: Lippincott Williams & Wilkins; 2009.

39. Rikli RE, Jones CJ. Development and validation of a functional fitness test for community-residing older adults. *Journal of Aging & Physical Activity*. 1999;7(2):129-161.

40. Cohen J. *Statistical power analysis for the behavioral sciences.* Second ed. Hillsdale: Erlbaum; 1988.

41. Brucker PS, Yost K, Cashy J, Webster K, Cella D. General population and cancer patient norms for the functional assessment of cancer therapy-general (FACT-G). *Eval Health Prof*. 2005;28(2):192-211.

42. Newton MJ, Hayes SC, Janda M, et al. Safety, feasibility and effects of an individualised walking intervention for women undergoing chemotherapy for ovarian cancer: A pilot study. *BMC Cancer*. 2011;11:389.

43. von Gruenigen V,E., Courneya KS, Gibbons HE, Kavanagh MB, Waggoner SE, Lerner E. Feasibility and effectiveness of a lifestyle intervention program in obese endometrial cancer patients: A randomized trial. *Gynecol Oncol*. 2008;109(1):19-26.

44. Bourke L, Thompson G, Gibson DJ, et al. Pragmatic lifestyle intervention in patients recovering from colon cancer: A randomized controlled pilot study. *Archives of Physical Medicine & Rehabilitation*. 2011;92(5):749-755.

45. Stull VB, Snyder DC, Demark-Wahnefried W. Lifestyle interventions in cancer survivors: Designing programs that meet the needs of this vulnerable and growing population. *J Nutr*. 2007;137(1):243-248.

46. Fitts SS, Guthrie MR. Six-minute walk by people with chronic renal failure: Assessment of effort by perceived exertion. *Am J Phys Med Rehabil*. 1995;74(1):54-58.

47. Overend T, Anderson C, Sawant A, Perryman B, Locking-Cusolito H. Relative and absolute reliability of physical function measures in people with end-stage renal disease. *Physiother Can*. 2010;62(2):122-128.

48. Kasymjanova G, Correa JA, Kreisman H, et al. Prognostic value of the six-minute walk in advanced non-small cell lung cancer. *J Thorac Oncol*. 2009;4(5):602-607.

49. Webster K, Cella D, Yost K. The functional assessment of chronic illness therapy (FACIT) measurement system: Properties, applications, and interpretation. *Health Qual Life Outcomes*. 2003;1:79-79.

7: CHAPTER 7

Study 2: Paper 2

Changes in Motivational Outcomes Following a Supervised Physical Activity Program with Behavioral Counseling in Kidney Cancer Survivors: A Pilot Study

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Clinical Trial Registration: ClinicalTrials.gov Identifier NCT01571401

7-1. INTRODUCTION

The rates of obesity and kidney cancer have been increasing in parallel over the past few decades. A positive association between body mass index (BMI) and kidney cancer has been established, with the greatest risk among individuals who are the most obese.[1] Despite the increasing incidence rates of kidney cancer, the survival rates have improved,[2] highlighting the need to promote healthy lifestyles in kidney cancer survivors (KCS). Physical activity (PA) has beneficial effects on overall QoL, cancer-specific concerns, fatigue, and pain across many cancer survivor groups [3] including KCS.[4] However, given the established benefits of PA, the majority of cancer survivors are still not meeting public health PA guidelines [5, 6] including KCS. [4] The majority of randomized controlled trials (RCTs) in cancer survivors have included a supervised PA component, however, behavior change and motivation declines significantly after the supervised intervention is completed. [7, 8] Therefore, interventions may need to be coupled with PA counseling and education to influence sustained behavior change in short-term supervised PA interventions.

To promote PA maintenance, interventions are more effective when they are theoretically-based. [9] Application of behavioral theories provides a foundation to understand the mechanisms that influence behavior change. Behavior change interventions can improve effectiveness by including program elements and strategies in changing the underlying cognitive variables known to be associated PA. The Theory of Planned Behavior (TPB) has gained theoretical support and promising evidence to predict and explain PA motivation and behavior in cancer survivors. [9] The TPB proposes that a person's intention to perform a behavior is the immediate proximal predictor of that behavior as it reflects the level of motivation a person is willing to exert to perform the behavior. [10] Intention is theorized to mediate the influence of three main constructs on behavior: attitude, subjective norm, and perceived behavioral control (PBC). Attitude reflects a positive or negative evaluation of performing the behavior, and has both instrumental (e.g., harmful/beneficial) and affective (e.g., boring/enjoyable) components. Subjective norm is defined as the perceived social pressure to perform the behavior, and includes both injunctive (e.g., what significant others think the person ought to do) and descriptive (e.g., what significant others themselves do) components. PBC is an evaluation of how easy or difficult it will be to perform a behavior, and includes perceived control (e.g., personal control over the behavior) and self-efficacy (e.g., the belief that one is capable of performing a behavior). Furthermore, the TPB also proposes that attitude, subjective norm, and PBC are determined by underlying salient beliefs. [10] Attitude is characterized by behavioral beliefs, which consist of the perceived advantages and disadvantages of performing a behavior, as well as the factors that make the behavior enjoyable and unenjoyable. Subjective norm is determined by normative beliefs that are formed by an individual's perception that significant others think s/he should engage in a behavior. Control beliefs are established from an individual's perception that s/he has the necessary resources, skills, and opportunities to engage in behavior, and they formulate the structure for PBC. [10]

In the TPB, the proximal construct predicting behavioral action is the intention to act. [10] This construct represents motivation to engage in a behavior, and theorizing for this intention-behavior relationship has been supported reliably in the PA domain. [11] However, meta-analyses have shown that intentions alone are insufficient to predict behavioral change,[12] given that a substantial amount of behavioral variance remains unexplained. Prior research examining the intention-behavior gap has suggested that either additional variables other than intention explain behavior or other variables moderate the intention-behavior relationship.[13, 14] Planning is one such variable, and is usually translated into implementation intentions.[15] Planning specifies the 'when', 'where', and 'how' when engaging in an intended behavior.[15] Implementation intentions are 'if-then' plans that link good opportunities to act with behavioral activities that will be effective in accomplishing one's goals. They enable individuals to become aware of and create opportunities to achieve their goals,[14] and specifies the what, where, when, who, and how of engaging in an intended behavior. [15]

We previously completed a TPB-based behavior change intervention designed to assess the feasibility and preliminary efficacy of adding behavioral counseling to supervised physical activity in KCS on changes in self-reported PA.[16] The Trying Activity in Kidney Cancer Survivors (TRACKS) Trial was an RCT conducted to determine the effects of supervised PA program plus standard exercise counseling (SPA+EC) versus a supervised PA plus motivationally-enhanced behavioral counseling (SPA+BC) on changes in self-reported moderate/vigorous PA among 32 KCS. In the primary outcome paper, we reported that the SPA+BC group reported an increase of 34 minutes more PA than the SPA+EC group. Furthermore, the SPA+BC group significantly improved their 6-minute walk scores. Several measures of QoL positively changed favoring the SPA+BC group, although were not clinically meaningful. Finally, we reported excellent adherence to the intervention, high trial satisfaction, and low participant burden ratings compared to SPA+EC. Nevertheless, facilitating behavior change requires an understanding of the motivational outcomes that follow short-term interventions. Changes in motivational outcomes related to PA intervention may be important for long-term adoption and maintenance of PA.

Furthermore, the development of the TRACKS trial was based on previous studies examining the PA-related preferences [17] and theoretical correlates [18] identified by our research group. We previously identified the PA preferences of KCS where the findings revealed that over 80% of KCS felt they were able or maybe able to participate in a PA program designed for KCS and over 70% were interested or maybe interested in doing so.[17] The most common PA preferences were to: receive PA information from a fitness expert at a cancer centre (55.7%), receive information via print material (50.0%), start a PA program after treatment (36.5%), exercise with a spouse (39.6%), exercise at home (52.0%), do moderate intensity PA (58.4%), and walk in both the summer (69.4%) and winter (48.2%).[17] These findings were used to for inform the TRACKS trial as targeted PA programs based on preferences may be able to facilitate improved long-term PA adherence and health outcomes in KCS. Moreover, we previously determined the most important social cognitive correlates of PA intentions and behavior based on the TPB to determine the most important targets for change in the development of the TRACKS trial.[18] Our study provided evidence that PA is strongly associated with planning and intention which, in turn, are strongly associated with PBC, instrumental attitude, and descriptive norm.[18] In the TRACKS trial, the behavioral counseling strategies were based on these previous TPB findings.

There have been relatively few studies examining the effects of motivational outcomes following a supervised PA program using the TPB among lung cancer survivors,[19] lymphoma patients,[20] pediatric cancer survivors,[21] and breast cancer survivors.[22-24] Many of these studies were able to demonstrate that supervised PA has motivational effects that varied by cancer type.

Here, we report the motivational outcomes of the TRACKS trial, which is the first to examine the impact of a SPA+EC versus SPA+BC program on motivation levels among KCS. We hypothesized that the SPA+BC group would have significant positive effects on the TPB constructs compared to the SPA+EC group. Based on a previous study conducted by our research group identifying the correlates of PA using the TPB,[18] we hypothesized that the SPA+BC group would have significant positive effects on the TPB constructs (i.e., PBC, planning) compared to the SPA+EC group.

7-2. METHODS

Design and Procedures

The methods of the TRACKS Trial have been previously reported.[18] In brief, the study piloted a two-armed, single blind, RCT comparing SPA+EC to SPA+BC. Participants were recruited based on their interest indicated on a previous survey study conducted between May and September 2010.[4] Eligibility criteria for the trial included the following: a) between the ages of 18 to 80 years of age; b) histologically confirmed kidney cancer (Stage I-IIIa) but now cured or in remission; c) ability and willingness to effectively communicate in English; d) able to attend the supervised PA sessions and not planning to be away for three consecutive days for the duration of the program; and e) interested in increasing their PA. Randomization occurred after all baseline measurements were completed. Participants were randomly assigned with equal allocation (1:1 ratio) to one of two groups using a computer-generated random numbers list. The allocation sequence was generated independently and concealed from the study co-ordinator. All participants were blinded to group assignment since they were only informed they would receive one of two types of counseling.

Intervention Groups

The goal of both arms of the intervention was to gradually increase PA by at least 60 minutes of moderate intensity or 30 minutes of vigorous intensity PA to a minimum of 150 minutes of moderate intensity or 75 minutes of vigorous intensity PA per week. Participants in both arms were provided with six individual supervised PA sessions over a 4-week period with a PA specialist that tapered to an unsupervised home-based program (8 weeks) by the end of the intervention. Participants assigned to both groups were given an individualized aerobic prescription at a moderate-to-vigorous intensity where the duration and intensity that accounts for the participant's baseline fitness test results, PA history, and PA-related preferences. To ensure quality control, both arms of the intervention were delivered by the same PA specialist. The PA specialist was a certified personal trainer who had experience with physical activity behavior change interventions among cancer survivors.

In addition to the supervised PA sessions, the SPA+EC received standard exercise counseling to teach proper PA technique, how to monitor intensity, and to progress PA safely and effectively to achieve the public health PA guidelines. The SPA+BC group received six individual face-to-face behavioral counseling sessions with a PA specialist. These counseling sessions were combined with the supervised PA sessions, and were provided directly following the supervised PA session. The behavioral counseling component of the intervention was based on a previous study identifying the theoretical determinants[18] and PA preferences of KCS.[17] The behavioral counseling strategies sessions were focused on the benefits of PA, how to make PA fun and enjoyable, how to obtain social support for PA, how to anticipate and overcome barriers, and how to implement a plan to translate intentions into behavior. In addition, salient PA beliefs were identified that were used to supplement the sessions including targeting the benefits of PA such as weight loss and improvement in fitness and strength. The enjoyable aspects of PA were highlighted including exercising with others, engaging in a fun activity, and exercising outdoors. Addressing barriers to PA such as the presence of health problems and pain/soreness, as well as lack of time was the main target for influencing PA levels of KCS, considering PBC was the strongest correlate of PA intention. A PA manual was also distributed to each participant as an ongoing resource, which was developed separately for each of the two groups, with the behavioral counseling group containing more content (i.e., theory-based counseling). The counselling sessions for both groups were delivered while the participant was exercising, if possible. On average, each session in the SPA+EC group was one hour in duration, and the SPA+BC group was one hour and fifteen minutes in duration.

Measures

Motivational outcomes were assessed at baseline, 4 weeks (post-intervention), and 12 weeks. The primary time point for motivational outcomes was at 4 weeks.

Demographic and medical information

Demographic variables were assessed using self-report and included age, sex, education level, marital status, annual income, employment status, and ethnicity. Medical variables were also assessed using self-report and included time since diagnosis, type of kidney cancer, lymph node involvement, disease stage, previous and current treatments, previous recurrence, and current disease status, which have been used previously in studies with cancer survivors. [25, 26]

Theory of planned behavior variables

Prior to completing the TPB measures, regular PA for participants was defined as “moderate intensity PA (e.g., brisk walking) performed for at least 150 minutes per week (2.5 hours), OR vigorous intensity PA performed at least 75 minutes per week (1.25 hours).” The TPB items were developed based on guidelines recommended by Ajzen,[10, 27] as well as previous studies with cancer survivors. [22]

Given there were different assessment points for the study, each questionnaire had a different time referent for engaging in regular PA. For example, in the baseline questionnaire, all TPB items assessed doing regular PA over the *next 4 weeks*. The post-intervention questionnaire assessed doing regular PA over the *next 8 weeks*. The 12-week follow-up questionnaire assessed doing regular PA over the *next 3 months*.

Intention. Intention was assessed by two items. The first item, “Do you intend to do regular PA over the next month,” was rated on a 7-point Likert-type scale from 1 (*strongly intend*) to 7 (*no, not really*). The second item, “How motivated are you to do regular PA over the next month,” was rated on a 7-point Likert-type scale from 1 (*not at all motivated*) to 7 (*extremely motivated*).

Attitude. Attitude was measured by six items using a 7-point bipolar adjective scale that assessed both the instrumental (useful/useless, beneficial/harmful, important/unimportant) and affective (enjoyable/unenjoyable, pleasurable/painful, interesting/boring) aspects of attitude. The verbal descriptors were *extremely* (Points 1 and 7), *quite* (Points 2 and 6), and *slightly* (Points 3 and 5). The stem that preceded the adjectives was “I think that for me to participate in regular PA over the next month would be…”. Separate scores for affective and instrumental attitudes were computed as they were applied as separate variables for analyses.

Subjective norm. Subjective norm was measured by six items rated on a 7-point Likert-type scale. The three items that measured injunctive norm were preceded by the stem “I think that if I participated in regular PA over the next month, most people who are important to me would be…” followed by the scales 1=*extremely disapproving* to 7=*extremely approving*, 1=*extremely discouraging* to 7=*extremely encouraging*, and 1=*extremely unsupportive* to 7=*extremely supportive*. The three items that assessed descriptive norm were: [1] “I think that over the next month, most people who are important to me will be…” followed by the scales 1=*extremely inactive* to 7=*extremely active*; [2] “I think that over the next month, most people who are important to me will themselves participate regularly in PA” followed by the scales 1=*strongly disagree* to 7=*strongly agree*); and [3] “I think that over the next month, the exercise levels of most people who are important to me will be…” followed by the scales 1=*extremely low* to 7=*extremely high*.

Perceived behavioral control (PBC). PBC was determined by six items on a 7-point Likert-type scale. Three items assessed the perceived control component of PBC. The specific items were: [1] If you were really motivated, how much control would you have over doing regular PA over the next month” (1 = *very little control* to 7 = *complete control*); [2] “Whether or not I engage in regular PA over the next month is completely up to me” (1 = *strongly disagree* to 7 = *strongly agree*); and [3] “How much do you feel that engaging in PA over the next month is beyond your control?” (1 = *strongly disagree* to 7 = *strongly agree*). Three items assessed the self-efficacy component of PBC which included: [1] Participating in regular PA over the next month would be…followed by the scale 1 = *extremely difficult* to 7 = *extremely easy*; [2] If I wanted to, I could easily engage in regular PA over the next month (1 = *strongly disagree* to 7 = *strongly* *agree*); and [3] How confident would you be that you could do regular PA over the next month?" (1 = *not at all confident* to 7 = *extremely confident*).

Underlying TPB beliefs.

Underlying beliefs were solicited for behavioral, control beliefs, and normative beliefs using six open-ended questions from a previous study conducted in KCS.[18] The beliefs were assessed on a 7-point Likert-type scale ranging from 1 = *extremely unlikely* to 7 = *extremely likely*.

Behavioral beliefs. The behavioral beliefs focused on both the behavioral (i.e., perceived benefits of PA) and affective beliefs (i.e., perceived enjoyment of regular PA). The behavioral belief items were preceded by the statement: "If you were to do regular PA over the next month, do you think you would…" followed by the most frequently mentioned behavioral beliefs (eight items for behavioral beliefs; eight items for affective beliefs).

Normative beliefs. The normative beliefs addressed the extent to which important specific others would be supportive of doing regular PA, as well as what important specific others are doing. The normative beliefs assessed the support of important and were preceded by the statement: "How supportive do you think each of the following people would be if you tried to do regular PA over the next month?" followed by seven referent groups. The normative beliefs assessed what important others are doing and were preceded by the statement: "How likely do you think it is that each of the following people would do PA over the next month?" followed by five referent groups.

Control beliefs. The control beliefs focused on the extent to which certain barriers would interfere with doing PA regularly. The control beliefs items were preceded by the statement: "If you were really motivated, how confident are you that you could do regular PA over the next month if…" followed by the nine most frequently reported control beliefs.

Planning. Planning was measured using the instrument developed and validated by Rise et al. [28] The four items were: [1] "I have made plans concerning 'when' I am going to engage in regular PA over the next month;" [2] "I have made plans concerning 'where' I am going to engage in regular PA over the next month;" [3] "I have made plans concerning 'what' kind of regular PA I am going to engage in over the next month;" and [4] "I have made plans concerning 'how' I am going to get to a place to engage in regular PA over the next month." All items were rated using a 7-point Likert-type scale ranging from 1 (no plans) to 7 (detailed plans).

Data Analyses

Our pilot trial had 80% power to detect only a large standardized effect size of 1.0 for our primary and secondary outcomes using a two-tailed test with α=0.05. [29] Given that this was a feasibility study with a small sample size, no adjustment was made for multiple testing and the results were interpreted for both statistical significance, as well as patterns of change that were considered potentially meaningful. Since there are no meaningful cutpoints established for the TPB variables, we adopted the cutpoints for health outcomes where an effect size of 0.33 or one third standard deviation appears to be a benchmark for potentially meaningful differences.[30] All statistical analyses were performed using SPSS 20 (SPSS Inc., Chicago, IL). For all analyses, the intention-to-treat approach was adopted to include all participants in their randomized condition who provided 4-week or 12-week data.

Baseline comparisons were performed using analysis of variance (ANOVAs). Analyses of covariance (ANCOVAs) were used to assess motivational outcomes between the SPA+EC versus the SPA+BC group from baseline to 4-weeks (post-intervention), and from baseline to 12-week follow-up. Due to the small sample size in the pilot study, only the baseline value of the outcome measure was used as a covariate for change scores.

7-3. RESULTS

Participant flow through the trial and a detailed description of the demographic and medical profile of the participants have been reported elsewhere.[16] Briefly, of the original 1,985 mailed surveys, 703 were returned completed and 380 KCS expressed interest in participating in a future PA study. From the 380 interested participants, 105 participants resided in Edmonton, Alberta and were contacted about the TRACKS Trial. Of the 105 KCS mailed recruitment packages, 14 were returned to sender due to wrong address or deceased. Of the 91 recruitment packages, 32 KCS were interested and randomized in the trial (16 in each group), generating a 35.2% response rate (32/91). Overall, the mean age was 61.8 ± 9.8, 50.0% were male, mean BMI was 29.1 ± 5.6, mean number of months since diagnosis was 74.0 ± 38.9, 96.9% were disease-free, 96.9% had received surgery, and 93.8% had localized kidney cancer.

We previously assessed the representativeness of our sample where we compared KCS who participated in the trial with those who declined participation in the trial, and these findings have been reported elsewhere.[16] In brief, participants in the TRACKS trial did not differ in terms of age, sex, fatigue levels, number of comorbidities, disease stage, systemic therapy, and months since diagnosis, but they were less likely to rate their general health as good, had a lower body mass index, and were more likely to be meeting PA guidelines.

Changes in TPB Constructs

Tables 1 and 2 provide the changes in the TPB variables from baseline to 4-weeks (postintervention) and from baseline to 12-week follow-up, respectively, by group assignment. At postintervention, significant medium effect size differences were noted for planning (mean change=+1.0; 95% CI=0.2 to 1.9; d=+.55; p=.017), perceived control (mean change=+0.5; 95% CI=0.2 to 0.9; d=+.61; p=.005), and self-efficacy (mean change=+0.6; 95% CI=-0.1 to 1.3; d=+.57; p=.078) that favored the SPA+BC group. At postintervention, small effect size differences were noted for affective attitude that were potentially meaningful (mean change=-0.3; 95% CI=-0.8 to 0.2; d=-.32; p=.19). No differences were observed for intention (p=.94), instrumental attitude (p=.91), and injunctive (p=.98) and descriptive norm (p=.92). At 12-week follow-up, there were no statistical differences between groups on any motivational variable, but there were meaningful small to medium effect size differences for affective (mean change=-0.6; 95% CI=-1.4 to 0.2; d=-.55; p=.13) and instrumental attitude (mean change=-0.4; 95% CI=-1.3 to 0.4; d=-.31; p=.38), and injunctive norm (mean change=+0.3; 95% CI=-0.3 to 0.8; d=+.40; p=.32), although this was not statistically significant.).

Changes in Salient PA Beliefs

Tables 3 and 4 provide the changes in behavioral beliefs from baseline to 4-weeks (postintervention) and from baseline to 12-week follow-up, respectively, by group assignment. At postintervention and 12-week follow-up, there were no significant differences in behavioral beliefs observed. There were meaningful small effect size group differences for losing weight (mean change=+0.4; 95% CI=-0.3 to 1.0; d=+.47; p=.22), improving strength (mean change=-0.3; 95% CI=-0.7 to 0.2; d=-.32; p=.25), and lowering blood pressure (mean change=+0.6; 95% CI=-0.5 to 1.7; d=+.35; p=.25) at postintervention. At 12-week follow-up, there were meaningful small effect size group differences for feeling good/better (mean change=-0.3; 95% CI=-1.2 to 0.7; d=-.32; p=.54), improving fitness (mean change=-0.3; 95% CI=-1.2 to 0.6; d=-.37; p=.55), and increasing flexibility (mean change=-0.5; 95% CI=-1.5 to 0.4; d=-.41; p=.26).

Tables 5 and 6 provide the changes in affective beliefs at baseline to 4-weeks (postintervention) and at baseline to 12-week follow-up, respectively for the SPA+EC versus SPA+BC group. At postintervention, significant small effect size differences were noted in ‘exercising with others’ (mean change=+0.8; 95% CI=0.1 to 1.6; d=+.42; p=.021) and ‘team sports’ (mean change=+0.8; 95% CI=-0.1 to 1.7; d=+.48; p=.082, borderline) that favored the SPA+BC group. Also, a significant large effect size differences were observed for ‘good weather’ (mean change=+1.0; 95% CI=0.3 to 1.7; d=+.82; p=.008) that favored the SPA+BC group. Potentially meaningful group differences were noted for participating in a variety of activities (mean change=+0.4; 95% CI=-0.6 to 1.3; d=+.44; p=.41), exercising outdoors (mean change=+0.5; 95% CI=-0.2 to 1.2; d=+.46; p=.17), and doing an activity that was fun/enjoyable (mean change=+0.4; 95% CI=-0.3 to 1.0; d=+.40; p=.21). At 12-week follow-up, potentially meaningful group differences were observed for exercising with others (mean change=+0.6; 95% CI=-0.0 to 2.2; d=+.32; p=.43), doing a variety of activities (mean change=+0.8; 95% CI=-0.4 to 1.9; d=+.88; p=.19), exercising outdoors (mean change=+0.4; 95% CI=-1.1 to 1.9; d=+.37; p=.59), good weather (mean change=+0.6; 95% CI=-0.4 to 1.6; d=+.49; p=.23), and doing an activity that was fun/enjoyable (mean change=+0.5; 95% CI=-0.4 to 1.3; d=+.50; p=.28).

Tables 7 and 8 provide the changes in control at baseline to 4-weeks (postintervention) and at baseline to 12-week follow-up, respectively for the SPA+EC versus SPA+BC group. At postintervention, significant medium effect size differences were noted in being confident that KCS were able to exercise when tired/fatigued (mean change=+0.8; 95% CI=0.1 to 1.5; d=+.55; p=.030), being busy or having limited time (mean change=+0.7; 95% CI=-0.1 to 1.5; d=+.58; p=.097, borderline), having long work hours (mean change=+1.1; 95% CI=0.1 to 2.1; d=+.69; p=.037), and having other commitments (mean change=+1.0; 95% CI=0.3 to 1.8; d=+.71; p=.010) that favored the SPA+BC group. Potentially meaningful group differences were noted in being confident that KCS were able to exercise having family responsibilities (mean change=+0.5; 95% CI=-0.4 to 1.5; d=+.36; p=.27). At 12-week follow-up, there were no significant differences between the groups for the control beliefs. However, potentially meaningful differences were noted in being confident that KCS were able to exercise when tried/fatigued (mean change=+0.6; 95% CI=-0.4 to 1.5; d=+.41; p=.22), were busy or having limited time (mean change=+0.6; 95% CI=-0.7 to 1.9; d=+.49; p=.38), having family responsibilities (mean change=+0.6; 95% CI=-0.7 to 1.8; d=+.43; p=.37), bad weather (mean change=+0.3; 95% CI=-0.7 to 1.4; d=+.32; p=.52), and having other commitments (mean change=+0.7; 95% CI=-0.3 to 1.7; d=.+50; p=.18). It is important to note that we did not analyze normative beliefs given that less than 10% of the sample completed this section. Many of the referents were not applicable to KCS in this trial including spouse, coworkers, neighbors, and church group.

7-4. DISCUSSION

The primary purpose of this study was to determine the effects of adding behavioral counseling to supervised exercise on motivational outcomes in KCS. In support of our hypotheses, we found that KCS in the SPA+BC group reported significantly higher planning, perceived control, and self-efficacy at postintervention. However, these effects were no longer evident at 12-weeks follow-up. There was a trivial effect size increase for descriptive norm, and a small effect size increase for injunctive norm that were changing in the right direction favoring the SPA+BC group. We also found significant improvements for group differences in select affective beliefs including exercising with others, good weather, and participating in team sports that favored the SPA+BC group. These effects however, were also no longer significant or meaningful at 12-week follow-up. There were no significant effects on behavioral beliefs between the two groups, however all behavioral beliefs, with the exception of improving strength and increasing flexibility, had changes that favored the SPA+BC group. Again, these effects were no longer evident at 12-week follow-up. Moreover, there were significant medium effect size differences that favored the SPA+BC group for control beliefs including being confident they could exercise when tired/fatigued, having long work hours, and having other commitments at postintervention, with no significant effects at 12-week follow-up.

Research examining the impact of supervised exercise implementing a behavioral counseling component on motivational outcomes has been scant in cancer populations, making comparative evaluations difficult. However, there has been support for motivational counseling in other clinical populations including patients with coronary artery disease where those who received a theory-based motivational counseling intervention (i.e., ecological perspective) were more physically active at follow-up compared to usual care. [31]

Perhaps the most relevant behavior change intervention among cancer survivors was the 16-week PA intervention that targeted the theoretical tenets of the TPB among pediatric cancer survivors. [32] The researchers delivered a PA intervention designed to influence PA levels that included a 30-minute educational session, 45 minutes of aerobic training, and 15 minutes of strength and flexibility training. Educational sessions targeted the core variables of TPB including long-term benefits of PA, goal setting and planning, self-monitoring, and overcoming barriers. At postintervention, change scores revealed a meaningful effect for only behavioral intention. It is important to note that Keats & Culos-Reed [21] evaluated a single-group intervention with pediatric cancer survivor, and was not a RCT. Previous trials among breast cancer survivors[22, 24] and lymphoma patients [7] revealed stronger intentions after the intervention. Vallance et al. [22] examined a TPB-based behavior change intervention in 377 breast cancer survivors to determine the effects of breast-cancer specific PA print materials versus a step pedometer, or their combination compared to a standard care group on PA behavior. The intervention groups was superior to the standard care group in intention, with intentions and planning partially attenuating the effect of the intervention on PA behavior at 12-week follow-up. However, Vallance et al. [22] evaluated print-based materials with no supervised PA component.

Jones et al. [24] was a three-armed trial design for 329 breast cancer survivors who were randomly assigned to receive an oncologist exercise recommendation only, an oncologist recommendation plus referral to an exercise specialist, or to usual care. The researchers found that breast cancer survivors who received an oncologist's recommendation to exercise reported more positive intentions to exercise compared to those who did not receive a recommendation. Again, there were differences in our study compared to Jones et al.'s study where they evaluated an oncologist recommendation intervention on breast cancer survivors, and was not a supervised PA program.

Moreover, Courneya et al. [20] examined the effects of a 12-week supervised exercise program compared with usual care on 122 lymphoma patients, and found that supervised exercise resulted in stronger intentions. The findings from these studies were inconsistent with our finding as we did not find a significant effect between the two groups at postintervention for intention. In our study, more than half of the participants were already achieving public health PA guidelines and had extremely high levels of intention reported at baseline (i.e., 6.4/7). Therefore, changes are likely due to a ceiling effect and low variability in the intention component. In addition, it is also important to note that KCS remained highly motivated at postintervention (i.e., 6.6/7) suggesting that this was a highly motivated group that just needed additional strategies to maintain these levels after the intervention was complete. It is noteworthy that although the findings from the above mentioned studies are inconsistent with our results, the research design, counseling methods, and cancer survivor group were very different. Although Courneya et al. [20] did evaluate a supervised PA program in lymphoma patients, the program did not include a behavioral counseling component.

Our study did find significant improvements for planning, perceived control, and self-efficacy at postintervention that favored the SPA+BC group more than the SPA+EC group. This is consistent with previous trials with a supervised PA component with breast cancer survivors, [23, 33] lymphoma patients, [20] and lung cancer survivors. [19] Courneya et al. [23] examined exercise beliefs based on the TPB after a 15-week exercise intervention and found positive increases on perceptions of control at postintervention among breast cancer survivors. Specifically, breast cancer survivors were extremely confident they could exercise if the weather was bad, they had limited time, or they became tired or fatigued.

Also, Courneya et al.[20] found that a 12-week supervised exercise intervention resulted in stronger intentions, PBC, and self-efficacy which was borderline significant among breast cancer survivors. Rogers et al.[33] used the social cognitive theory to examine the effects of a 12-week behavior change intervention that included a supervised exercise component and counseling sessions which resulted in lower barrier interference at postintervention. Peddle-McIntyre et al.[19] examined the effects of a 10-week supervised progressive resistance training program on 15 lung cancer survivors and found improvements in self-efficacy and PBC after the intervention. Self-efficacy is theorized to be influenced by mastery of performance, social modeling, and physiological arousal.[34] Following the TRACKS trial, KCS demonstrated significant improvements in the 6-minute walk test. Cardiovascular fitness and physical functioning tests also revealed improvements, although not significant. Therefore, it is not surprising that KCS were able to feel a sense of personal accomplishment and mastery of aerobic training. Moreover, the TRACKS trial provided positive social modeling where KCS were able to see other cancer survivors successfully achieving the PA program goals, which contributed to a positive vicarious experience. KCS also received positive reinforcement from the PA specialist, which can have an effect on self-efficacy. Finally, KCS may have been able to interpret emotional and physiological signs of exercise such as increased heart rate, breathing rate, muscle soreness, and sweating as positive signs that their body is responding appropriately to exercise.

In terms of perceived control, there were several positive features of the TRACKS trial that may have influenced this outcome. For example, we provided a one-on-one face-to-face supervised PA session that was supplemented with behavioral counseling that addressed how KCS can anticipate and overcome their own personal barriers to PA. We also provided an individualized PA prescription that was based on the fitness level of the participant, and free access to a gym facility and parking to facilitate their PA program. KCS were also shown how to use a variety of PA equipment and how to progress through their program safely and effectively, eliminating the daunting nature of beginning a PA program.

In terms of planning, constant discussion was inherent throughout the SPA+BC group where the PA specialist worked with the participant to seek opportunities outside the facility to engage in PA. Moreover, the TRACKS trial included unsupervised, home-based workouts during the 4-week intervention where participants were required to meet their PA prescription on their own, and thus they had to develop a plan of where they would fulfill the home-based workout. Finally, during the last week of the supervised PA session, KCS in the SPA+BC group completed a through a detailed planning worksheet where they were asked to develop a plan of ‘when’, where’, ‘how’, and ‘what PA they were planning to engage in during the 8-week home-based program to fulfill the goal of the intervention. These elements of the TRACKS trial program may have facilitated the improvements in the planning construct that favored the SPA+BC group. Moreover, our findings are also consistent with other clinical populations including cardiac patients. In a systematic review examining behavior change trials to increase PA in cardiac patients, Ferrier and colleagues [35] found that in the post-cardiac rehabilitation context, behavior change trials that placed an emphasis on self-monitoring of PA, having the patient set specific PA goals, identifying barriers and developing plans for relapse prevention were most frequently associated with positive PA outcomes. In the non-cardiac rehabilitation context, home-based programs that included follow-up prompts, general encouragement, specific goals set by the researchers and self-monitoring were most often associated with increased PA.

The ability of the TRACKS trial to influence planning, perceived control, and self-efficacy, but not intention warrants discussion. According to Ajzen,[10] intentions capture the motivational factors that influence behavior where they are indicators of how hard individuals are willing to try, as well as how much effort they will invest to perform the behavior. In the TPB, the lack of actual control over a behavior reduces the predictive validity of intentions.[10] There has been debate regarding the distinction of forming intentions, which is primarily a motivational process, versus implementing it, which is a volitional process. Sheeran and Orbell [36] argue that the assumption that intentions can achieve long-range prediction is unrealistic given the differences between volition and intentions. This is further supported by Chatzisarantis et al.,[37] where they found discriminant validity between intentions, volitional intentions, and forced intentions, and a significant contribution of volitional intentions and forced intentions to the prediction of effort. Our study found that the intervention was able to produce changes in planning suggesting that it may not be the motivational component that is influencing KCS to initiate in PA behavior, but the volitional strategies of planning by which KCS need to engage in to successfully produce behavior change. In previous research, Conner et al. [38] suggested that much of the intention-behavior gap has been shown to be attributable to strong intenders not acting rather than nonintenders who do act, therefore, when such strong intenders form action plans they are significantly more likely translate intentions into behavior and reduce the intention-behavior discordance.[38] In our study, there was a ceiling effect for the intention construct, suggesting that the majority of KCS were strong intenders for engaging in PA in both intervention groups, however it was the planning strategies present in the SPA+BC group that eventually resulted in behavior change.

At 12-week follow-up, there as a slight increase in injunctive norm that favored the SPA+BC group compared to the SPA+EC group, suggesting that KCS were able to obtain social support for participating in PA throughout the program. Affective attitude demonstrated potentially meaningful group differences at postintervention and 12-week follow-up where there was a decrease in the SPA+BC group. There were also potentially meaningful group differences for instrumental attitude and injunctive norm at 12-week follow-up. It is possible that KCS were not as concerned with the enjoyable aspects of PA, as they are with the benefits of PA. This finding is interesting and may be due to differences in health and age of KCS compared to other cancer survivor groups. KCS are more likely to be overweight and have one or more established comorbidities due to their older age. Therefore, KCS are more likely to be concerned about how PA may influence their health such as preventing further functional and mobility declines, rather than how to make PA fun. For example, KCS may engage in PA to help reduce their weight, lower blood pressure and cholesterol levels, control their current comorbidities, and to prevent the addition of other health issues that may be associated with inactivity.

Another important finding was that the effect of the TRACKS trial on motivational outcomes was not significant at the 12-week follow-up. This is consistent with a previous supervised exercise trial in lymphoma patients, where Courneya et al. [20] found that the supervised exercise program resulted in stronger intentions, perceived control, and self-efficacy after intervention, but only the effect of perceived control was maintained at 6-month follow-up. This is a common finding among PA behavior change trials and suggests that sustained motivation through PA supervision and counseling is what maintains the behavioral changes after supervised PA is complete. At postintervention, KCS were asked to exercise on their own for the 8-week home-based program. This alone could account for the TPB variables dissipating at 12-week follow-up since KCS were transitioning from a structured, supervised PA program to self-directed, unsupervised PA. These changes do reflect the reality of these supervised PA programs, and thus strategies are needed to maintain PA motivation after the short-term effects of a supervised PA program begin to decline.

Future research aimed at sustaining motivation following a supervised PA intervention should consider gradually reducing supervision over time, as well as maintaining some contact (i.e., telephone counseling) to maintain ongoing support for KCS. Future PA interventions should consider extending the length of the supervised PA program to increase the number and intensity of the behavioral counseling strategies offered. Although the effects of the motivational outcomes were no longer significant at 12-week follow-up, the addition of behavioral counseling to a supervised PA program attenuated the decline in the TPB constructs compared to the exercise counseling group.

Very few trials have examined motivational outcomes at the belief-level. Analyzing data at the belief-level allows for the identification of intervention components or materials that were effective at influencing behavior change. It also offers important insight into targeting specific beliefs that would not have been otherwise apparent at the aggregate level. [22] In the TRACKS trial, several affective and control beliefs demonstrated significant improvements favoring the SPA+BC group compared to the SPA+EC group. In particular, affective beliefs about ‘exercising with others’ and ‘good weather’ were positively influenced by the intervention. Promising group differences were also observed for doing a variety of activities, exercising outdoors, and doing an activity that was fun and enjoyable, which favored the SPA+BC group. Affective attitude has been shown to improve following a supervised PA program in lung cancer survivors [19] and breast cancer survivors, [23] but it is interesting that our intervention did not find an improvement in affective attitude.

Our belief-level findings are also inconsistent with a previous study examining TPB beliefs among breast cancer survivors, where several key behavioral and control beliefs mediated the effect of the print-based PA intervention on intentions.[22] However, a previous study examining the correlates of PA behavior in KCS by our research group found that instrumental attitude, but not affective attitude was a significant correlate of intention,[18] suggesting that it is the benefits of PA that are more important than the fun/enjoyable aspects of PA. Nevertheless, we did find improvements in affective beliefs suggesting that after undergoing a supervised PA program, KCS perceived the program to be enjoyable because they were able to exercise with others, which may include other cancer survivors in the facility. In addition, KCS perceived the program to be enjoyable due to good weather and being able to exercise outdoors, and this may have been due to the majority of the home-based workouts being completed outdoors since the study took place during the summer months. In addition, KCS had the option of choosing a variety of equipment to meet their PA prescription in the facility and for their home-based workouts. These effects did not remain significant at 12-week follow-up, but there were promising group differences that had a small to large effect size noted for exercising with others, doing a variety of activities, exercising outdoors and in good weather, and doing an activity that was fun and enjoyable, which favored the SPA+BC group. This suggests that KCS did not find the PA program to be as enjoyable when it was self-directed and they were on their own to achieve the intervention goal. However, the purpose of adding behavioral counseling to supervised PA was to prevent further declines in some of these salient beliefs for PA.

Control beliefs about KCS being confident to engage in PA when they were ‘feeling tired/fatigued,’ ‘having long work hours,’ and ‘having other commitments' also demonstrated significant differences that favored the SPA+BC group at postintervention. Potentially meaningful group differences that had a small to medium effect size were noted for KCS being confident that they were able to engage in PA when they were busy and had limited time, and had family responsibilities, which favored the SPA+BC group. This suggests that KCS in the SPA+BC group felt more confident to engage in PA given the anticipated barriers that they may encounter. The findings from the belief-level analyses were consistent with a previous behavior change trial among breast cancer survivors where control beliefs of 'having additional family responsibilities' and 'didn't fit routine' were key beliefs that mediated the effect of the intervention on intentions. [22] Given that self-efficacy and perceived control exhibited significant improvements at postintervention for KCS, it is not surprising that select control beliefs aligned quite well with the global TPB construct of PBC. Again, these effects were no longer significant at 12-week follow-up, but there was a small to medium effect size noted in KCS being able to exercise when busy or having limited time, having family responsibilities, presence of bad weather, and having other commitments that were promising. A possible explanation may have to do with the assessment of PBC in the trial. At baseline, PBC was assessed for the supervised PA program, where KCS already knew that they were receiving individualized training and prescription by a PA specialist and a gym facility available to them. At 12-week follow-up, PBC was assessed by how confident the participant is to engage in regular PA over the next 3 months, in which they would carry out their PA program at home without support of a supervised PA program. Moreover, adding behavioral counseling to supervised PA prevented further declines in confidence to engage in PA at 12-week follow-up, where KCS felt that were confident to exercise on their own because they had the appropriate strategies to overcome barriers. Future research should continue developing interventions targeting specifically at the relevant beliefs over a longer period, as well as with a larger sample to test for possible mediation of the effect of the underlying beliefs on PA behavior.

It is interesting to note that in a previous study conducted to examine the correlates of PA using the TPB in KCS revealed significant model pathways to PA from PBC, intention, and planning, where intention emerged as the strongest correlate. In terms of planning, there was a significant pathway to planning from intention. In addition, there were significant model pathways to intention for which PBC was the strongest correlate followed by instrumental attitude and descriptive norm.[18] Our trial was successful in changing planning and PBC and its associated underlying beliefs, but these changes resulted in small differences in behavior change as noted in our primary outcome study.[16] Unfortunately, our trial was unable to change intention, instrumental attitude, and descriptive norm constructs. This suggests that future research may need to focus on increasing the intensity of the counseling sessions to target the relevant beliefs to induce behavior change.

Our trial should be interpreted within the context of important strengths and limitations. To the best of our knowledge, our study is the first examine the effects of adding behavioral counseling to supervised PA on motivational outcomes in KCS. It is also one of the few RCTs to examine the underlying salient beliefs of PA behavior change. Other strengths include testing a validated two-component model of the TPB, and a well-designed supervised PA intervention comparing two type of counseling with high study completion rate and limited loss-to-follow-up. However, we do acknowledge the limitations of our study, which include the relatively short-term intervention with limited follow-up, the small sample size, and our limited power to examine mediation of the intervention effect on TPB variables for PA. It is also important to consider the selection bias of the trial given that half of KCS enrolled in the trial were already meeting public health PA guidelines and were highly motivated. Cost effectiveness was not assessed in this study, but future research should consider whether adding behavioral counseling to supervised PA would be economically efficient in achieving changes in PA. These studies should take into account the costs associated with personnel, facilities, intervention material, and intervention time required for the delivery of additional counseling sessions and supervised PA.

In conclusion, the TRACKS trial provides preliminary evidence that adding behavioral counseling to supervised PA had some positive effects on motivational outcomes, and that the TPB is a useful model for developing PA behavior change interventions in KCS. Our data suggest that future behavior change interventions should consider targeting select behavioral, affective, and control beliefs to enhance motivation among KCS. For example, strategies that focus on how to obtain social support for exercise and having access to a variety of low-cost exercise options that may include group classes to make it more enjoyable. Strategies on how to overcome anticipated barriers may be helpful in influencing PBC. In addition, detailed planning including when, where, how, and what kind of PA to engage in, as well as goal setting may be effective in translating intentions into behavior. Future research is warranted given the lack of research in motivational outcomes with RCTs. Studies should consider longer-term follow-up to determine motivational outcomes for PA maintenance. Research is also needed to determine the content, intensity (i.e., dose), duration, and frequency of behavioral counseling sessions and the amount of ongoing support required to impact motivation. Overall, the findings from the TRACKS trial provide the necessary foundation to develop larger, randomized controlled trials that may improve the health and fitness of KCS.

Table 7-1. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Theory of Planned Behavior Variables at Postintervention in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	Postintervention	Mean Change	[1]Adjusted Between Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
Intention						
SPA+EC (n=15)	6.2 (0.9)	6.5 (0.8)	+0.3 [-0.1 to 0.6]	-0.0 [-0.4 to 0.4]	.94	-.02
SPA+BC (n=14)	6.4 (0.7)	6.6 (0.5)	+0.1 [-0.2 to 0.5]			
Planning						
SPA+EC (n=15)	4.6 (2.0)	5.1 (1.5)	+0.5 [-0.4 to 1.4]	+1.0 [0.2 to 1.9]	.017	+.55
SPA+BC (n=14)	4.2 (2.1)	6.0 (1.0)	+1.8 [0.9 to 2.8]			
Perceived control						
SPA+EC (n=15)	5.1 (0.7)	4.7 (0.5)	-0.4 [-0.8 to -0.0]	+0.5 [0.2 to 0.9]	.005	+.61
SPA+BC (n=14)	4.7 (0.3)	5.2 (0.4)	+0.5 [0.1 to 0.9]			
Self-efficacy						
SPA+EC (n=15)	5.9 (0.9)	5.6 (1.2)	-0.3 [-0.8 to 0.3]	+0.6 [-0.1 to 1.3]	.078	+.57
SPA+BC (n=14)	6.2 (0.8)	6.3 (0.4)	+0.1 [-0.4 to 0.7]			
Affective Attitude						
SPA+EC (n=15)	5.5 (1.1)	5.7 (0.7)	+0.2 [-0.3 to 0.7]	-0.3 [-0.8 to 0.2]	.19	-.32
SPA+BC (n=14)	5.7 (0.9)	5.4 (0.7)	-0.3 [-0.8 to 0.2]			
Instrumental Attitude						
SPA+EC (n=15)	6.2 (0.9)	6.4 (1.3)	+0.2 [-0.2 to 0.6]	-0.0 [-0.5 to 0.4]	.91	-.03
SPA+BC (n=14)	6.6 (0.4)	6.5 (0.4)	-0.1 [-0.5 to 0.3]			
Injunctive Norm						
SPA+EC (n=15)	6.3 (0.8)	6.0 (0.7)	-0.2 [-0.6 to 0.1]	+0.0 [-0.5 to 0.5]	.98	+.01
SPA+BC (n=14)	6.5 (0.6)	6.2 (1.0)	-0.3 [-0.7 to 0.1]			
Descriptive Norm						
SPA+EC (n=15)	5.0 (1.6)	4.7 (1.5)	-0.3 [-0.7 to 0.2]	+0.0 [-0.5 to 0.6]	.92	+.03
SPA+BC (n=14)	5.0 (1.6)	4.7 (1.2)	-0.2 [-0.7 to 0.2]			

Note: SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling. [1]Difference in mean change adjusted for baseline value.

Table 7-2. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Theory of Planned Behavior Variables at 12-Week Follow-Up in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	12-Week Follow-Up	Mean Change	[1]Adjusted Between Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
Intention						
SPA+EC (n=15)	6.2 (0.9)	6.0 (1.2)	-0.2 [-0.9 to 0.4]	-0.1 [-1.0 to 0.8]	.78	-.09
SPA+BC (n=14)	6.4 (0.7)	6.0 (1.5)	-0.4 [-1.0 to 0.3]			
Planning						
SPA+EC (n=15)	4.6 (2.0)	5.4 (1.8)	+0.7 [-0.4 to 1.9]	+0.3 [-1.0 to 1.5]	.67	+.14
SPA+BC (n=14)	4.2 (2.1)	5.5 (1.6)	+1.3 [0.1 to 2.5]			
Perceived control						
SPA+EC (n=15)	5.1 (0.7)	4.7 (0.7)	-0.4 [-0.9 to 0.2]	+0.1 [-0.5 to 0.6]	.75	+.10
SPA+BC (n=14)	4.7 (0.3)	4.9 (0.7)	+0.2 [-0.3 to 0.7]			
Self-efficacy						
SPA+EC (n=15)	5.9 (0.9)	5.5 (1.5)	-0.4 [-1.2 to 0.4]	+0.1 [-1.1 to 1.2]	.93	+.07
SPA+BC (n=14)	6.2 (0.8)	5.7 (1.7)	-0.5 [-1.3 to 0.4]			
Affective Attitude						
SPA+EC (n=15)	5.5 (1.1)	5.7 (1.3)	+0.2 [-0.4 to 0.8]	-0.6 [-1.4 to 0.2]	.13	-.55
SPA+BC (n=14)	5.7 (0.9)	5.3 (1.2)	-0.5 [-1.0 to 0.1]			
Instrumental Attitude						
SPA+EC (n=15)	6.2 (0.9)	6.2 (1.3)	+0.0 [-0.5 to 0.6]	-0.4 [-1.3 to 0.4]	.31	-.38
SPA+BC (n=14)	6.6 (0.4)	6.3 (1.3)	-0.4 [-0.9 to 0.2]			
Injunctive Norm						
SPA+EC (n=15)	6.3 (0.8)	5.9 (0.8)	-0.3 [-0.7 to 0.1]	+0.3 [-0.3 to 0.8]	.32	+.40
SPA+BC (n=14)	6.5 (0.6)	6.3 (0.8)	-0.2 [-0.6 to 0.3]			
Descriptive Norm						
SPA+EC (n=15)	5.0 (1.6)	4.9 (1.5)	-0.2 [-0.7 to 0.4]	+0.1 [-0.7 to 0.8]	.87	+.10
SPA+BC (n=14)	5.0 (1.6)	4.9 (1.7)	-0.1 [-0.6 to 0.5]			

Note: SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling. [1]Difference in mean change adjusted for baseline value.

Table 7-3. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Behavioral Beliefs at Postintervention in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	Postintervention	Mean Change	[1]Adjusted Between Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
Lose weight/control weight						
SPA+EC (n=15)	5.9 (0.9)	5.6 (1.2)	-0.3 [-0.8 to 0.2]	+0.4 [0.3 to 1.0]	.22	+.47
SPA+BC (n=14)	6.1 (0.8)	6.1 (0.6)	+0.0 [-0.5 to 0.5]			
Improve energy level						
SPA+EC (n=15)	6.0 (1.2)	6.0 (0.8)	+0.0 [-0.5 to 0.5]	+0.3 [-0.2 to 0.8]	.22	+.26
SPA+BC (n=14)	5.8 (1.1)	6.2 (0.6)	+0.4 [-0.1 to 0.1]			
Feel good/better						
SPA+EC (n=15)	6.1 (1.0)	6.1 (0.7)	+0.0 [-0.4 to 0.4]	+0.1 [-0.2 to 0.5]	.43	+.11
SPA+BC (n=14)	6.1 (0.9)	6.2 (0.4)	+0.1 [-0.3 to 0.6]			
Improve strength						
SPA+EC (n=15)	5.9 (1.2)	6.1 (0.8)	+0.1 [-0.3 to 0.6]	-0.3 [-0.7 to 0.2]	.25	-.32
SPA+BC (n=14)	6.3 (0.6)	5.9 (0.5)	-0.4 [-0.8 to 0.1]			
Feel healthier/improve health						
SPA+EC (n=15)	6.1 (1.2)	6.1 (0.7)	+0.0 [-0.5 to 0.5]	+0.2 [-0.3 to 0.6]	.41	+.19
SPA+BC (n=14)	6.3 (0.8)	6.4 (0.5)	+0.1 [-0.5 to 0.6]			
Improve fitness						
SPA+EC (n=15)	6.3 (1.0)	6.2 (0.9)	-0.1 [-0.5 to 0.2]	+0.2 [-0.2 to 0.6]	.29	+.25
SPA+BC (n=14)	6.4 (0.6)	6.4 (0.5)	+0.1 [-0.3 to 0.4]			
Lower blood pressure						
SPA+EC (n=15)	4.5 (1.9)	5.1 (1.6)	+0.6 [-0.5 to 1.7]	+0.6 [-0.5 to 1.7]	.25	+.35
SPA+BC (n=14)	5.4 (1.4)	5.8 (1.0)	+0.4 [-0.7 to 1.6]			
Increase flexibility						
SPA+EC (n=15)	5.3 (1.4)	5.9 (0.8)	+0.6 [-0.1 to 1.3]	-0.1 [-0.8 to 0.5]	.67	-.08
SPA+BC (n=14)	6.3 (0.6)	5.9 (0.7)	-0.4 [-1.0 to 0.3]			

Note: SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling. [1]Difference in mean change adjusted for baseline value.

Table 7-4. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Behavioral Beliefs at 12-Week Follow-Up in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	12-Week Follow-Up	Mean Change	[1]Adjusted Between Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
Lose weight/control weight						
SPA+EC (n=15)	5.9 (0.9)	6.1 (1.5)	+0.2 [-0.4 to 0.8]	-0.2 [-1.0 to 0.6]	.59	-.24
SPA+BC (n=14)	6.1 (0.8)	6.0 (0.8)	-0.1 [-0.7 to 0.5]			
Improve energy level						
SPA+EC (n=15)	6.0 (1.2)	5.9 (1.4)	-0.1 [-0.7 to 0.6]	-0.0 [-0.9 to 0.9]	.96	-.02
SPA+BC (n=14)	5.8 (1.1)	5.8 (1.3)	+0.0 [-0.7 to 0.7]			
Feel good/better						
SPA+EC (n=15)	6.1 (1.0)	6.1 (1.3)	+0.1 [-0.6 to 0.7]	-0.3 [-1.2 to 0.7]	.54	-.32
SPA+BC (n=14)	6.1 (0.9)	5.9 (1.4)	-0.2 [-0.9 to 0.5]			
Improve strength						
SPA+EC (n=15)	5.9 (1.2)	6.0 (1.4)	+0.1 [-0.6 to 0.8]	-0.1 [-1.1 to 0.9]	.83	-.11
SPA+BC (n=14)	6.3 (0.6)	6.1 (1.1)	-0.2 [-0.9 to 0.5]			
Feel healthier/improve health						
SPA+EC (n=15)	6.1 (1.2)	6.1 (1.3)	-0.1 [-0.6 to 0.5]	-0.1 [-0.9 to 0.7]	.80	-.10
SPA+BC (n=14)	6.3 (0.8)	6.1 (1.1)	-0.2 [-0.8 to 0.4]			
Improve fitness						
SPA+EC (n=15)	6.3 (1.0)	6.4 (1.3)	+0.1 [-0.6 to 0.7]	-0.3 [-1.2 to 0.6]	.55	-.37
SPA+BC (n=14)	6.4 (0.6)	6.1 (1.2)	-0.2 [-0.9 to 0.5]			
Lower blood pressure						
SPA+EC (n=15)	4.5 (1.9)	5.1 (1.7)	+0.6 [-0.2 to 1.4]	+0.2 [-0.8 to 1.2]	.66	+.12
SPA+BC (n=14)	5.4 (1.4)	5.7 (1.1)	+0.4 [-0.5 to 1.2]			
Increase flexibility						
SPA+EC (n=15)	5.3 (1.4)	5.8 (1.4)	+0.5 [-0.2 to 1.1]	-0.5 [-1.5 to 0.4]	.26	-.41
SPA+BC (n=14)	6.3 (0.6)	5.9 (1.3)	-0.4 [-1.1 to 0.2]			

Note: SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling. [1]Difference in mean change adjusted for baseline value.

Table 7-5. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Affective Beliefs at Postintervention in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	Postintervention	Mean Change	[1]Adjusted Between Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
Exercise with others						
SPA+EC (n=15)	4.1 (2.2)	3.4 (1.8)	-0.7 [-1.3 to -1.2]	+0.8 [0.1 to 1.6]	.021	+.42
SPA+BC (n=14)	4.3 (1.6)	4.4 (1.4)	+0.1 [-0.5 to 0.6]			
Variety of activities						
SPA+EC (n=15)	5.6 (1.1)	5.0 (1.5)	-0.6 [-1.3 to 0.1]	+0.4 [-0.6 to 1.3]	.41	+.44
SPA+BC (n=14)	5.4 (0.8)	5.3 (1.0)	-0.1 [-0.8 to 0.6]			
Outdoors						
SPA+EC (n=15)	6.2 (1.1)	5.9 (1.1)	-0.7 [-1.3 to -0.0]	+0.5 [-0.2 to 1.2]	.17	+.46
SPA+BC (n=14)	6.2 (1.1)	6.4 (0.7)	+0.4 [-0.2 to 1.1]			
Good weather						
SPA+EC (n=15)	5.9 (1.0)	5.3 (1.2)	-0.6 [-1.1 to -0.2]	+1.0 [0.3 to 1.7]	.008	+.82
SPA+BC (n=14)	5.8 (1.4)	6.2 (0.8)	+0.4 [-0.1 to 0.9]			
Team sports						
SPA+EC (n=15)	2.7 (1.5)	2.1 (1.1)	-0.6 [-1.3 to 0.1]	+0.8 [-0.1 to 1.7]	.43	+.48
SPA+BC (n=14)	2.1 (1.8)	2.6 (1.7)	+0.4 [-0.3 to 1.2]			
Exercise to music						
SPA+EC (n=15)	4.5 (2.1)	4.8 (2.1)	+0.3 [-0.7 to 1.2]	+0.3 [-1.0 to 1.5]	.66	+.15
SPA+BC (n=14)	4.4 (1.9)	5.0 (1.8)	+0.6 [-0.4 to 1.5]			
Fun/enjoyable activity						
SPA+EC (n=15)	6.1 (1.1)	5.5 (0.8)	-0.5 [-1.1 to 0.0]	+0.4 [-0.3 to 1.0]	.21	+.40
SPA+BC (n=14)	6.1 (0.9)	5.9 (1.0)	-1.1 [-0.7 to 0.4]			
Pain-free activity						
SPA+EC (n=15)	5.2 (1.5)	5.5 (1.2)	+0.3 [-0.5 to 1.2]	+0.2 [-0.6 to 0.9]	.63	+.14
SPA+BC (n=14)	5.2 (1.3)	5.7 (0.7)	-0.5 [-0.4 to 1.4]			

Note: SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling. [1]Difference in mean change adjusted for baseline value.

Table 7-6. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Affective Beliefs at 12-Week Follow-Up in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	12-Week Follow-Up	Mean Change	[1]Adjusted Between Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
Exercise with others						
SPA+EC (n=15)	4.1 (2.2)	4.1 (2.1)	+0.0 [-1.3 to 1.3]	+0.6 [-0.9 to 2.2]	.43	+.32
SPA+BC (n=14)	4.3 (1.6)	4.8 (2.1)	+0.5 [-0.8 to 1.8]			
Variety of activities						
SPA+EC (n=15)	5.6 (1.1)	5.1 (1.9)	-0.5 [-1.1 to 0.0]	+0.8 [-0.4 to 1.9]	.19	+.88
SPA+BC (n=14)	5.4 (0.8)	5.7 (1.1)	-0.1 [-0.7 to 0.4]			
Outdoors						
SPA+EC (n=15)	6.2 (1.1)	4.7 (2.2)	-1.5 [-2.5 to -0.4]	+0.4 [-1.1 to 1.9]	.59	+.37
SPA+BC (n=14)	6.2 (1.1)	5.1 (1.8)	-1.1 [-2.2 to 0.0]			
Good weather						
SPA+EC (n=15)	5.9 (1.0)	5.4 (1.7)	-0.5 [-1.3 to 0.2]	+0.6 [-0.4 to 1.6]	.23	+.49
SPA+BC (n=14)	5.8 (1.4)	5.9 (1.1)	+0.1 [-0.7 to 0.9]			
Team sports						
SPA+EC (n=15)	2.7 (1.5)	2.6 (1.7)	-0.1 [-0.8 to 0.7]	-0.3 [-1.3 to 0.7]	.53	-.18
SPA+BC (n=14)	2.1 (1.8)	2.0 (1.4)	-0.1 [-0.9 to 0.7]			
Exercise to music						
SPA+EC (n=15)	4.5 (2.1)	4.9 (2.1)	+0.4 [-0.7 to 1.5]	-0.0 [-1.5 to 1.4]	.99	-.01
SPA+BC (n=14)	4.4 (1.9)	4.9 (2.4)	+0.4 [-0.7 to 1.5]			
Fun/enjoyable activity						
SPA+EC (n=15)	6.1 (1.1)	5.5 (1.4)	-0.6 [-1.3 to 0.1]	+0.5 [-0.4 to 1.3]	.28	+.50
SPA+BC (n=14)	6.1 (0.9)	5.9 (0.8)	-0.1 [-0.9 to 0.6]			
Pain-free activity						
SPA+EC (n=15)	5.2 (1.5)	5.3 (1.7)	+0.1 [-1.0 to 1.1]	+0.4 [-0.8 to 1.6]	.48	+.29
SPA+BC (n=14)	5.2 (1.3)	5.7 (1.3)	+0.5 [-0.6 to 1.5]			

Note: SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling. [1]Difference in mean change adjusted for baseline value.

Table 7-7. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Control Beliefs at Postintervention in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	Postintervention	Mean Change	[1]Adjusted Between Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
Tired/fatigued						
SPA+EC (n=15)	5.5 (1.8)	4.9 (1.1)	-0.5 [-1.3 to 0.2]	+0.8 [0.1 to 1.5]	.030	+.55
SPA+BC (n=14)	5.4 (1.1)	5.7 (0.8)	+0.3 [-0.5 to 1.1]			
Medical/health problems						
SPA+EC (n=15)	4.5 (1.6)	4.2 (1.3)	-0.3 [-1.2 to 0.6]	+0.3 [-0.6 to 1.3]	.49	+.19
SPA+BC (n=14)	4.4 (1.6)	4.5 (1.4)	+0.1 [-0.9 to 1.0]			
Busy/limited time						
SPA+EC (n=15)	5.6 (1.4)	5.1 (1.2)	-0.5 [-1.2 to 0.2]	+0.7 [-0.1 to 1.5]	.097	+.58
SPA+BC (n=14)	5.3 (1.1)	5.7 (0.9)	-0.4 [-0.3 to 1.2]			
Long work hours						
SPA+EC (n=15)	5.1 (1.5)	4.9 (1.6)	-0.3 [-1.3 to 0.7]	+1.1 [0.1 to 2.1]	.037	+.69
SPA+BC (n=14)	5.1 (1.7)	5.9 (0.9)	+0.9 [-0.2 to 1.9]			
Pain/soreness						
SPA+EC (n=15)	4.5 (1.6)	4.2 (1.8)	-0.3 [-1.4 to 0.7]	+0.3 [-1.0 to 1.6]	.66	+.19
SPA+BC (n=14)	4.8 (1.6)	4.6 (1.7)	-0.2 [-1.3 to 0.9]			
Family responsibilities						
SPA+EC (n=15)	5.1 (1.3)	4.9 (1.4)	-0.1 [-0.8 to 0.6]	+0.5 [-0.4 to 1.5]	.27	+.36
SPA+BC (n=14)	4.5 (1.5)	5.1 (1.4)	+0.6 [-0.1 to 1.4]			
Bad weather						
SPA+EC (n=15)	5.9 (1.1)	5.7 (1.2)	-0.1 [-0.8 to 0.5]	+0.2 [-0.6 to 1.1]	.56	+.21
SPA+BC (n=14)	5.4 (0.6)	5.8 (1.0)	+0.4 [-0.3 to 1.0]			
Other commitments						
SPA+EC (n=15)	5.3 (1.6)	4.8 (1.6)	-0.5 [-1.1 to 0.1]	+1.0 [0.3 to 1.8]	.010	+.71
SPA+BC (n=14)	4.8 (1.2)	5.6 (0.8)	+0.8 [0.2 to 1.4]			
Limited/no access to gym						
SPA+EC (n=15)	5.5 (1.3)	5.5 (1.0)	-0.1 [-0.9 to 0.8]	+0.3 [-0.5 to 1.2]	.42	+.19
SPA+BC (n=14)	5.0 (1.9)	5.6 (1.3)	+0.7 [-0.2 to 1.5]			

Note: SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling. [1]Difference in mean change adjusted for baseline value.

Table 7-8. Effects of Supervised Physical Activity Plus Exercise or Behavioral Counseling on Control Beliefs at 12-Week Follow-Up in Kidney Cancer Survivors, Edmonton, Alberta, Canada, June-November 2012.

	Baseline	12-Week Follow-Up	Mean Change	[1]Adjusted Between Group Difference in Mean Change		
Outcome	Mean (SD)	Mean (SD)	Mean [95% CI]	Mean [95% CI]	p-value	Cohen's d
Tired/fatigued						
SPA+EC (n=15)	5.5 (1.8)	4.8 (1.5)	-0.6 [-1.3 to 0.3]	+0.6 [-0.4 to 1.5]	.22	+.41
SPA+BC (n=14)	5.4 (1.1)	5.4 (1.6)	-0.1 [-0.8 to 0.6]			
Medical/health problems						
SPA+EC (n=15)	4.5 (1.6)	4.3 (1.4)	-0.2 [-0.9 to 0.5]	-0.1 [-0.9 to 0.8]	.88	+.06
SPA+BC (n=14)	4.4 (1.6)	4.2 (1.4)	-0.2 [-1.0 to 0.5]			
Busy/limited time						
SPA+EC (n=15)	5.6 (1.4)	4.8 (1.9)	-0.8 [-1.7 to 0.1]	+0.6 [-0.7 to 1.9]	.38	+.49
SPA+BC (n=14)	5.3 (1.1)	5.2 (1.6)	-0.1 [-1.0 to 0.9]			
Long work hours						
SPA+EC (n=15)	5.1 (1.5)	4.6 (2.0)	-0.5 [-1.5 to 0.5]	+0.3 [-1.1 to 1.6]	.70	+.19
SPA+BC (n=14)	5.1 (1.7)	4.8 (1.8)	-0.3 [-1.3 to 0.8]			
Pain/soreness						
SPA+EC (n=15)	4.5 (1.6)	4.4 (1.3)	-0.1 [-1.1 to 0.8]	+0.0 [-1.0 to 1.1]	.96	+.02
SPA+BC (n=14)	4.8 (1.6)	4.5 (1.6)	-0.3 [-1.3 to 0.7]			
Family responsibilities						
SPA+EC (n=15)	5.1 (1.3)	4.9 (1.9)	-0.2 [-1.1 to 0.7]	+0.6 [-0.7 to 1.8]	.37	+.43
SPA+BC (n=14)	4.5 (1.5)	5.1 (1.6)	+0.6 [-0.3 to 1.6]			
Bad weather						
SPA+EC (n=15)	5.9 (1.1)	5.5 (1.6)	-0.4 [-1.1 to 0.3]	+0.3 [-0.7 to 1.4]	.52	+.32
SPA+BC (n=14)	5.4 (0.6)	5.5 (1.2)	+0.1 [-0.7 to 0.8]			
Other commitments						
SPA+EC (n=15)	5.3 (1.6)	4.9 (1.4)	-0.3 [-1.1 to 0.5]	+0.7 [-0.3 to 1.7]	.18	+.50
SPA+BC (n=14)	4.8 (1.2)	5.4 (1.3)	+0.6 [-0.2 to 1.5]			
Limited/no access to gym						
SPA+EC (n=15)	5.5 (1.3)	5.1 (1.7)	-0.4 [-1.4 to 0.6]	+0.3 [-0.9 to 1.4]	.62	+.19
SPA+BC (n=14)	5.0 (1.9)	5.3 (1.2)	+0.3 [-0.7 to 1.4]			

Note: SPA+EC=Supervised physical activity plus exercise counseling; SPA+BC=Supervised physical activity plus behavioral counseling. [1]Difference in mean change adjusted for baseline value.

REFERENCES

1. Chow W, Dong LM, Devesa SS. Epidemiology and risk factors for kidney cancer. *Nat Rev Urol*. 2010;7:245-257.

2. 1. Canadian Cancer Society's Steering Committee on Cancer Statistics. *Canadian Cancer Statistics 2012*. Toronto: Canadian Cancer Society; 2012.

3. Mishra SI, Scherer RW, Geigle PM, et al. Exercise interventions on health-related quality of life for cancer survivors. *Cochrane Database Syst Rev*. 2012;8:CD007566.

4. Trinh L, Plotnikoff RC, Rhodes RE, North S, Courneya KS. Associations between physical activity and quality of life in a population-based sample of kidney cancer survivors. *Cancer Epidemiol Biomarkers*. 2011;20(5):859-868.

5. Schmitz KH, Courneya KS, Matthews C, et al. American College of Sports Medicine roundtable on exercise guidelines for cancer survivors. *Med Sci Sports Exerc*. 2010;42:1409-1426.

6. Rock CL, Doyle C, Demark-Wahnefried W, et al. Nutrition and physical activity guidelines for cancer survivors. *CA Cancer J Clin*. 2012;62(4):242-274.

7. Courneya KS, Sellar CM, Stevinson C, et al. Randomized controlled trial of the effects of aerobic exercise on physical functioning and quality of life in lymphoma patients. *J Clin Oncol*. 2009;27:4605-4612.

8. Courneya KS, Segal RJ, Mackey JR, et al. Effects of aerobic and resistance exercise in breast cancer patients receiving adjuvant chemotherapy: a multicenter randomized controlled trial. *J Clin Oncol*. 2007;25:4396-4404.

9. Pinto BM, Ciccolo JT. Physical activity motivation and cancer survivorship. *Recent Results Cancer Res*. 2011;186:367-387.

10. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991;50:179-211.

11. Downs DS, Hausenblas HA. The Theories of Reasoned Action and Planned Behavior Applied to Exercise: A Meta-analytic Update. *Journal of Physical Activity & Health*. 2005;2:76-97.

12. Hagger MS, Chatzisarantis NLD, Biddle SJH. A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: predictive validity and the contribution of additional variables. *J Sport Exercise Psychol*. 2002;24:3-32.

13. Rhodes RE, Plotnikoff RC, Courneya KS. Predicting the physical activity intention-behavior profiles of adopters and maintainers using three social cognition models. *Ann Behav Med*. 2008;36:244-252.

14. Sheeran P, Milne S, Webb TL, Gollwitzer PM. Implementation intentions and health behaviour. In: Conner M, Norman P, editors. *Predicting health beahviour.* Second ed. New York: Open University Press; 2005. p. 276-323.

15. Gollwitzer PM. Implementation intentions: strong effects of simple plans. *American Psychologist*. 1999;54:493-503.

16. Trinh L, Plotnikoff RC, Rhodes RE, North S, Courneya KS. Feasibility and preliminary efficacy of adding behavioral counseling to supervised physical activity in kidney cancer survivors: A randomized controlled trial. *In preparation.*

17. Trinh L, Plotnikoff RC, Rhodes RE, North S, Courneya KS. Physical activity preferences in a population-based sample of kidney cancer survivors. *Support Care Cancer*. 2012;20:1709-1717.

18. Trinh L, Plotnikoff RC, Rhodes RE, North S, Courneya KS. Correlates of physical activity in a population-based sample of kidney cancer survivors: an application of the theory of planned behavior. *Int J Behav Nutr Phys Act*. 2012;9:96.

19. Peddle-McIntyre C, Bell G, Fenton D, McCargar L, Courneya KS. Changes in motivational outcomes after a supervised resistance exercise training intervention in lung cancer survivors. *Cancer Nurs*. 2013;36:27-35.

20. Courneya KS, Stevinson C, McNeely ML, et al. Effects of Supervised Exercise on Motivational Outcomes and Longer-Term Behavior. *Med Sci Sports Exerc*. 2012;44:542-549.

21. Keats MR, Culos-Reed N. A Theory-Driven Approach to Encourage Physical Activity in Pediatric Cancer Survivors: A Pilot Study. *J Sport Exercise Psychol*. 2009;31:267-283.

22. Vallance JKH, Courneya KS, Plotnikoff RC, Mackey JR. Analyzing theoretical mechanisms of physical activity behavior change in breast cancer survivors: results from the activity promotion (ACTION) trial. *Ann Behav Med*. 2008;35:150-158.

23. Courneya KS, Jones LW, Mackey JR, Fairey AS. Exercise Beliefs of Breast Cancer Survivors Before and After Participation in a Randomized Controlled Trial. *Int J Behav Med*. 2006;13:259-264.

24. Jones LW, Courneya KS, Fairey AS, Mackey JR. Does the theory of planned behavior mediate the effects of an oncologist's recommendation to exercise in newly diagnosed breast cancer survivors? Results from a randomized controlled trial. *Health Psychol*. 2005;24:189-197.

25. Vallance JKH, Courneya KS, Plotnikoff RC, Yasui Y, Mackey JR. Randomized controlled trial of the effects of print materials and step pedometers on physical activity and quality of life in breast cancer survivors. *J Clin Oncol*. 2007;25:2352-2359.

26. Karvinen KH, Courneya KS, Plotnikoff RC, Spence JC, Venner PM, North S. A prospective study of the determinants of exercise in bladder cancer survivors using the Theory of Planned Behavior. *Support Care Cancer*. 2009;17:171-179.

27. Ajzen I. Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior. *J Appl Soc Psychol*. 2002;32:665-683.

28. Rise J, Thompson M, Verplanken B. Measuring implementation intentions in the context of the theory of planned behavior. *Scand J Psychol*. 2003;44:87-95.

29. Cohen J. *Statistical Power Analysis for the Behavioral Sciences.* Second ed. Hillsdale: Erlbaum; 1988.

30. Brucker PS, Yost K, Cashy J, Webster K, Cella D. General population and cancer patient norms for the Functional Assessment of Cancer Therapy-General (FACT-G). *Eval Health Prof*. 2005;28:192-211.

31. Reid RD, Morrin LI, Higginson LAJ, et al. Motivational counselling for physical activity in patients with coronary artery disease not participating in cardiac rehabilitation. *Eur J Prev Cardiol*. 2012;19:161-166.

32. Keats MR, Culos-Reed S. A community-based physical activity program for adolescents with cancer (project TREK): program feasibility and preliminary findings. *J Pediatr Hematol Oncol*. 2008;30:272-280.

33. Rogers LQ, Markwell S, Hopkins-Price P, et al. Reduced Barriers Mediated Physical Activity Maintenance Among Breast Cancer Survivors. *J Sport Exercise Psychol*. 2011;33:235-254.

34. Bandura A. Health Promotion by Social Cognitive Means. *Health Education & Behavior*. 2004;31:143-164.

35. Ferrier S, Blanchard CM, Vallis M, Giacomantonio N. Behavioural interventions to increase the physical activity of cardiac patients: a review. *Eur J Cardiovasc Prev Rehabil*. 2011;18:15-32.

36. Sheeran P, Orbell S. Do intentions predict condom use? Meta-analysis and examination of six moderator variables. *Br J Soc Psychol*. 1998;37(Pt 2):231-250.

37. Chatzisarantis NLD, Frederick C, Biddle SJH, Hagger MS, Smith B. Influences of volitional and forced intentions on physical activity and effort within the theory of planned behaviour. *J Sports Sci*. 2007;25:699-709.

38. Conner M, Sandberg T, Norman P. Using Action Planning to Promote Exercise Behavior. *Annals of Behavioral Medicine*. 2010;40:65-76.

8: CHAPTER 8

DISCUSSION

8-1. OVERVIEW

The purpose of this dissertation was to design and implement a behaviour change to examine the effects of adding behavioural counseling to a standard supervised exercise program on changes in self-reported physical activity (PA). The advantages of adding behavioural counselling are that it confronts participants with their own personal reasons and barriers to adopting a PA program compared to offering generic educational materials. The Trying Activity in Kidney Cancer Survivors (TRACKS) Trial, which to the best of our knowledge, is the first randomized controlled trial (RCT) of a PA intervention in kidney cancer survivors (KCS). The TRACKS Trial was informed by the theoretical determinants based on Chapter 5 (Study 1) and PA preferences of KCS based on Chapter 4 (Study 1).

8-2. STRENGTHS AND LIMITATIONS

The main strengths and limitations of each of the studies in the dissertation have been presented in each chapter. Overall, a major strength of the dissertation was the process used to guide the development of the behaviour change trial. The dissertation collected preliminary data on the association between PA and QoL in KCS to determine if health promotion efforts are warranted in this population (Chapter 2, Study 1). Following a positive dose-response relationship found between PA and QoL, Chapter 3 (Study 1) identified the PA programming and counselling preferences of KCS to enhance intervention efforts based on the specific needs, interests, and preferences of KCS. Chapter 4 (Study 1) determined the most important social cognitive correlates of PA intentions and behaviour based on the Theory of Planned Behaviour (TPB) to determine the most important targets for change in the development of the TRACKS trial. The TRACKS trial was also theoretically-based which provides a foundation to understand the mechanisms that influence behaviour change (1). Behaviour change interventions can improve effectiveness by including program elements and techniques on changing the underlying cognitive variables known to be associated PA. The TPB has been shown to be a robust model and has gained theoretical support in the PA and cancer domain (1). Another major strength of the dissertation is that this is the first study to examine PA in KCS. Previous studies in kidney cancer have focused on the prevention aspects of cancer and were mainly observational cohort studies (2). The series of studies in the dissertation have focused on KCS examining novel aspects of promoting PA among this population.

Furthermore, a major strength of the dissertation that culminated in the design of the TRACKS trial was the addition of a behavioural counselling component to supervised PA and the rigorous comparison group, which is the first attempt at empirically evaluating a behaviour change trial in KCS. The well-designed two-armed, single blind RCT comparing two types of counselling, in addition to supervised PA, was able to elicit changes in PA that favoured the SPA+BC group. Other strengths of our study included face-to-face supervised PA sessions, the theoretically-based intervention content, high rates of adherence and measurement completion rates, intention-to-treat analysis, and trivial loss-to-follow-up. The strengths of the trial provide valuable information on the design of optimal programs for increasing PA that effectively targets the relevant determinants in KCS. Also, KCS involved in the trial had various comorbidities and fitness abilities where they were appreciative of the personalized nature and delivery of the program, rather than a generic prescription. Future interventions should continue to create personalized PA programs for KCS to maximize fitness and health gains.

The limitations to the TRACKS trial were the relatively short-term intervention with limited follow-up, the small sample size, and our limited power to examine mediation of the intervention effect on TPB variables for PA. It was also important to note the selection bias of the trial given that half of KCS enrolled in the trial were already meeting public health PA guidelines, were highly motivated, and already had favourable beliefs about PA. This factor may have influenced our findings, and thus our results may have been stronger if we had a sample with less motivated KCS. The selection bias was also inherent in the recruitment methods where we only invited KCS who indicated that they were willing to participate in a future PA study from Study 1. This may affect the generalizability of the trial findings, as it underscores the importance in appealing to KCS that are less inclined to participate in trials of a similar nature. Another limitation of the TRACKS trial was that the majority of the intervention was conducted in the warmer months (June-November), where it is unknown if the intervention would be equally effective during the winter months.

The largest limitation in the overall dissertation was the reliance on self-reported measures of PA and sitting time, which could introduce measurement error and reporting biases. Future studies should consider using objective measures of PA and sitting time (i.e., accelerometry) to obtain more complete data including energy expenditure. Other limitations include the focus on only the survivorship phase of the cancer control framework (3). To gain a comprehensive understanding of how PA influences kidney cancer, research efforts are warranted across all phases of the cancer continuum including the treatment phase and the palliative phase.

8-3. FUTURE RESEARCH DIRECTIONS

The findings from the cross-sectional survey and the behaviour change intervention that encompass this dissertation provide insight into future research directions that warrant further investigation. To the best of our knowledge, there are currently no studies examining PA among KCS. Future research should continue examining other health outcomes related to PA and/or sitting time in KCS, other than QoL. For example, research efforts can focus on novel health outcomes including kidney function (i.e., glomerular filtration rate) and survival, as well as biological mechanism including insulin levels, oxidative stress levels, and obesity-related inflammation that underlie the relationship between obesity and cancer.

As mentioned previously, to obtain a complete understanding of how PA influences kidney cancer, research efforts should be conducted across the cancer continuum including the treatment phase. Given that the symptoms most evident with kidney cancer treatments include pain, fatigue, worry, depression, and sleep disturbance (4), it would be imperative to examine the role of PA in symptom management. The relationship between sitting time and treatment-related symptoms may also provide important insight in the deleterious effects of this behaviour, independent of PA.

Future research in PA promotion strategies with KCS should examine an array of PA determinants that not only includes medical, demographic, and social cognitive correlates, but also other factors such as the perceived and built environment. It would also be important to note that the majority of research to date has applied the TPB as a framework for understanding PA in cancer survivors. In order to determine the theoretical frameworks that are most effective for influencing PA levels among KCS, an examination of other social cognition models (i.e., transtheoretical model, social cognitive theory) is warranted.

Furthermore, given that the TRACKS trial is the first study to evaluate a behaviour change trial on changes in self-reported PA, future research should continue building upon the TRACKS trial by implementing a larger scale, multi-centre trial. Based on the promising pilot data, increasing the sample size may be able to generate enough power to detect clinically meaningful changes in fitness and health outcomes. Additional research is also warranted to establish the maintenance of PA levels after short-term interventions. For example, future studies should consider extending the length of the face-to-face counselling sessions to increase the intensity of the behavioural strategies being delivered. Maintaining a tapered contact throughout the home-based component either through face-to-face and/or telephone counseling may contribute to longer-term PA maintenance. Distance-based strategies (i.e., internet-based resources) should also be incorporated into behaviour change trials to maintain contact and provide a source of motivation once the intervention is over. The mode of exercise should also be considered where aerobic PA may be supplemented with resistance training in future trials to improve health and fitness outcomes in KCS. In terms of sitting time, future behaviour change trials should also implement behavioural counselling strategies to reduce and break up sitting time.

Finally, in terms of our measurement tools, future studies should continue using the FACT scales and SF-36 to assess QoL given that we did see positive changes in the right direction favoring the SPA+BC group compared to the SPA+EC group. These scales appear to be appropriate since they capture cancer-specific QoL and specific concerns that KCS may experience through the FKSI-15 scale, as well as generic QoL. In terms of objective measures of physical functioning, the six minute walk test (6MWT) should be used in future studies to complement our measure of cardiorespiratory fitness (VO2max). The 6MWT is attractive because it is self-paced and is a good indicator of aerobic fitness for KCS who are older, where mobility issues may be present. However, other measures of the Seniors' Fitness Test (SFT) designed to capture physical function related to upper and lower body strength and flexibility may not be necessary to include in future studies that focus on aerobic PA only. Given the lack of a resistance or flexibility component in the TRACKS trial, it is not surprising that these parameters did not produce a significant effect between the groups.

Future studies should consider developing strategies to understand the behavioural beliefs of those who are less motivated to participate in a PA program. The selection bias may affect the generalizability of these findings across KCS given our inability to attract those who are less inclined to participate. Finally, a cost-effectiveness strategy should be implemented in future behaviour change trials to determine the economical value of these interventions in public and health care settings based on the requirements for personnel, equipment, intervention material, and the time associated with the delivery of the trial components.

8-4. PRACTICAL IMPLICATIONS

Although research in PA and KCS is preliminary in nature, the dissertation reported an improvement in QoL observed among KCS who reported some PA but less than meeting the public health PA guidelines. This finding has practical implications in the development of appropriate PA interventions in this population where PA does not necessarily need to be performed at a high volume for survivors to derive benefit. Beginning a PA program at lower levels of frequency, intensity, and duration may be less daunting and more attainable for many KCS who are completely sedentary, and may still potentially improve QoL. KCS also expressed an interest in PA programs designed specifically for their cancer group, and that they felt able to participate in this type of program. These results suggest that health care professionals and practitioners should consider appropriately designed interventions that target the most important correlates of PA (e.g., PBC, planning) to facilitate motivation. For example, practitioners can assist KCS in adopting strategies to anticipate and overcome their personal barriers to PA. Also, developing an effective plan for PA that includes goal setting may be essential for improving long-term PA adoption. These programs should also reflect the current fitness levels of KCS given the number of comorbidities present. Gradually increasing the PA prescription as tolerated by KCS to meet the public health PA guidelines could improve adherence to PA. Finally, a home-based component following supervised PA provides KCS with the opportunity to engage in PA in their own environment, although it may be necessary to consider providing continued contact by the PA specialist to sustain motivation.

8-5. CONCLUSIONS

Improvements in survival rates of KCS, coupled with the low rates of PA participation has prompted research efforts in promoting PA in this understudied cancer survivor group. The dissertation is an advancement over previous studies in behaviour change trials among cancer survivors (5-11) in that it includes a rigorous comparison group that also receives supervised PA rather than the standard of care, and that it examines the addition of behavioural counselling to supervised PA. Specially, theory-based behaviour change interventions may potentially improve QoL and increase PA levels in this population. The dissertation provides preliminary evidence that PA is associated with positive changes in QoL that develops the rationale for health promotion efforts in KCS. The findings in PA-related preferences and social cognitive correlates of PA provide the foundation for determining important targets for change among interventions. The TRACKS trial has provided promising findings that suggest that adding behavioural counselling to supervised PA has the potential to influence the adoption of PA and physical function. It also demonstrates that the TPB framework is useful for understanding the mechanism for behaviour change.

Although behavioural counselling does have an impact on PA levels in KCS, the results from the TRACKS trial reveal that the effects on fitness, health, and behavioural outcomes are not maintained once the intervention is complete. This suggests that future interventions need to incorporate strategies that may include longer-term follow-up and maintaining a tapered contact system to sustain PA and QoL among KCS.

REFERENCES

1. Pinto BM, Ciccolo JT. Physical activity motivation and cancer survivorship. Recent Results Cancer Res. 2011;186:367-87.

2. Leitzmann MF. Physical activity and genitourinary cancer prevention. In: Courneya KS, Friedenreich CM, editors. Physical activity and cancer. New York: Springer; 2011. p. 43-72.

3. Courneya KS, Friedenreich CM. Physical activity and cancer control. Semin Oncol Nurs. 2007;23(4):242-52.

4. Harding G, Cella D, Robinson D Jr, Mahadevia PJ, Clark J, Revicki DA. Symptom burden among patients with renal cell carcinoma (RCC): Content for a symptom index. Health Qual Life Outcomes. 2007;5. doi:10.1186/1477-7525-5-34.

5. Basen-Engquist K, Taylor CLC, Rosenblum C, Smith MA, Shinn EH, Greisinger A, et al. Randomized pilot test of a lifestyle physical activity intervention for breast cancer survivors. Patient Educ Couns. 2006;64(1-3):225-34.

6. Matthews CE, Wilcox S, Hanby CL, Der Ananian C, Heiney SP, Gebretsadik T, et al. Evaluation of a 12-week home-based walking intervention for breast cancer survivors. Support Care Cancer. 2007;15(2):203-11.

7. Pinto BM, Frierson GM, Rabin C, Trunzo JJ, Marcus BH. Home-based physical activity intervention for breast cancer patients. J Clin Oncol. 2005;23(15):3577-87.

8. Jones LW, Courneya KS, Fairey AS, Mackey JR. Effects of an oncologist's recommendation to exercise on self-reported exercise behavior in newly

diagnosed breast cancer survivors: A single-blind, randomized controlled trial. Ann Behav Med. 2004;28(2):105-13.

9. Vallance JKH, Courneya KS, Plotnikoff RC, Yasui Y, Mackey JR. Randomized controlled trial of the effects of print materials and step pedometers on physical activity and quality of life in breast cancer survivors. J Clin Oncol. 2007;25(17):2352-9.

10. Rogers LQ, Hopkins-Price P, Vicari S, Pamenter R, Courneya KS, Markwell S, et al. A randomized trial to increase physical activity in breast cancer survivors. Med Sci Sports Exerc. 2009;41(4):935-46.

11. Taylor CLC, Demoor C, Smith MA, Dunn AL, Basen-Engquist K, Nielsen I, et al. Active for life after cancer: A randomized trial examining a lifestyle physical activity program for prostate cancer patients. Psychooncology. 2006;15(10):847-62.

Appendix A

Literature Review in Kidney Cancer and Physical Activity

TABLE OF CONTENTS

Treatment of Kidney Cancer

Complementary and alternative methods.

Complementary methods refer to treatments that are used along with the standard medical care, whereas alternative treatments are used instead of a conventional medicine. Most complementary treatment methods are not offered as cures for cancer. Mainly, they are used to relieve some of the side effects. Some methods that are used along with regular treatment are meditation to reduce stress, acupuncture to help relieve pain, or peppermint tea to relieve nausea. Some complementary methods are known to help, while others have not been tested (1).

In kidney cancer, there has been limited research showing a direct link between nutrients and herbs with treatment. However, some key natural substances show promise in providing overall kidney health support. Alpha-lipoic acid is an antioxidant nutrient that reduces oxidative stress in the kidneys, which may result in decreased inflammation and may improve response to treatment and survival (2). Green tea extracts may be beneficial as it contains an active ingredient, Epigallocatechin-3-gallate (EGCG) that regulates the p53 tumor suppressor gene, which is the most frequently mutated gene in human cancers. EGCG increases apoptosis, or death of tumor cells, by generating healthy, unmutated p53 (2). An amino acid known as L-camitine is synthesized in the kidneys, and has been shown to improve kidney function in people with kidney disease and dialysis, as well as chronic kidney failure (2). Improving kidney function may in turn be advantageous to those with kidney cancer. Further, melatonin was reported to be synergistic with interferon in metastatic RCC.

However, melatonin may exaggerate some of the adverse side effects of IL-2, and thus it should not be taken by those undergoing this treatment. Panax ginseng has demonstrated that it can inhibit RCC by inhibiting proliferation (2).

Finally, some potential vitamins such as vitamins A and D can be beneficial to those with kidney cancer. Individuals with kidney cancer have been found to exhibit low levels of vitamin A and zinc. Both of these nutrients aid in apoptosis, and thus supplementing these two nutrients would stimulate apoptosis in existing tumors, although this theory remains unproven (2). On the other hand, vitamin D inhibits proliferation of cancer cells by terminating their ability to divide and replicate, supports apoptosis, and reduces angiogenesis. It also increases insulin sensitivity, thereby reducing production of insulin-like growth factors and improving sugar metabolism (2). These complementary approaches to kidney cancer should be proceeded with caution as many of them are hypothesized and have yet to undergo rigorous research trials.

Alternative treatments may be offered as cancer cures, but these treatments have not been proven safe and effective in clinical trials. Some of these methods may have adverse side effects and negative interactions (3). Although these therapies have been used widely by patients, it has been subject to debate, since it has been noted that they are no more effective than placebo (3), and should be used in an evidence-based manner.

Risk Factors for Kidney Cancer

Although a variety of risk factors have been implicated as causal agents in the development of RCC, the etiology, nonetheless, is still not well understood (4-6).

Smoking.

Perhaps the most well established risk factor for RCC is cigarette smoking (7). It is thought that 20-30% of all RCC is due to smoking (8). A meta-analysis of 24 studies revealed that compared with lifetime non-smokers, smokers increased the RCC risk by 54% among men and 22% among women (9). A dose-response pattern of risk was evident, with risk doubling among men and increasing 58% among women who smoked more than a pack of cigarettes per day (9). In addition, many case-control studies have cigarette smoking clearly increases the risk for RCC, with estimated relative risks ranging from 1.24 to 2.3 (7). Smoking cessation reduces the risk by 25-30%, but only among long-term quitters of 10 or more years (7, 10). In addition to carcinogens in tobacco smoke, cigarette smoking is hypothesized to increase RCC risk through chronic tissue hypoxia caused by smoking-related conditions such as chronic obstructive pulmonary disease and exposure to carbon monoxide (8, 10).

Obesity.

Consistent positive associations between RCC and obesity have been reported among both men and women, with an increased risk among women (11-15). Relative risk calculations range from 1.9 to 5.9 (7, 16), with the risk rising with increasing body mass index (BMI) (17, 18). A meta-analysis of data from prospective observational studies estimated that the risk of developing RCC increased 24% and 34% for men and women, respectively, for every 5 kg/m^2 increase in BMI (19). The pathophysiology underlying the association between obesity and RCC risk is not well understood. However, several mechanisms have been proposed including higher estrogen and insulin levels, release of adipose tissue growth factors, cholesterol metabolism abnormalities, hypertension and immune malfunction (10, 15, 18).

Diet.

Related to obesity, dietary factors may increase or decrease risk of RCC, but this remains unclear (8). Increased intake of fruits and vegetables has consistently been associated with decreased risk of RCC, but what specific nutrients are responsible for this are unknown (7, 20). It is thought that the protective effects of antioxidants such as vitamins A, C, and E and carotenoids reduce this risk (8). Alcohol consumption has been inversely associated with RCC in a number of recent cohort studies (21-24), although the association is not statistically significant or is observed only in subgroups of subjects with certain age or BMI level in some studies (22, 24). Furthermore, total fluid intake from all beverages, including coffee, tea, milk, juice, soda and water, has not been consistently linked to risk (24).

Hypertension.

Sufficient evidence from cohort studies has accumulated linking hypertension reported at baseline to subsequent RCC incidence (10). Cohort studies with blood pressure measurements taken at baseline clinic visits have generally shown increasing risk of RCC with increasing blood pressure (10). Compared with individuals with normal blood pressure, those with the highest blood pressure (≥100 mm Hg diastolic pressure or ≥160 mm Hg systolic pressure) were found to have twofold or higher risks. Use of diuretics and other antihypertensive medications have also been linked with an elevated risk, but this association is likely confounded by a history of hypertension (10).

Other preexisting conditions and medication use.

Increased incidence of RCC has been observed among patients on long-term hemodialysis and those with acquired cystic kidney disease (4, 7). About 5-9% of the patients with acquired cystic disease will develop RCC, showing a higher incidence than the general population (20). Excess risks have also been observed with kidney stones and infection, however, the findings have not been consistent (4). Elevated RCC occurrence has also been reported among patients with end-stage renal disease waiting renal transplant, as well as renal transplant patients (10) .

Diabetes is also considered an emerging risk factor for RCC, and it may be related to both hypertension and obesity (4). However, recent studies have suggested that diabetes may not be an independent risk factor since its association with RCC was found to be insignificant after adjusting for obesity and hypertension (10).

A variety of medications have also been implicated as risk factors for RCC, including phenacetin-containing analgesics, acetaminophen and diuretics, although research in this area still remains unclear (7, 10).

Genetic factors.

There are unmodifiable risk factors that exist which increase the relative risk of RCC significantly. Von Hippel-Lindau (VHL) disease is an autosomal dominant disorder which affects approximately one in 40,000 individuals (7). It is caused by a mutation of the von Hippel-Lindau gene, which encodes a tumor suppressor protein (7). This protein takes part in cell cycle regulation and angiogenesis (20). Forty to sixty percent of the patients with VHL disease present an RCC, although they are usually low-grade tumors (20). Familial papillary renal cell syndrome is a rare group of disorders characterized by an early onset of papillary RCC, which tend to be multifocal and bilateral. These disorders are autosomal dominant (7). In addition, familial clear cell RCC is a hereditary from of multiple, bilateral clear cell RCC, but without any clinical evidence of suffering the VHL disease (20). Multiple cutaneous and uterine leiomyomatosis is also an autosomal dominant tumor syndrome characterized by benign leiomyomas in the skin and uterus, which show increased risk of type 2 papillary RCC (8, 20).

Tuberous sclerosis is a much more common disorder associated with clear cell RCC, with an incidence between 2-4% (7, 8). It affects one in 10,000 individuals (7). Phenotypically, this disease is characterized by the formation of multiple benign hamartomas, especially in the central nervous system, where they cause seizures and mental deficiency. Hamartomas are also found in the kidney, where they are known as angiomyolipomas, in which they tend to cause hemorrhage (7).

Finally, Brit-Hogg-Dube syndrome is a dominantly inherited predisposition to benign fibrofolliculomas (hair follicle tumors) and other benign tumors of the skin and soft tissue, as well as colon polyps and lung cysts (7). There is increased incidence of renal tumors, which can be clear cell, papillary, or chromophobe tumors or oncocytomas (7).

Occupational exposures.

Although RCC is not considered an occupational disease, several occupationally derived exposures have been implicated as a risk factor, including asbestos, gasoline fumes, chlorinated solvents, diesel exhaust, high levels of ionizing radiation, polycyclic aromatic hydrocarbons (PAHs), printing and dyes, cadmium, and lead (4, 8). These risk factors have all been suggested as causative factors but have not been conclusively demonstrated. If any effects exist, it is likely to be small and require additional factors for development of RCC (8).

Physical activity.

Evidence linking physical activity (PA) to the reduction of RCC risk is emerging. Data from the most recent cohort studies suggest an inverse association between RCC risk and leisure time and/or occupational activity levels, although other studies have reported no association. The inverse trend was observed for current exercise, routine PA, recreational activity, or a composite of energy expenditure in a typical day. It has also been suggested that PA during adolescence may have a bearing on RCC later in life, but more studies need to be conducted to confirm the findings (10). PA may decrease RCC risk through a number of related pathways, including decreasing body weight and blood pressure, improving insulin sensitivity, and reducing chronic inflammation and oxidative stress (10). A more detailed analysis of the studies examining the association between PA and RCC risk is presented in the next section.

Physical Activity and Kidney Cancer Prevention

PA has been hypothesized to decrease the risk of RCC through reductions in body fat, blood pressure, and concentrations of circulating growth factors (25). However, the lack of literature about the relationship between PA and RCC risk yields inconclusive evidence. To our knowledge, there have only been 16 epidemiologic studies that have examined the association between PA and RCC risk (12, 14, 21, 25-37), but the results have been mixed. Of those 16 studies, one study (28) was an extension of a previous study (12). Of these, nine were case-control studies from 267-1,732 cases and 267-3,106 controls (12, 26-32, 38), with four studies (30-32, 37) showing a positive association between recreational PA (30, 32) or occupational PA (31, 37) and the reduction of RCC risk in men and/or women, whereas five showed no association with either occupational or leisure-time PA (12, 26, 28, 29, 37).

Eight prospective cohort studies have also examined the association between PA in relation to RCC with cohorts ranging from 3686-41,836 (14, 18, 21, 25, 27, 33, 34, 36), and of these, five studies found a protective effect with increased PA (14, 21, 25, 27, 33, 34), whereas the other three studies found PA to be unrelated to RCC risk (27, 35, 36). Mahabir et al. (27) found a protective effect with increased leisure-time PA, but not occupational PA.

Previous studies have yielded inconsistent results with some studies reporting no association between PA and RCC risk (26, 12, 27-29, 35, 36). In contrast, other studies have found a positive association between PA and RCC risk for both men and women (30), only women (21, 25, 32, 34) and only men (14, 27, 31, 33, 36). In terms of PA type, occupational PA reduced the risk of RCC in some studies (27, 31, 33), whereas other studies found leisure-time PA to reduce the risk of RCC (14, 25, 30, 32, 34). Tavani et al. (37) showed no association between leisure-time PA and RCC risk, but found a positive association between occupational PA and RCC risk.

In summary, there was an estimated average 8% RCC risk reduction with high versus low PA. This magnitude of risk reduction was slightly more pronounced in case control than cohort studies, for recreational than occupational activity, and for PA performed during late that early adulthood (38). In addition, PA performed during adolescence was also related to a reduction in RCC risk (25). Possible explanations for this finding is that adolescent PA may act as a proxy for activity undertaken during a longer span of time, perhaps including the early years of adulthood (25).

Some biologic mechanisms have been proposed by which increased PA may be linked to a risk reduction in RCC. PA may reduce lipid peroxidation (39), a process which may increase the frequency of DNA mutations in renal cells and thus promote RCC growth (39). PA is also associated with a decrease in serum insulin levels (40). Low insulin levels result in slower proliferation of renal cell cancer in vitro (40). RCC is also one of the cancer sites that have been most consistently observed to be associated with obesity (26). Since energy expenditure is an important determinant of weight and obesity, it is plausible that PA plays a role in the development of RCC (33).

Despite these plausible biologic mechanisms, inconsistent findings have been found between PA and RCC risk with previous studies, and may be due to the inadequate sample size influencing sufficient statistical power to detect a potential association, and failure to adjust for potential confounders such as body mass index (BMI), which was present in two studies (29, 33). Also, few studies have examined both occupational and leisure-time PA with the same sample. Future research is warranted to confirm these results and to understand the underlying mechanisms involved. Specifically, data should be collected on all types of activity (recreational, occupational and household) with measures of duration and intensity at various periods of life on the risk of RCC, as well as potential confounders.

Prevalence and Determinants of Physical Activity in Cancer Survivors

Despite the well established benefits of PA for cancer survivors (e.g., decreased side effects, increased QoL, increased chemotherapy completion rates), a large proportion of cancer survivors do not engage in regular PA (41). Most recent research has adopted the public health guidelines established by the 2008 Physical Activity Guidelines for Americans (42), which have also been recommended for cancer survivors by the American Cancer Society (43) and the American College of Sports Medicine (44). These guidelines suggest that individuals should obtain 75 minutes of vigorous PA per week, 150 minutes of moderate PA per week or an equivalent combination. Although these guidelines are likely appropriate for cancer survivors who have completed their primary treatments and are considered disease-free, it is unclear if they are appropriate for cancer patients currently receiving intensive treatments or having existing disease (45).

In a comprehensive prevalence study, Coups and Ostroff (46) used data from the 2000 National Health Interview Survey (NHIS) to examine the prevalence of behavioural risk factors (e.g., smoking, physical inactivity) among a sample of 32,346 adults, 1646 of whom were cancer survivors. The researchers reported no differences in exercise participation rates between cancer survivors and non-cancer controls in the younger (18-39 years) and older (65+ years) cohorts but did report a significant difference in the middle-aged (i.e., 40-64 years) cohort. Specifically, approximately 31% of the middle-aged non-cancer controls were physically active compared to just 25% of middle-aged cancer survivors. The low rate of exercise participation was consistent across cancer survivor subgroups and ranged between 20 and 30%.

In another population-based prevalence investigation, Bellizzi et al. (47) extended the focus of previous population-based studies by combining 4 years of NHIS providing sufficient power for identifying subgroup (cancer type) differences in health behaviours among 7,384 cancer survivors and 121,347 non-cancer controls. This research also examined health behaviours by time since diagnosis to assess patterns of health behaviours in survivors. The proportion of cancer survivors who met public health guidelines for PA was 29.6%, compared with 36.6% for those without a history of cancer. Specifically, 37.6% of younger cancer survivors (i.e., 18-40 years) were more likely to meet the public health recommendations for PA compared with 33% of middle-aged survivors (i.e., 40-64 years), and 24.9% of older survivors (i.e., 65 years of age and older).   In terms of time since diagnosis, survivors 2 to 4 years after diagnosis and 5 to 9 years after diagnosis were more likely to meet PA recommendations (32.6% and 33.3%, respectively) compared with survivors less than 1 year from diagnosis (26.9%) and 1 year after diagnosis (27.7%). Another noteworthy finding was that survivors 5 to 9 years after diagnosis were more likely to meet PA levels (33.3%) compared with those survivors more than 10 years from diagnosis (29.5%). Across cancer survivor subgroups, a higher proportion of breast (28.7%), prostate (30.1%), and gynecologic (29.4%) cancer survivors were meeting current PA recommendations compared with the other sites.

This study found cancer survivors were more likely to meet recommended levels of PA compared with controls, whereas the study by Coups and Ostroff (46) reported no significant differences between survivors and controls across the three age cohorts, with the exception of the higher prevalence of PA in 40- to 64-year old survivors (25.8%) compared with controls (30.8%). Differences found between studies may be due to Bellizzi et al. (47) adjusting for statistically significant differences in reported functional limitations between survivors and controls.

Given the low rate of PA participation in many cancer survivor groups both during and after treatments, identifying and understanding the determinants of PA is essential for informing the design of health-promotion strategies aimed at increasing PA in this population. Theory-driven research has been more valuable in changing health-related behaviour than atheoretical approaches (48), as they help inform the development and evaluation of interventions (49). Most recent research in the determinants of PA in cancer survivors has employed validated social cognitive models of human motivation and behaviour, most notably the Theory of Planned Behaviour (TPB) (50), to facilitate understanding of PA. Overall, the TPB has been demonstrated to be a robust model for understanding PA behaviour across a broad range of nonclinical and clinical populations (51) including cancer patients (52-54).

The TPB proposes that a person's *intention* to perform a behaviour is the immediate proximal predictor of that behaviour as it reflects the level of motivation a person is willing to exert to perform the behaviour (50). Intention is theorized to mediate the influence of three main constructs on behaviour: attitude, subjective norm, and perceived behavioural control (PBC). Attitude reflects a positive or negative evaluation of performing the behaviour, and has both instrumental (e.g., harmful/beneficial) and affective (e.g., boring/enjoyable) components. Subjective norm is defined as the perceived social pressure to perform the behaviour, and includes both *injunctive* (e.g., what significant others think the person ought to do) and *descriptive* (e.g., what significant others themselves do) components. PBC is an evaluation of how easy or difficult it will be to perform a behaviour. Furthermore, the TPB also proposes that attitude, subjective norm, and PBC are determined by underlying salient beliefs (50).

Attitude is characterized by behavioural beliefs, which consist of the perceived advantages and disadvantages of performing a behaviour, as well as the factors that make the behaviour enjoyable and unenjoyable. Subjective norm is determined by normative beliefs that are formed by an individual's perception that significant others think s/he should engage in a behaviour. Control beliefs are established from an individual's perception that s/he has the necessary resources, skills, and opportunities to engage in behaviour, and they formulate the structure for PBC. Finally, the TPB acknowledges that many external factors such as demographic and medical variables may influence individual beliefs about a behaviour and, via the TPB, influence the behaviour itself. Application of the TPB identifies underlying beliefs that determine one's attitude, subjective norm and PBC, and can provide an understanding of the factors that help initiate PA behaviour (50).

To our knowledge, seventeen studies have examined the TPB and PA in cancer survivors in a number of different tumor sites at various stages of the cancer continuum. Of these studies, three examined colorectal cancer survivors (55-57); two examined breast cancer survivors (58, 59); four involved mixed cancer survivors (60-63); and one focused on prostate cancer survivors (64). Single studies have examined NHL survivors (65), multiple myeloma survivors (66), adolescent cancer survivors (67), endometrial cancer survivors (53), brain cancer survivors (68), ovarian cancer survivors (54), and bladder cancer survivors (52). Overall, promising evidence was found for the utility of the TPB framework for understanding PA in cancer survivors in these studies, accounting for 14-37%

of the variance in PA behaviour and 23-68% of the variability in PA intention. However, the constructs that made the most important contributions to predicting PA behaviour and intention varied across cancer survivor groups due to distinct features of each group including symptoms, treatment modalities, side effects, age, and gender.

For example, one of the most recent studies investigated the determinants of PA in 359 ovarian cancer survivors (54). A population-based, cross-sectional, mailed survey of ovarian cancer survivors was conducted, where measures included self-reported PA, medical and demographic factors, and social-cognitive variables from the TPB. In terms of the results from the medical and demographic variables, survivors were more likely to be meeting PA guidelines if they were younger, more highly educated, wealthier, employed, free of arthritis, more than 5 years since diagnosis, had a healthy body-mass index, had early-stage disease, and were currently disease free. Within the TPB framework, results of the hierarchical multiple-regression analysis, indicated that 36% of the variance in PA behaviour was explained with intention being the sole independent correlate. An additional 6% of the variance in PA behaviour was explained when the medical and demographic variables were added to the model, with being disease-free, having a healthy BMI, and being better educated contributing to independent associations with behaviour. However, intention still remained the most important correlate for PA behaviour. For PA intentions, 39% of the variance was explained, with affective attitude being the strongest predictor, followed by instrumental attitude, and PBC, all of which provided independent associations.

The researchers concluded that the TPB is a useful framework to examine motivation for PA in this understudied population.

One of the largest studies to date was a prospective study of 397 bladder cancer survivors (52). Bladder cancer survivors completed a mailed questionnaire at baseline that assessed demographic, medical, behavioural, and TPB variables and a second questionnaire 3 months later that assessed exercise. Multiple regression analyses revealed that intention, PBC, and planning explained 20.9% of the variance in exercise behaviour. On the other hand, instrumental attitude, affective attitude, descriptive norm, and PBC explained 39.1% of the variability in exercise intention, with PBC and affective attitude being the strongest correlates. Two demographic/medical/behavioural variables (i.e., age and adjuvant therapy) moderated some of the relationships between exercise and the TPB. The researchers concluded that the TPB may be an effective framework for understanding and designing exercise interventions among bladder cancer survivors.

Many cancer survivors decrease their frequency of PA after diagnosis, emphasizing the need for intervention. Exercise adherence is a difficult challenge for the general population, and is likely to be even more difficult for cancer survivors, especially after a cancer diagnosis and during medical treatments, as evidenced by the decreases in exercise participation during cancer treatment (41). Although a number of difference cancer types have been explored in previous research, no study to date has examined the determinants of PA in KCS. Thus, it is unknown which TPB constructs, if any, predict PA intention and/or behaviour in this tumour group. Since there are numerous demographic and medical differences between tumor types, it is imperative to collect data on individual cancer groups, rather than attempt to generalize the results from other cancer populations.

Perceived Environment and Physical Activity in Cancer Survivors

Research pertaining to the determinants of PA has previously been focused on determinants at the individual level, thereby neglecting physical environments as influences of PA. It is now established that environments that people build and inhabit provide potential opportunities and barriers to engaging in PA behaviour (69). Previous literature in this area such as primary studies and narrative reviews has yielded ambiguous associations between the perceived environment and PA. Duncan et al. (69) sought to resolve the aforementioned inconsistencies and conducted a meta-analytic review to identify the strength and direction of relationships between characteristics of the perceived environment and PA. The results confirm previous findings that the perceived environment has a modest, yet significant association with PA. This is illustrated by selected environmental variables explaining relatively small amounts of variance (4–7%) in PA. The presence of heavy traffic explained the least amount of variance (R^2 = 0.04), PA facilities and sidewalks explained 5% and 6% of PA variance respectively, whereas shops and services explained the greatest amount, accounting for 7%. The contribution of these potential changes to community behaviour may be great since favorable alterations to communities may induce small changes in behaviours of entire populations. However, the researchers acknowledge that environmental changes may have different effects on various sub-groups of the population, such as cancer survivors. Identifying and modifying environments to produce positive changes in PA among cancer survivors is essential. PA intervention efforts should be theory-based, and one useful framework that has been extensively validated and mentioned previously is the TPB. It seems practical to incorporate environmental variables within this existing frame to further understand and explain PA behaviour (70).

Ajzen (50, 70) acknowledges two paths for the possible integration of the TPB with variables external to the TPB, such as the perceived environment. First, the TPB is considered a proximal model of behavioural action. This suggests that external variables should be mediated by the TPB structure in their relationship with behaviour, and may contribute to additional variance in behaviour. For example, the route whereby the environment influences PA behaviour is through the impact on attitude, subjective norm, and PBC. Second, external variables may moderate the TPB model pathways when predicting behaviour. Since Ajzen (50) does not make any specific references about TPB moderators, the basic constructs of the TPB can generate differences in the predictive strength of its variables (i.e., attitude, subjective norm, PBC, and intention) (71). These variations would be caused by moderators. For example, people who have close and easy access to recreation facilities should follow through with their initial PA plans more than those who do not have easy access because they face fewer geographic barriers to implementing those plans.

To our knowledge, no study to date has examined the role of the perceived environment among cancer survivors, and even more specifically, KCS. However, there have been limited studies examining the prediction of leisure-time walking among the general population using this integrated framework. Results from one study show that the largest predictor of leisure-time walking was an individual's intention to walk. In turn, walking intention was predicted by the effects of walking infrastructure quality and aesthetics which were subsequently mediated by attitudes (72). Furthermore, Rhodes et al., (71) showed that retail land-mix use and neighbourhood aesthetics were associated with walking through affective and instrumental attitudes. Also, those individuals who perceived closer access to recreation facilities had a larger intention-behaviour relationship than those who perceived having more distant access.

McCormack, Spence, Berry, & Doyle-Baker (73) examined the role of PBC in mediating the relationship between perceptions of neighbourhood walkability and frequency of moderate (MODPA) and vigorous PA (VIGPA). Perceived easy access to facilities was associated with participation in VIGPA and MODPA among women and VIGPA among men. Furthermore, Kamphuis et al. (74) reported on how neighbourhood perceptions and individual cognitions influenced socioeconomic differences in recreational walking among 1994 older adults. They found that neighbourhood perceptions (i.e., neighbourhood aesthetics) and individual cognitions (i.e., attitude, social influences, PBC, and intention) made important contributions to socioeconomic differences in recreational walking.

Integrating environmental variables within the TPB model among cancer survivors have been non-existent in the literature, and research in this area would be beneficial for adding breadth and depth to the TPB model. In addition, environmental variables have been independently associated with PA preferences (e.g., indoors versus outdoors) (75). An individual's exercise preferences may influence the effects of an exercise intervention on the individual (e.g., adherence). Therefore, program preferences deserve consideration in a target population before designing interventions, and will be discussed in greater detail in the following section.

Physical Activity Preferences of Cancer Survivors

Despite the potential benefits of PA, low participation rates for PA remain apparent among cancer survivors. This has led researchers to speculate that PA promotion and advocacy efforts may be enhanced by targeting PA interventions to the population group of interest using elicited exercise needs, interests, and preferences (76). Although a number of studies have successfully explored social cognitive correlates of exercise motivation, fewer studies have documented the PA programming and counseling preferences of cancer survivors.

One plausible factor that may influence PA attitudes and motivation is whether or not the program being administered to participants is consistent with their preferences, since tailoring PA programs to the preferences of the target population may increase adoption and maintenance of the program (77). For example, Courneya et al. (78) examined patient preference for different types of exercise training during breast cancer chemotherapy, the adoption of the TPB to understand patient preference, and assessments of beliefs about both types of exercise training to allow a direct comparison of beliefs. The **S**upervised **T**rial of **A**erobic versus **R**esistance **T**raining (START) compared the effects of aerobic exercise training (AET) and resistance exercise training (RET) to usual care in 242 breast cancer patients beginning adjuvant chemotherapy. The researchers found patient preference was strongly related to the motivational difference between the two exercise interventions, which was based on differences in beliefs about the expected benefits, enjoyment, difficulty, and support for engaging in each type of exercise during chemotherapy. Participants that had a preference for RET had significantly more positive beliefs about RET compared to those that preferred AET. Furthermore, participants that preferred RET also had significantly more positive RET beliefs for perceived behavioural control and motivation, and more positive RET beliefs for instrumental attitude and affective attitude in comparison to participants with no preference. Participants with no preference indicated more positive RET beliefs for instrumental attitude, subjective norm, and motivation when compared to participants that preferred AET.

Twelve studies to date have examined PA preferences among cancer survivors, of which three studies have been conducted with breast cancer survivors (75, 79, 80), two studies have been conducted with a sample of mixed cancer group (77, 81), whereas single studies have been examined in other tumor groups including non-Hodgkin’s lymphoma survivors (76), endometrial cancer survivors (82), bladder cancer survivors (83), head and neck cancer survivors (84), brain cancer survivors (85), ovarian cancer survivors (86), and young adult cancer survivors (87).

Among the studies conducted with breast cancer survivors, there was a general consensus that suggests they prefer counseling after treatment, face-to-face counselling, and from an exercise specialist. They also preferred a home-based program of moderate intensity, and walking was the preferred mode of PA. The most recent study was conducted by Bélanger et al. (87) with 588 young adult cancer survivors to understand the unique physical activity programming and counseling preferences among this cancer group. The results indicate that the majority of young adult cancer survivors were interested (78%) and able (88%) to participate in an activity program. They also preferred receiving activity counseling from a fitness expert at the cancer centre (49.6%), information by brochure (64%), starting activity after treatment (64%), walking (51%), doing activity with others (49%), and doing activity at a community fitness center (46%). Current PA levels and age were consistent factors that modified the PA preferences for this cancer group. Specifically, a pronounced difference was found for the preferred location of exercise, where 51% of participants not meeting the public health PA guidelines preferred to do PA at home compared to only 36% of those meeting the guidelines. On the other hand, the most profound age difference was for type of activity. Preference for walking was reported in 18% of young adult cancer survivors in their 20s compared to 35% in their 30s and 61% in their 40s.

The largest study to date to examine PA preferences in a cancer survivor group was conducted by Gjerset et al. (81). The researchers investigated the interest and preferences for exercise among a mixed cancer sample of 1,284 Norwegian cancer survivors. The results indicated that 76% of Norwegian cancer survivors were interested or maybe interested in receiving exercise counselling at some point after their cancer diagnosis. The interest in exercise counselling in men was associated with younger age, presence of comorbidity and having received chemotherapy. In women, interest in exercise counselling was associated with younger age, higher education and current PA levels. The majority preferred face-to-face exercise counselling with an exercise specialist from a cancer centre, at a hospital, and immediately after treatment. Walking was the preferred modality at a moderate intensity, at a community fitness centre and together with other cancer survivors.

One study employed qualitative methods to examine PA preferences in breast cancer survivors. Whitehead & Lavelle (79) using a semi-structured interview or focus group with 29 older breast cancer survivors (1 to 5 years postdiagnosis) aged 59 to 86 to explore PA patterns, motivators, facilitators, barriers, and preferences. For PA programs, participants expressed that more gentle forms of exercise were preferable, especially those that were tailored to their abilities and treatment related concerns. Activities that were holistic in nature, involved other older breast cancer survivors, and with an instructor who is knowledgeable about both cancer and their age-related needs were also preferred. In a study with rural breast cancer survivors, Rogers et al. (75) found that among the 483 breast cancer survivors, the most popular options were counseling after treatment (36%), face-to-face (47%), and from an exercise specialist (40%). In addition, rural breast cancer survivors preferred home-based (63%), unsupervised (47%), moderate intensity exercise (65%) that was primarily walking.

Single studies have been conducted to examine PA preferences among cancer survivors in other tumor groups. Stevinson et al. (86) found, in a cross-sectional survey of 359 ovarian cancer survivors, that participants indicated preferences for programs to be home-based (48.9%), commenced post-treatment (69.5%), and involved walking (62.7%). Another cross-sectional study involving 90 head and neck cancer survivors generated slightly different preferences where most participants reported a lack of preference for counseling source (66%) and delivery channel (47%). The preferred counseling source was an exercise specialist (17%) and the mode of delivery was face-to-face (40%). Many participants preferred to exercise either outdoors (49%) or in the home (35%) and preferred to exercise alone (50%). The majority preferred unsupervised exercise (55%) and flexible scheduling (66%). The preferred time of day was morning (47%) and intensity was moderate (50%). Walking was the preferred mode of exercise in both the summer (47%) and the winter (44%) in conjunction with other popular types including sports, resistance training, and yard work/gardening (75).

Similarly, a cross-sectional study of 397 bladder cancer survivors indicated that 81.1% of participants were, or might be, interested in an exercise program designed for bladder cancer survivors, and 84.3% felt they would be able to participate in such a program. Common preferences include initiating an exercise program immediately after treatment (39.1%), exercising alone (35.8%), at home (53.7%), in the morning (36.6%), at a moderate intensity (61.7%), and to do spontaneous/flexible sessions (56.9%) and unsupervised exercise (70.6%). Walking was the preferred type of exercise (81.1%), which was similar to previous studies in other tumor groups (83). Furthermore, older bladder cancer survivors were more likely to prefer to exercise at home (77% vs. 68%), engage in light intensity exercise (33% vs. 16%) and want unsupervised exercise sessions.

In a study with 386 endometrial cancer survivors, 76.9% of the participants said they were interested or might be interested in doing an exercise program, with 81.7% indicating that they were able or likely able to actually do an exercise program. Many of the participants indicated that walking was the most commonly preferred activity (68.6%) and moderate exercise was their preferred intensity (61.1%). Participants also indicated a preference for exercise counseling from an exercise specialist affiliated with a cancer center (40.9%), preferred the location to be a cancer center (41.0%), and preferred to have face-to-face counseling (82.8%). The most common preference for beginning an exercise regime was 3-6 months post-treatment (39.3%), and participants were equally distributed in terms of their inclination to exercise alone (23.8%), with friends (22.6%), or no preference (23.8%) (82).

Vallance et al. (76) conducted a study with 431 NHL survivors and found that an overwhelming majority reported that they would possibly be interested (81%) and able (85%) to participate in an exercise programme. The majority of participants listed walking as their preferred choice of exercise (55%), and moderate level exercise as the preferred intensity (62%). More than half of the participants (56%) indicated they would have preferred to initiate an exercise program at least 3 months after treatment. Approximately equal proportions of participants indicated that they would rather exercise alone (31%) or with others (35%).

Preferring to exercise in the morning was reported by 43% of participants.

Jones et al. (85) examined exercise preferences in 106 brain cancer survivors. Participants reported that they would be able to participate in an exercise program during treatment (47.2%), while some (32.1%) felt unable to exercise during this time. Similar proportions of participants preferred to exercise at home (25.5%) with their spouse or other family members (23.6%). The majority of participants felt they were capable of exercising for at least 20 min per exercise session (49%), at least three times a week (27.3%) while on treatment. Walking (51%) was the preferred modality of exercise during treatment followed by resistance training (44%) being the second preferred type. After completing adjuvant therapy, the majority of participants (84%) felt that they were able to exercise during this time. Approximately equal proportions of participants preferred to exercise at home (43.4%) with their spouse or other family members (40.6%), and they felt capable of exercising for at least 20 min per exercise session (86.8%) at least three times a week (63.2%). Again, walking (53%) was the most common choice of exercise during treatment followed by resistance training (36%) and cycling (19%). These results were similar to the preferences reported during treatment.

In an earlier cross-sectional study in a mixed cancer group, 307 breast, prostate, lung, and colorectal cancer survivors were examined to provide a comprehensive assessment of exercise counseling and program preferences among this group (77). For exercise counseling, 84% of participants indicated that they would have, or possibly would have, been interested in exercise counseling at some point after diagnosis. The preferred mode of delivery was to have face-to-face counseling (85%), with 77% preferring to receive it from an exercise specialist associated with a cancer center. In terms of exercise programming, walking was the preferred modality (81%), almost all preferred recreational exercises (98%), unsupervised exercise was desired (57%), and moderate-intensity exercise was preferred (56%). Moreover, 48% preferred to exercise in the morning, 44% preferred to exercise alone, 40% preferred to exercise at home, and 32% preferred to commence their exercise program prior to treatment.

A common theme among all of these studies is that the majority of participants indicated preferences for walking as the exercise of choice, moderate intensity exercise, home-based exercise programming, exercising alone, and initiating an exercise program after treatment had ended. However, exercise preferences are unique and varied across different tumor types that require attention. Knowledge of the specific exercise programming and counseling preferences in various groups of cancer survivors is paramount for a tailored regime to the survivor group, and thus generate greater adherence and perhaps lead to more effective and enjoyable exercise programs.

Physical Activity Behaviour Change Interventions in Cancer Survivors

In recent years, there has been a widespread adoption of behavioural support interventions implemented into many randomized controlled trials (RCTs) in the PA domain. Physical activity RCTs can be divided into health outcome trials or behaviour change trials, where the distinction lies within the primary outcome of the trial (88). The primary purpose of health outcome trials is to examine the effects of a PA intervention on some health outcome such as cardiorespiratory fitness, body composition, psychosocial functioning, biomarkers, or disease states. On the other hand, the primary purpose of behaviour change trials is to examine the effects of a behavioural support intervention on some facet of PA behaviour itself such as the type, volume, intensity, or PA maintenance (88).

Physical activity behaviour change research in cancer survivors should be informed by the PA determinants literature. Given that the PA determinants research is guided by theory, this suggests that PA behaviour change interventions should also be guided by theory. The application of behavioural theories can assist researchers in understanding why a particular intervention was successful or unsuccessful, and it allows researchers to understand the mechanisms that influence behaviour for a given cancer survivor group.

There has been emerging research in randomized trials of PA behaviour change in cancer survivors. Currently, there are six studies that focused on breast cancer (89-94), one study on prostate cancer (95), one study on endometrial cancer (96), and three on mixed cancer survivors (97-99). Of these studies, eight interventions were based on Social Cognitive Theory (SCT) (89-91, 94-96, 98, 99), six interventions were based on the Transtheoretical Model (TTM) in addition to the SCT (89, 91, 95, 97-99), and two interventions were based on the TPB (92, 93). It is important to note that eight of these studies were behaviour change studies where the primary outcome was PA (90-94, 96, 97, 99). The remaining three studies were effectiveness health outcome trials where the primary outcome was physical functioning and/or QoL (89, 95, 98).

Among a mixed cancer type group employing the SCT constructs, Project LEAD (Project Leading the Way in Education Against Disease) was the first health outcome trial to examine whether a 6-month personally tailored telephone counseling program was effective in improving diet and exercise behaviours among 182 breast and prostate cancer survivors (98). Survivors were randomized into a treatment or control group. The treatment group received telephone counseling and tailored print materials designed to increased exercise and an improved overall diet, whereas the control group received general health counseling and materials. The primary outcome of this study was physical function. Secondary outcomes included diet quality, exercise, BMI, depression, QoL, and perceived health.

This study did not achieve its accrual target, but the change scores for physical function were in the direction and of the magnitude projected. The intervention also did not achieve statistical significance in changes in PA, and the researchers noted that the PA measure used [Community Healthy Activities

Models Program for Seniors (CHAMPS)], which categorizes weekly activity into blocks of time, lacked sensitivity to detect modest increases in exercise. For example, an increase of two 20-minute exercise sessions per week over baseline would not be detected using this instrument. Differences between the intervention groups diminished post-intervention for physical function, diet quality, and PA. However, the researchers found significant increases in self-efficacy for exercise adoption at 6 months following the intervention. These study findings suggest that home-based diet and exercise interventions hold promise in improving lifestyle behaviours among older cancer survivors, given the changes in the end points in the projected direction. Future studies should incorporate larger sample sizes and interventions that sustain long-term effects (98).

Another health outcome trial was the Active for Life After Cancer, which was a randomized trial evaluating the efficacy of a 6-month group-based lifestyle PA program for prostate cancer patients to improve QoL including physical and emotional functioning compared to a group-based Educational Support Program and a Standard Care Program (no group) (95). One hundred and thirty-four prostate cancer survivors were randomly assigned to one of the three study conditions: Lifestyle Program, Educational Support Program, or a standard care control condition (Standard Care). Results demonstrated no significant improvements in QoL at 6 or 12 months. Lifestyle participants reported significant improvements in most theoretical mediators proposed by the Transtheoretical Model and Social Cognitive Theory to influence PA. However, despite these improvements, no significant changes were noted in terms of energy expenditure. The lifestyle approach is a promising mechanism for promoting adoption and adherence for some individuals, but focusing on cognitive-behavioural skills training alone is insufficient in producing favorable changes in PA among this group.

The most recent behaviour change study testing the SCT model will be conducted with endometrial cancer. Basen-Engquist et al. (96) is currently examining the *Steps to Health* intervention, which applies a SCT-based model of endometrial cancer survivors' adoption and maintenance of exercise to increase walking or other moderate intensity PA. The researchers will test the influence of self-efficacy and outcome expectations on adherence to PA recommendations, as well as examining the determinants of self-efficacy. Endometrial cancer survivors who are 6 months post-treatment are provided with an intervention involving print materials and telephone counseling, and complete assessments of fitness, activity, self-efficacy and outcome expectations, and determinants of self-efficacy every 2 months over a 6-month period. The findings of this study will guide the development of more effective interventions to help cancer survivors adopt and maintain a more active lifestyle to experience health and QoL benefits.

In another study in a mixed cancer group, FRESH START was a randomized controlled trial based on the SCT designed to examine whether a personally tailored program (based on print material) would increase exercise and fruit and vegetable consumption, and decrease fat intake of individuals recently diagnosed with breast or prostate cancer (99). Five hundred forty-three participants were randomly assigned either to a 10-month program of tailored mailed print materials promoting fruit and vegetable consumption, reducing total/saturated fat intake, and/or increasing exercise or to a 10-month program of non-tailored mailed materials on diet and exercise available in the public domain. Data show that both arms significantly improved their lifestyle behaviours; however, the FRESH START intervention reported greater effectiveness in increasing the a number of lifestyle behaviours at recommended levels, such as increasing the weekly number of minutes exercised, daily intake of fruit and vegetable consumption, and overall diet quality, as well as decreasing intakes of fat and saturated fat, in comparison to the control arm. This study provides evidence for the utility of a distance medicine-based diet and exercise intervention in inducing lifestyle changes among cancer survivors.

In another study, Rogers et al. (94) examined the feasibility and preliminary outcomes of a pilot randomized trial designed to increase PA in sedentary breast cancer survivors receiving hormone therapy (Better Exercise Adherence after Treatment for Cancer; BEAT Cancer program). Forty-one breast cancer patients were randomly assigned to receive a 12-week multidisciplinary physical activity behaviour change intervention (n=21) or usual care (n=20). The specific SCT constructs addressed in six discussion group sessions included self-efficacy, emotional coping, reciprocal determinism, perceived barriers, outcome expectations, behavioural capability, goal setting, environment, observational learning, and self-control. The findings indicate that the BEAT Cancer program significantly improved PA counts measured by accelerometer, muscle strength, and social well-being with large effect size increases in moderate activity, vigorous activity, and fitness that were not statistically significant due to limited study power. Intervention effects on the underlying determinants of PA were not reported in the study. Overall, behaviour change interventions using the SCT constructs have generally been effective in increasing PA among cancer survivors.

Moreover, a few studies have examined the effects of an intervention on the underlying determinants of behaviour change using the TTM. Pinto et al. (91) examined the efficacy of a home-based PA intervention for breast cancer patients. Eighty-six sedentary women who had completed treatment were randomly assigned to a PA or control group. Participants in the PA intervention received 12 weeks of PA counselling (based on the TTM) delivered via telephone, as well as weekly exercise tip sheets. The intervention was successful in increasing PA, improving fitness and psychological well-being, as well as increasing behavioural processes. Bennett et al. (97) conducted a prospective RCT of mixed cancer survivors (with the majority of them being breast cancer survivors) to test whether motivational interviewing (MI) would help long-term cancer survivors increase their PA levels. Fifty-six physically inactive adult cancer survivors were randomly assigned to either the intervention or control groups. The MI intervention consisted of one in-person counseling session followed by two MI telephone calls over 6 months. Control group participants received two telephone calls without MI content. The results revealed that participants in the MI intervention group increased their self-reported PA by a mean 1,556 kcal/week, compared to a mean increase of 397 kcal/week in the control group. The intervention group participants were more inactive compared to the control group at the beginning of the study, but were more active than the control group at the end of 6 months. In the presence of MI counseling, cancer survivors with high self-efficacy for PA increased regular PA at a higher rate than did those with low self-efficacy. On the other hand, participants in the control group increased PA at approximately the same rate, regardless of individual self-efficacy. Overall, although many of the behaviour change interventions employing the TTM has been in conjunction with another theory (i.e., SCT), the TTM has utility in providing useful information on PA motivation among cancer survivors.

The TPB is the most widely used theory to predict and explain PA motivation and behaviour in cancer survivors (100). Overall, studies have provided promising evidence that the TPB may be a useful model for understanding PA in various cancer survivor groups. The aforementioned determinants literature in the PA domain provides evidence that the TPB may be an effective social cognitive model for understanding behaviour change.

However, the application of the TPB in behaviour change interventions in PA has been limited. Jones et al. (92) examined the effects of an oncologist's recommendation to exercise on self-reported exercise behaviour in newly diagnosed breast cancer survivors initiating their first adjuvant therapy treatment. Using a single-blind, 3-armed, randomized controlled trial, 450 breast cancer survivors were randomly assigned to receive an oncologist exercise recommendation only, an oncologist exercise recommendation plus referral to an exercise specialist, or usual care (i.e., no recommendation). Results of the study indicated that participants receiving the exercise recommendation reported 3.4

more MET hours of total exercise per week and approximately 30 min more moderate intensity exercise per week compared to the usual care group. In terms of the TPB, the direct effects of attitude, subjective norm, and PBC on intention were supported, but no direct effects of intention on exercise were found.

The Activity Promotion (ACTION) Trial was a RCT designed to examine the effects of a breast cancer-specific PA print material intervention on TPB variables and to determine if PA at 12 weeks follow-up was mediated by TPB variables at 4 weeks (93, 101). Three hundred and seventy-seven breast cancer survivors were randomly assigned to receive either a standard public health recommendation for PA, a step pedometer alone, or one of two TPB-based behaviour change interventions consisting of print materials (alone or combined with a step pedometer). The comparison group received a standard public health recommendation for PA. The results revealed that survivors receiving the TPB-based interventions indicated positive changes in the TPB constructs and beliefs (i.e., instrumental attitude, intention, and planning) when compared to the standard recommendation group. However, the intervention generated relatively weak effects on salient behavioural and control beliefs, with no effects on normative beliefs. Mediation analyses reported that both planning and intention partially mediated the effects of the intervention on PA at 12 weeks.

Overall, the utility of the TPB is promising for PA motivation among various cancer populations given the handful of studies conducted in this domain. However, behaviour change interventions using the TPB has been show to be effective in increasing PA in other non-cancer populations including a general adult population (102, 103) and an elderly population (104).

The use of a theoretical framework provides the groundwork upon which evidence-based interventions are built and plays an essential role in the development and implementation of best practices. By examining potentially tailored, feasible, and innovative forms of PA promotion in the cancer population, cancer care professionals can disseminate these interventions to influence PA adoption and maintenance, and further enhancing QoL after treatment.

References

1. Cancer.org [Internet]. American Cancer Society, Inc.; c2011 [updated 2011 Apr 18; cited 2011 Apr 27]. Available from: http://www.cancer.org/Cancer/KidneyCancer/DetailedGuide/index.

2. Alschuler L, Gazella KA. The definitive guide to cancer of the colon, stomach, and kidney. Integr Med Clin J. 2007;6(4):30-7.

3. Bardia A, Barton DL, Prokop LJ, Bauer BA, Moynihan TJ. Efficacy of complementary and alternative medicine therapies in relieving cancer pain: A systematic review. J Clin Oncol. 2006;24(34):5457-64.

4. Moore LE, Wilson RT, Campleman SL. Lifestyle factors, exposures, genetic susceptibility, and renal cell cancer risk: A review. Cancer Invest. 2005;23(3):240-55.

5. Dhote R, Thiounn N, Debré B, Vidal-Trecan G. Risk factors for adult renal cell carcinoma. Urol Clin North Am. 2004;31(2):237-47.

6. Gupta K, Miller JD, Li JZ, Russell MW, Charbonneau C. Epidemiologic and socioeconomic burden of metastatic renal cell carcinoma (mRCC): A literature review. Cancer Treat Rev. 2008;34(3):193-205.

7. Martel CL, Lara PN. Renal cell carcinoma: Current status and future directions. Crit Rev Oncol Hematol. 2003;45(2):177-90.

8. Nelson EC, Evans CP, Lara Jr PN. Renal cell carcinoma: Current status and emerging therapies. Cancer Treat Rev. 2007;33(3):299-313.

9. Hunt JD, van der Hel OL, McMillan GP, Boffetta P, Brennan P. Renal cell carcinoma in relation to cigarette smoking: Meta-analysis of 24 studies. Int J Cancer. 2005;114(1):101-8.

10. Chow W, Devesa SS. Contemporary epidemiology of renal cell cancer. Cancer J. 2008;14(5):288-301.

11. Hu J, Mao Y, White K. Overweight and obesity in adults and risk of renal cell carcinoma in Canada. Soz Praventivmed. 2003;48(3):178-85.

12. Mellemgaard A, Engholm G, McLaughlin JK, Olsen JH. Risk factors for renal-cell carcinoma in denmark. III. role of weight, physical activity and reproductive factors. Int J Cancer. 1994;56(1):66-71.

13. Chow WH, Gridley G, Fraumeni JF, J., Järvholm B. Obesity, hypertension, and the risk of kidney cancer in men. N Engl J Med. 2000;343(18):1305-11.

14. van Dijk BAC, Schouten LJ, Kiemeney LALM, Goldbohm RA, van den Brandt PA. Relation of height, body mass, energy intake, and physical activity to risk of renal cell carcinoma: Results from the Netherlands cohort study. Am J Epidemiol. 2004;160(12):1159-67.

15. Amling CL. The association between obesity and the progression of prostate and renal cell carcinoma. Urol Oncol. 2004;22(6):478-84.

16. Pischon T, Lahmann PH, Boeing H, Tjønneland A, Halkjaer J, Overvad K, et al. Body size and risk of renal cell carcinoma in the european prospective investigation into cancer and nutrition (EPIC). Int J Cancer. 2006;118(3):728-38.

17. Murai M, Oya M. Renal cell carcinoma: Etiology, incidence and epidemiology. Curr Opin Urol. 2004;14(4):229-33.

18. Bergström A, Hsieh CC, Lindblad P, Lu CM, Cook NR, Wolk A. Obesity and renal cell cancer--a quantitative review. Br J Cancer. 2001;85(7):984-90.

19. Renehan AG, Tyson M, Egger M, Heller RF, Zwahlen M. Body-mass index and incidence of cancer: A systematic review and meta-analysis of prospective observational studies. Lancet. 2008;371(9612):569-78.

20. Pascual D, Borque A. Epidemiology of kidney cancer. Adv Urol. 2008. doi:10.1155/2008/782381.

21. Nicodemus KK, Sweeney C, Folsom AR. Evaluation of dietary, medical and lifestyle risk factors for incident kidney cancer in postmenopausal women. Int J Cancer. 2004;108(1):115-21.

22. Rashidkhani B, Akesson A, Lindblad P, Wolk A. Alcohol consumption and risk of renal cell carcinoma: A prospective study of Swedish women. Int J Cancer. 2005;117(5):848-53.

23. Mahabir S, Leitzmann MF, Virtanen MJ, Virtamo J, Pietinen P, Albanes D, et al. Prospective study of alcohol drinking and renal cell cancer risk in a cohort of finnish male smokers. Cancer Epidemiol Biomarkers Prev. 2005;14(1):170-5.

24. Lee JE, Giovannucci E, Smith-Warner S, Spiegelman D, Willett WC, Curhan GC. Total fluid intake and use of individual beverages and risk of renal cell cancer in two large cohorts. Cancer Epidemiol Biomarkers Prev. 2006;15(6):1204-11.

25. Moore SC, Chow W, Schatzkin A, Adams KF, Park Y, Ballard-Barbash R, et al. Physical activity during adulthood and adolescence in relation to renal cell cancer. Am J Epidemiol. 2008;168(2):149-57.

26. Pan SY, DesMeules M, Morrison H, Wen SW. Obesity, high energy intake, lack of physical activity, and the risk of kidney cancer. Cancer Epidemiol Biomarkers Prev. 2006;15(12):2453-60.

27. Mahabir S, Leitzmann MF, Pietinen P, Albanes D, Virtamo J, Taylor PR. Physical activity and renal cell cancer risk in a cohort of male smokers. Int J Cancer. 2004;108(4):600-5.

28. Mellemgaard A, Lindblad P, Schlehofer B, Bergström R, Mandel JS, McCredie M, et al. International renal-cell cancer study. III. role of weight, height, physical activity, and use of amphetamines. Int J Cancer. 1995;60(3):350-4.

29. Goodman MT, Morgenstern H, Wynder EL. A case-control study of factors affecting the development of renal cell cancer. Am J Epidemiol. 1986;124(6):926-41.

30. Menezes RJ, Tomlinson G, Kreiger N. Physical activity and risk of renal cell carcinoma. Int J Cancer. 2003;107(4):642-6.

31. Lindblad P, Wolk A, Bergström R, Persson I, Adami HO. The role of obesity and weight fluctuations in the etiology of renal cell cancer: A population-based case-control study. Cancer Epidemiol Biomarkers Prev. 1994;3(8):631-9.

32. Chiu BC, Gapstur SM, Chow W, Kirby KA, Lynch CF, Cantor KP. Body mass index, physical activity, and risk of renal cell carcinoma. Int J Obes (Lond). 2006;30(6):940-7.

33. Bergström A, Moradi T, Lindblad P, Nyrén O, Adami HO, Wolk A. Occupational physical activity and renal cell cancer: A nationwide cohort study in Sweden. Int J Cancer. 1999;83(2):186-91.

34. Setiawan VW, Stram DO, Nomura AMY, Kolonel LN, Henderson BE. Risk factors for renal cell cancer: The multiethnic cohort. Am J Epidemiol. 2007;166(8):932-40.

35. Bergström A, Terry P, Lindblad P, Lichtenstein P, Ahlbom A, Feychting M, et al. Physical activity and risk of renal cell cancer. Int J Cancer. 2001;92(1):155-7.

36. Paffenbarger RS, Hyde RT, Wing AL. Physical activity and incidence of cancer in diverse populations: A preliminary report. Am J Clin Nutr. 1987;45(1):312-7.

37. Tavani A, Zucchetto A, Dal Maso L, Montella M, Ramazzotti V, Talamini R, et al. Lifetime physical activity and the risk of renal cell cancer. Int J Cancer. 2007;120(9):1977-80.

38. Leitzmann MF. Physical activity and genitourinary cancer prevention. In: Courneya KS, Friedenreich CM, editors. Physical activity and cancer. New York: Springer; 2011. p. 43-72.

39. Gago-Dominguez M, Castelao JE, Yuan J, Ross RK, Yu MC. Lipid peroxidation: A novel and unifying concept of the etiology of renal cell carcinoma (United States). Cancer Causes Control. 2002;13(3):287-93.

40. Kellerer M, von EC, Mühlhöfer A, Capp E, Mosthaf L, Bock S, et al. Insulin- and insulin-like growth-factor-I receptor tyrosine-kinase activities in human renal carcinoma. Int J Cancer. 1995;62(5):501-7.

41. Irwin ML. Physical activity interventions for cancer survivors. Br J Sports Med. 2009;43(1):32-8.

42. US Department of Health and Human Services (USDHHS). 2008 physical activity guidelines for Americans. Washington: USDHHS; 2008.

43. Doyle C, Kushi LH, Byers T, Courneya KS, Demark-Wahnefried W, Grant B, et al. Nutrition and physical activity during and after cancer treatment: An American cancer society guide for informed choices. CA Cancer J Clin. 2006;56(6):323-53.

44. Haskell WL, Lee I, Pate RR, Powell KE, Blair SN, Franklin BA, et al. Physical activity and public health: Updated recommendation for adults from the American college of sports medicine and the American heart association. Med Sci Sports Exerc. 2007;39(8):1423-34.

45. Courneya KS, Karvinen, KH, Vallance, JKH. Exercise motivation and behavior change. In: Feuerstein M, editor. Handbook of cancer survivorship. New York: Springer; 2007. p. 113-132.

46. Coups EJ, Ostroff JS. A population-based estimate of the prevalence of behavioral risk factors among adult cancer survivors and noncancer controls. Prev Med. 2005;40(6):702-11.

47. Bellizzi KM, Rowland JH, Jeffery DD, McNeel T. Health behaviors of cancer survivors: Examining opportunities for cancer control intervention. J Clin Oncol. 2005;23(34):8884-93.

48. Michie S, Abraham C. Interventions to change health behaviours: Evidence-based or evidence-inspired? Psychol Health. 2004;19(1):29-49.

49. The Improved Clinical Effectiveness through Behavioural Research Group. Designing theoretically-informed implementation interventions. Implement Sci. 2006;1:4-11.

50. Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process. 1991;50(2):179-211.

51. Hagger MS, Chatzisarantis NLD, Biddle SJH. A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and the contribution of additional variables. J Sport Exercise Psychol. 2002;24(1):3-32.

52. Karvinen KH, Courneya KS, Plotnikoff RC, Spence JC, Venner PM, North S. A prospective study of the determinants of exercise in bladder cancer survivors using the theory of planned behavior. Support Care Cancer. 2009;17(2):171-9.

53. Karvinen KH, Courneya KS, Campbell KL, Pearcey RG, Dundas G, Capstick V, et al. Correlates of exercise motivation and behavior in a population-based sample of endometrial cancer survivors: An application of the theory of planned behavior. Int J Behav Nutr Phys Act. 2007;4(21). doi:10.1186/1479-5868-4-21.

54. Stevinson C, Tonkin K, Capstick V, Schepansky A, Ladha AB, Valiance JK, et al. A population-based study of the determinants of physical activity in ovarian cancer survivors. J Phys Act Health. 2009;6(3):339-46.

55. Courneya KS, Friedenreich CM. Determinants of exercise during colorectal cancer treatment: An application of the theory of planned behavior. Oncol Nurs Forum. 1997;24(10):1715-23.

56. Courneya KS, Friedenreich CM, Arthur K, Bobick TM. Physical exercise and quality of life in postsurgical colorectal cancer patients. Psychol Health Med. 1999;4(2):181-187.

57. Courneya KS, Friedenreich CM, Quinney HA, Fields ALA, Jones LW, Fairey AS. Predictors of adherence and contamination in a randomized trial of exercise in colorectal cancer survivors. Psychooncology. 2004;13(12):857-66.

58. Courneya KS, Friedenreich CM. Utility of the theory of planned behavior for understanding exercise during breast cancer treatment. Psychooncology. 1999;8(2):112-22.

59. Courneya KS, Blanchard CM, Laing DM. Exercise adherence in breast cancer survivors training for a dragon boat race competition: A preliminary investigation. Psychooncology. 2001;10(5):444-52.

60. Blanchard CM, Courneya KS, Rodgers WM, Murnaghan DM. Determinants of exercise intention and behavior in survivors of breast and prostate cancer: An application of the theory of planned behavior. Cancer Nurs. 2002;25(2):88-95.

61. Courneya KS, Friedenreich CM, Sela RA, Quinney HA, Rhodes RE. Correlates of adherence and contamination in a randomized controlled trial of

exercise in cancer survivors: An application of the theory of planned behavior and the five factor model of personality. Ann Behav Med. 2002;24(4):257-68.

62. Rhodes RE, Courneya KS. Relationships between personality, an extended theory of planned behaviour model and exercise behaviour. Br J Health Psychol. 2003;8:19-36.

63. Courneya KS, Keats MR, Turner R. Social cognitive determinants of hospital-based exercise in cancer patients following high-dose chemotherapy and bone marrow transplantation. Int J Behav Med. 2000;7(3):189-203.

64. Courneya KS, Segal RJ, Reid RD, Jones LW, Malone SC, Venner PM, et al. Three independent factors predicted adherence in a randomized controlled trial of resistance exercise training among prostate cancer survivors. J Clin Epidemiol. 2004;57(6):571-9.

65. Courneya KS, Vallance JKH, Jones LW, Reiman T. Correlates of exercise intentions in non-hodgkin's lymphoma survivors: An application of the theory of planned behavior. J Sport Exerc Psychol. 2005;27(3):335-349.

66. Jones LW, Courneya KS, Vallance JKH, Ladha AB, Mant MJ, Belch AR, et al. Understanding the determinants of exercise intentions in multiple myeloma cancer survivors: An application of the theory of planned behavior. Cancer Nurs. 2006;29(3):167-75.

67. Keats MR, Culos-Reed S, Courneya KS, McBride M. Understanding physical activity in adolescent cancer survivors: An application of the theory of planned behavior. Psychooncology. 2007;16(5):448-57.

68. Jones LW, Guill B, Keir ST, Carter K, Friedman HS, Bigner DD, et al. Using the theory of planned behavior to understand the determinants of exercise intention in patients diagnosed with primary brain cancer. Psychooncology. 2007;16(3):232-40.

69. Duncan MJ, Spence JC, Mummery WK. Perceived environment and physical activity: A meta-analysis of selected environmental characteristics. Int J Behav Nutr Phys Act. 2005;2(11). doi:10.1186/1479-5868-2-11.

70. Ajzen I. Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. J Appl Soc Psychol. 2002;32(4):665-83.

71. Rhodes RE, Brown SG, McIntyre CA. Integrating the perceived neighborhood environment and the theory of planned behavior when predicting walking in a canadian adult sample. Am J Health Promot. 2006;21(2):110-8.

72. Rhodes RE, Courneya KS, Blanchard CM, Plotnikoff RC. Prediction of leisure-time walking: An integration of social cognitive, perceived environmental, and personality factors. Int J Behav Nutr Phys Act. 2007;4(51). doi:10.1186/1479-5868-4-51.

73. McCormack GR, Spence JC, Berry T, Doyle-Baker P. Does perceived behavioral control mediate the association between perceptions of neighborhood walkability and moderate- and vigorous-intensity leisure-time physical activity? J Phys Act Health. 2009;6(5):657-66.

74. Kamphuis CB, van Lenthe FJ, Giskes K, Huisman M, Brug J, Mackenbach JP. Socioeconomic differences in lack of recreational walking among older adults: The role of neighbourhood and individual factors. Int J Behav Nutr Phys Act. 2009;6(1). doi: 10.1186/1479-5868-6-1.

75. Rogers LQ, Markwell SJ, Verhulst S, McAuley E, Courneya KS. Rural breast cancer survivors: Exercise preferences and their determinants. Psychooncology. 2009;18(4):412-21.

76. Vallance JKH, Courneya KS, Jones LW, Reiman T. Exercise preferences among a population-based sample of non-hodgkin's lymphoma survivors. Eur J Cancer Care (Engl). 2006;15(1):34-43.

77. Jones LW, Courneya KS. Exercise counseling and programming preferences of cancer survivors. Cancer Pract. 2002;10(4):208-15.

78. Courneya KS, Reid RD, Friedenreich CM, Gelmon K, Proulx C, Vallance JK, et al. Understanding breast cancer patients' preference for two types of exercise training during chemotherapy in an unblinded randomized controlled trial. Int J Behav Nutr Phys Act. 2008;5(52). doi:10.1186/1479-5868-5-52.

79. Whitehead S, Lavelle K. Older breast cancer survivors' views and preferences for physical activity. Qual Health Res. 2009;19(7):894-906.

80. Rogers LQ, Matevey C, Hopkins-Price P, Shah P, Dunnington G, Courneya KS. Exploring social cognitive theory constructs for promoting exercise among breast cancer patients. Cancer Nurs. 2004;27(6):462-73.

81. Gjerset GM, Fosså ,S.D., Courneya KS, Skovlund E, Jacobsen AB, Thorsen L. Interest and preferences for exercise counselling and programming among norwegian cancer survivors. Eur J Cancer Care (Engl). 2011;20(1):96-105.

82. Karvinen KH, Courneya KS, Campbell KL, Pearcey RG, Dundas G, Capstick V, et al. Exercise preferences of endometrial cancer survivors: A population-based study. Cancer Nurs. 2006;29(4):259-65.

83. Karvinen KH, Courneya KS, Venner P, North S. Exercise programming and counseling preferences in bladder cancer survivors: A population-based study. J Cancer Surviv. 2007;1(1):27-34.

84. Rogers LQ, Malone J, Rao K, Courneya KS, Fogleman A, Tippey A, et al. Exercise preferences among patients with head and neck cancer: Prevalence and associations with quality of life, symptom severity, depression, and rural residence. Head Neck. 2009;31(8):994-1005.

85. Jones LW, Guill B, Keir ST, Carter K, Friedman HS, Bigner DD, et al. Exercise interest and preferences among patients diagnosed with primary brain cancer. Support Care Cancer. 2007;15(1):47-55.

86. Stevinson C, Capstick V, Schepansky A, Tonkin K, Vallance JK, Ladha AB, et al. Physical activity preferences of ovarian cancer survivors. Psychooncology. 2009;18(4):422-8.

87. Bélanger LJ, Plotnikoff RC, Clark A, Courneya KS. A survey of physical activity programming and counseling preferences in young adult cancer survivors. Cancer Nurs. In press.

88. Courneya KS. Efficacy, effectiveness, and behavior change trials in exercise research. Int J Behav Nutr Phys Act. 2010;7(81). doi: 10.1186/1479-5868-7-81.

89. Basen-Engquist K, Taylor CLC, Rosenblum C, Smith MA, Shinn EH, Greisinger A, et al. Randomized pilot test of a lifestyle physical activity intervention for breast cancer survivors. Patient Educ Couns. 2006;64(1-3):225-34.

90. Matthews CE, Wilcox S, Hanby CL, Der Ananian C, Heiney SP, Gebretsadik T, et al. Evaluation of a 12-week home-based walking intervention for breast cancer survivors. Support Care Cancer. 2007;15(2):203-11.

91. Pinto BM, Frierson GM, Rabin C, Trunzo JJ, Marcus BH. Home-based physical activity intervention for breast cancer patients. J Clin Oncol. 2005;23(15):3577-87.

92. Jones LW, Courneya KS, Fairey AS, Mackey JR. Effects of an oncologist's recommendation to exercise on self-reported exercise behavior in newly diagnosed breast cancer survivors: A single-blind, randomized controlled trial. Ann Behav Med. 2004;28(2):105-13.

93. Vallance JKH, Courneya KS, Plotnikoff RC, Yasui Y, Mackey JR. Randomized controlled trial of the effects of print materials and step pedometers on physical activity and quality of life in breast cancer survivors. J Clin Oncol. 2007;25(17):2352-9.

94. Rogers LQ, Hopkins-Price P, Vicari S, Pamenter R, Courneya KS, Markwell S, et al. A randomized trial to increase physical activity in breast cancer survivors. Med Sci Sports Exerc. 2009;41(4):935-46.

95. Taylor CLC, Demoor C, Smith MA, Dunn AL, Basen-Engquist K, Nielsen I, et al. Active for life after cancer: A randomized trial examining a lifestyle physical activity program for prostate cancer patients. Psychooncology. 2006;15(10):847-62.

96. Basen-Engquist K, Carmack CL, Perkins H, Hughes D, Serice S, Scruggs S, et al. Design of the steps to health study of physical activity in survivors of endometrial cancer: Testing a social cognitive theory model. Psychol Sport Exerc. 2011;12(1):27-35.

97. Bennett JA, Lyons KS, Winters-Stone K, Nail LM, Scherer J. Motivational interviewing to increase physical activity in long-term cancer survivors: A randomized controlled trial. Nurs Res. 2007;56(1):18-27.

98. Demark-Wahnefried W, Clipp EC, Morey MC, Pieper CF, Sloane R, Snyder DC, et al. Lifestyle intervention development study to improve physical function in older adults with cancer: Outcomes from project LEAD. J Clin Oncol. 2006;24(21):3465-73.

99. Demark-Wahnefried W, Clipp EC, Lipkus IM, Lobach D, Snyder DC, Sloane R, et al. Main outcomes of the FRESH START trial: A sequentially tailored, diet and exercise mailed print intervention among breast and prostate cancer survivors. J Clin Oncol. 2007;25(19):2709-18.

100. Pinto BM, Ciccolo JT. Physical activity motivation and cancer survivorship. Recent Results Cancer Res. 2011;186:367-87.

101. Vallance JKH, Courneya KS, Plotnikoff RC, Mackey JR. Analyzing theoretical mechanisms of physical activity behavior change in breast cancer survivors: Results from the activity promotion (ACTION) trial. Ann Behav Med. 2008;35(2):150-8.

102. Darker CD, Frenchb DP, Eves FF, Sniehotta FF. An intervention to promote walking amongst the general population based on an 'extended' theory of planned behaviour: A waiting list randomised controlled trial. Psychol Health. 2010;25(1):71-88.

103. Courneya KS, McAuley E. Cognitive mediators of the social influence-exercise adherence relationship: A test of the theory of planned behavior. J Behav Med. 1995;18(5):499-515.

104. Estabrooks P, Carron AV. The conceptualization and effect of control beliefs on exercise attendance in the elderly. J Aging Health. 1998;10(4):441-57.

Appendix B

Kidney Cancer Survivor Cover Letter (Study 1)

Dear Sir/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 kidney cancer survivors. My co-investigator on the project is Dr. Scott North, who is a medical oncologist at the Cross Cancer Institute. 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 role of PA in kidney cancer survivors. Recent research has suggested that PA is beneficial for cancer patients and survivors, but we do not know about the PA habits, beliefs, and attitudes of kidney cancer survivors. The information gained from this study will be used to help develop physical activity programs to improve quality of life among kidney 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 kidney 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, Linda Trinh, at (780) 492-2829 (call collect from out of town) or e-mail ltrinh1@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

Scott North,MD
Medical Oncologist
Cross Cancer Institute

Appendix C

Letter from the Alberta Cancer Registry (Study 1)

Alberta Health Services [Logo]

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 to contact the researchers directly. Please note that once you contact the researchers, the research team will know your identity and they will have access to any personal information that you provide them. 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)

Physical Activity & Health in Kidney 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

Alberta Cancer Board

Appendix E

Questionnaire for Kidney Cancer Survivors (Study 1)

Date Completed: ___________________ Identification #__________

Physical Activity & Health in Kidney Cancer Survivors

Principal Investigators: Kerry S. Courneya, PhD, University of Alberta
Scott North, M.D., Cross Cancer Institute

Supported by internal research funds provided by
Dr. Kerry Courneya

Instructions

Thank you for agreeing to participate in this study. In this questionnaire, we are going to ask you a series of questions about yourself. Many of the questions ask you about your physical and mental health, and some may be viewed as personal. It is important to answer as many of these questions as possible, 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. Many of the questions may seem similar but it is important to treat each question separately and provide an answer for each. 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 Linda Trinh (Research Co-ordinator) at (780) 492-2829 (call collect from out of town) or email ltrinh1@ualberta.ca.

Below is a list of statements that people with kidney cancer have said are important to their quality of life. Please indicate the extent to which you have experienced each of the statements <u>during the past 7 days</u> by circling the appropriate number using the following scale. Please complete the questions even if you believe the symptom(s) are not associated with your previous kidney cancer diagnosis and even if it has been many years since your kidney cancer diagnosis. If you do not experience any of the particular symptoms, please indicate so by circling 0 (not at all).

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 a lack of energy	0	1	2	3	4
2. I have nausea	0	1	2	3	4
3. Because of my physical condition, I have trouble meeting the needs of my family	0	1	2	3	4
4. I have pain	0	1	2	3	4
5. I am bothered by side effects of treatment	0	1	2	3	4
6. I feel ill	0	1	2	3	4
7. I am forced to spend time in bed	0	1	2	3	4
8. I feel close to my friends	0	1	2	3	4
9. I get emotional support from my family	0	1	2	3	4
10. I get support from my friends	0	1	2	3	4
11. My family has accepted my illness	0	1	2	3	4
12. I am satisfied with family communication about my illness	0	1	2	3	4
13. I feel close to my partner (or the person who is my main support)	0	1	2	3	4

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

14. I feel sad	0	1	2	3	4
15. I am satisfied with how I am coping with my illness	0	1	2	3	4
16. I am losing hope in the fight against my illness	0	1	2	3	4
17. I feel nervous	0	1	2	3	4
18. I worry about dying	0	1	2	3	4
19. I worry that my condition will get worse	0	1	2	3	4
20. I am able to work (include work at home)	0	1	2	3	4
21. My work (include work at home) is fulfilling	0	1	2	3	4
22. I am able to enjoy life	0	1	2	3	4
23. I have accepted my illness	0	1	2	3	4
24. I am sleeping well	0	1	2	3	4
25. I am enjoying the things I usually do for fun	0	1	2	3	4
26. I am content with the quality of my life right now	0	1	2	3	4
27. I get tired easily	0	1	2	3	4
28. I feel weak all over	0	1	2	3	4
29. I have a good appetite	0	1	2	3	4
30. I have pain in my joints	0	1	2	3	4
31. I am bothered by the chills	0	1	2	3	4
32. I am bothered by fevers (episodes of high body temperature)	0	1	2	3	4

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

33. I am bothered by sweating	0	1	2	3	4
34. I have trouble concentrating	0	1	2	3	4
35. I have trouble remembering things	0	1	2	3	4
36. I get depressed easily	0	1	2	3	4
37. I get annoyed easily	0	1	2	3	4
38. I have emotional ups and downs	0	1	2	3	4
39. I feel motivated to do things	0	1	2	3	4
40. I am losing weight	0	1	2	3	4
41. I have bone pain	0	1	2	3	4
42. I have been short of breath	0	1	2	3	4
43. I have been coughing	0	1	2	3	4
44. I have had blood in my urine	0	1	2	3	4

The following section asks about any fatigue that you may 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 <u>PAST WEEK</u>:

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 starting things because I am tired	0	1	2	3	4
6. I have trouble finishing 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 things I want to do	0	1	2	3	4
13. I have to limit my social activities because I am tired	0	1	2	3	4

IMPORTANT: This next set of questions focus on 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 remember:

- 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 first three categories is the intensity of the endurance (aerobic) PA and 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 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?

	Times 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/STRENGTH EXERCISE (e.g., lifting weights, push ups, sit ups, therabands).	__________	__________

For the rest of our questions, we ask you to focus on regular PA. We define regular PA as moderate intensity PA (e.g., brisk walking) done for at least 150 minutes per week (2.5 hours) OR vigorous intensity PA (e.g., jogging) done for at least 75 minutes per week (1.25 hours).

What would be the most important benefits for you if you participated in a regular PA program and what would make PA fun or enjoyable for you? (List up to three each).

Most important benefits to you?	What would make it fun for you?
______________________	______________________
______________________	______________________
______________________	______________________

What factors make it easier or more difficult for you to stick with a regular PA program?

Factors that make it difficult for you	Factors that make it easier for you
______________________	______________________
______________________	______________________
______________________	______________________

Which people or groups that are important to you would support you participating in a regular PA program or currently do regular PA themselves?

Important people that support you	Important people that do PA themselves
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________

The following questions ask you to rate how you personally feel about doing regular PA over the next month. Please pay careful attention to the words at each end of the scale and circle the number that best represents how you feel. Please answer all items.

I think that for me to participate in regular PA over the next month would be:

	1	2	3	4	5	6	7
(a)	extremely harmful	quite harmful	slightly harmful		slightly beneficial	quite beneficial	extremely beneficial
(b)	extremely unenjoyable	quite unenjoyable	slightly unenjoyable		slightly enjoyable	quite enjoyable	extremely enjoyable
(c)	extremely unimportant	quite unimportant	slightly unimportant		slightly important	quite important	extremely important
(d)	extremely boring	quite boring	slightly boring		slightly fun	quite fun	extremely fun

I think that if I participated in regular PA over the next month, most people who are important to me would be:

	1	2	3	4	5	6	7
(a)	extremely discouraging	quite discouraging	slightly discouraging		slightly encouraging	quite encouraging	extremely encouraging
(b)	extremely unsupportive	quite unsupportive	slightly unsupportive		slightly supportive	quite supportive	extremely supportive

I think that over the next month, most people who are important to me will themselves participate regularly in PA.

	1	2	3	4	5	6	7
(a)	strongly disagree	moderately disagree	slightly disagree		slightly agree	moderately agree	strongly agree

These next questions ask you to rate how likely you feel it is that you would be able to participate in regular PA over the next month if you were really motivated. Pay careful attention to the words in each scale. Circle the number that best represents how you feel.

If you were really motivated…

1. How much control would you have over doing regular PA over the next month?

1 2 3 4 5 6 7
very little control some control complete control

2. How confident would you be that you could do regular PA over the next month?

1 2 3 4 5 6 7
not at all confident somewhat confident quite confident completely confident

This next set of questions ask you about your motivation and plans to do regular PA over the next month. Pay careful attention to the words at the end of each scale.

1. Do you intend to do regular PA over the next month?

1 2 3 4 5 6 7
no, not really somewhat intend strongly intend

2. How motivated are you to do regular PA over the next month?

1 2 3 4 5 6 7
not at all motivated somewhat motivated quite motivated extremely motivated

3. Do you have plans for when, where, and the type of PA you will do in the next month?

1 2 3 4 5 6 7
no specific plans some general ideas very detailed plans

4. How much **vigorous** intensity PA do you intend to do over the next month?

____ days per week for ____ minutes each day (write in numbers including 0)

5. How much **moderate** intensity PA do you intend to do over the next month?

____ days per week for ____ minutes each day (write in numbers including 0)

6. I have made plans concerning 'when' I am going to engage in regular PA over the next month. Circle the number that best represents how you feel:

No plans 1 2 3 4 5 6 7 **Detailed plans**

7. I have made plans concerning ‘where’ I am going to engage in regular PA over the next month. Circle the number that best represents how you feel:

No plans	1	2	3	4	5	6	7	**Detailed plans**

8. I have made plans concerning ‘what’ kind of regular PA I am going to engage in over the next month. Circle the number that best represents how you feel:

No plans	1	2	3	4	5	6	7	**Detailed plans**

9. I have made plans concerning ‘how’ I am going to get to a place to engage in regular PA over the next month. Circle the number that best represents how you feel:

No plans	1	2	3	4	5	6	7	**Detailed plans**

This next set of questions asks you about your PA preferences. Check only one response for each question.

1. Would you have liked to receive information about PA at some point after your kidney cancer diagnosis?

______ Yes ______ No ______ Maybe/Unsure

***Even if you responded NO, please answer the following questions**.

2. Do you think you would be able to do a PA program for kidney cancer survivors?

______ Yes ______ No ______ Maybe/Unsure

3. Would you be interested in doing a PA program for kidney cancer survivors?

______ Yes ______ No ______ Maybe/Unsure

4. When would you have liked to start a PA program?

_____ at the time of diagnosis _____ during treatment _____ right after treatment
_____ 3-6 months after treatment _____ at least 1 year after treatment

5. If you were to engage in regular PA, what types of PA would you be most interested in doing in the summer and the winter (List up to three)?

Summer PA	Winter PA
______________________________	______________________________
______________________________	______________________________
______________________________	______________________________

6. Who would you prefer to do regular PA with?

___ alone ___ other cancer survivors ___ family (excluding spouse)
___ friends ___ spouse

7. Who would you have liked to receive PA information from?

_____ oncologist _____ fitness expert from the community
_____ cancer support group _____ fitness expert from a cancer center
_____ nurse

8. How would you prefer to receive information about PA?

_____ brochures/print materials _____ self-help video _____ on the internet

_____ telephone _____ face-to-face _____ by e-mail

9. Where would you prefer to do a PA program?

_____ outside around my neighbourhood _____ in my home
_____ at a community fitness center _____ at a cancer center

10. When would you prefer to do a PA program?

_____ morning _____ afternoon _____ evening

11. Would you be interested in a program that would help you increase your PA level?

_____ No _____ Yes _____ Maybe/Unsure

12. If you were to engage in regular PA, what would you prefer? (check only one for each question):

a) ___light intensity ___moderate intensity ___vigorous intensity

b) _____the same activity each PA session _____different activities each PA session

c) _____supervised/instructed _____unsupervised/self-paced

d) _____spontaneous/flexible _____scheduled (i.e., specific days/times)

13. Do you have any PA equipment in your home?

___ No___Yes (please list)____

14. Do you currently have a fitness center membership?

___ No___ Yes (where?) _______________________________________

15. Do you have access to the internet? _____ No _____ Yes

16. Would you have been able and willing to complete this survey on-line?

_____ No   _____ Yes

This next question asks you for your home address. This information is very important because it will allow us to understand how the community you live in affects your physical activity and health. We will be able to examine the environment around your home using geographic information systems (GIS). This technology can provide sophisticated measures of the availability and accessibility of fresh fruit and vegetables, the diversity of stores in the food environment, the walkability of a community, and the availability of private and public resources for physical activity such as recreation and activity centers, parks, trails, and bike paths. For this reason it is very important information.

In order for us to understand how the community affects the physical activity and health of cancer survivors, we will need you to voluntarily disclose your address. Please note that all information is held in strict confidence and its presentation for research purposes will be group data only. The address that you provide will not be linked to you in any way. Nevertheless, if you are uncomfortable in providing your home address, please feel free to leave this question blank. Thank you for considering our request.

Address: ____

____

City/Town:_____________________________________

Postal Code:__________________________

This next set of questions asks you to describe your home, neighbourhood, or cancer centre. Please circle the best answer that corresponds with your view of your home, neighbourhood, or cancer centre.

	1 Strongly Disagree	2 Somewhat Disagree	3 Somewhat Agree	4 Strongly Agree
(1) Many shops, stores, markets or other places to buy things I need are within easy walking distance of my home	1	2	3	4
(2) My neighbourhood has several free or low cost recreation facilities, such as parks, walking trails, bike paths, and recreation centers.	1	2	3	4
(3) There are well-maintained sidewalks on most of the streets in my neighbourhood.	1	2	3	4
(4) There are many attractive natural sights in my neighbourhood (such as landscaping, views…).	1	2	3	4
(5) It feels unsafe to walk along the streets in my neighbourhood because there is so much traffic.	1	2	3	4
(6) There is a high crime rate in my neighbourhood.	1	2	3	4
(7) I have exercise equipment I can use at home.	1	2	3	4
(8) I have appropriate work-out attire (shoes, clothes).	1	2	3	4
(9) My oncologist or nurse recommended engaging in physical activity.	1	2	3	4
(10) My cancer centre gave me health education materials (e.g., pamphlets, videos, websites) about physical activity.	1	2	3	4
(11) My cancer centre has a fitness centre/gym.	1	2	3	4
(12) My cancer centre offers PA classes	1	2	3	4

This next part of the questionnaire is needed to help understand the medical profile 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 kidney cancer (month/year)? ____________ DK

2. Were you told by your oncologist that you had papillary kidney cancer?

_____ Yes _____ No _____ DK

3. Did your cancer involve the lymph nodes (please circle)? Yes No DK

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

Localized Metastasized DK

5. If your cancer was described as metastasized, where else in your body was it? (check all that apply)

_____ Lung _____ Lymph nodes _____ Brain _____ Liver

_____ Bone _____ Other (Please specify:___________) _____ Don't know

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

7. If yes, what type of surgery did you have?

_____ Partial nephrectomy (removed part of the kidney)

_____ Radical nephrectomy (removed the entire kidney)

_____ Don't know/not sure

8. If yes, what type of incision was used to remove your kidney or part of it?

_____ Laparoscopic (small incisions) _____ Open cut (large long incision)

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

10. Did your treatment include drug therapy (please circle)? Yes No

11. If yes, what kind of drug therapy did you receive? (check all that apply)

_____ Sunitinib (Sutent)   _____ Sorafenib (Nexavar)   _____ Temsirolimus (Torisel)

_____ Everolimus (Afinitor)   _____ Interleukin-2 (IL-2)   _____ Interferon

_____ Don’t know/not sure

12. If you received drug therapy, did your oncologist have to reduce your drug dosage at any point because you could not tolerate the side effects of the drug?

_____ Yes   _____ No   _____ DK

13. Did you participate in any experimental therapy trial?

_____ Yes   _____ No   _____ DK

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

_____ I am not currently receiving any treatments.

_____ I am currently still receiving cancer treatments.

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

16. What is the current status of your kidney 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. (a) Age: ______ (b) Sex: _____ Male _____ Female

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 _________________________

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 _____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)

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

At any time after your diagnosis with kidney cancer, did anyone involved in your cancer care or treatment discuss physical activity with you? Yes No

If yes, who was it? (check all that apply)

_____ cancer doctor (oncologist) _____ nurse _____ physiotherapist

_____nutritionist _____ psychologist _____ family doctor

_____ other: (please list): _____________________

If yes, what did they say?
____
____
____
____
____
____

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

Name: ____

Address: ____

____

Telephone: Home: ___________________ Cell: ________________________

E-mail:____

How do you prefer we contact you?____

For this last question, please estimate how much time you spent SITTING in each of the following activities on your last WORKING day (paid or unpaid work) and on your last NON-WORKING day (weekend day or day off).

If you did not engage in any sedentary activity in one of the categories, please write in "0".

	WORK DAY		**NON-WORK DAY**	
	hours	**mins**	**hours**	**mins**
For TRANSPORT (e.g., in car, bus, train etc)				
At WORK (e.g., sitting at a desk or using a computer)			--------	--------
Watching TV				
Using a computer at home (email, games, information, chatting)				
Other leisure activities (socializing, movies, etc, but NOT including TV or computer use)				
How much time did you spend SLEEPING on each of these days?				

Appendix F

TRACKS Trial Patient Cover Letter (Study 2)

Dear [insert name],

Previously, the Alberta Cancer Registry contacted you on my behalf to see if were interested in participating in a survey study on physical activity which required the voluntary participation of kidney cancer survivors. We thank you for completing that survey, and we are pleased to inform you that you were one of over 700 kidney cancer survivors who completed that survey! We have also include the main publication from that study showing that kidney cancer survivors who exercise have better quality of life and fewer symptoms that those who do not exercise. Moreover, we are also very pleased that you were one of over 375 kidney cancer survivors who indicated that we could contact you about a future physical activity study. At this time, we are very excited to offer you the opportunity to participate in another study, which is designed to help you increase your physical activity level.

For this study, you will be given a customized and supervised physical activity program plus exercise and/or behavioural counselling for 4 weeks free of charge. You will be asked to attend six individual supervised exercise sessions with an exercise specialist that eventually tapers to a home-based program by the end of the 4-week program. The program will take place at the Behavioural Medicine Fitness Centre at the University of Alberta. This is a fitness facility dedicated for research purposes only, and available to you free of charge for the 4-week program. Your personal physical activity trainer, supervised physical activity program, and counselling are also free. We will also pay for your parking at the Behavioural Medicine Fitness Centre when you come for your physical activity training sessions.

The information gained from this study will be used to help develop physical activity programs to improve quality of life among kidney cancer survivors.

Please see the enclosed pamphlet for more information regarding the trial. If you are interested in participating in the study or have any questions, please contact my Research Co-ordinator, Linda Trinh, at (780) 492-2829 (call collect from out of town) or e-mail Ltrinh1@ualberta.ca for more information.

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 kidney cancer survivors, and we hope that you find the time to assist us.
Thank you for considering our study.

Sincerely,

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

Scott North, MD
Medical Oncologist
Cross Cancer Institute

Appendix G

Response Letter for Interested Participants (Study 2)

[insert date]

Dear [insert name],

Thank you for joining the **__Tr__**ying **__Ac__**tivity for **__K__**idney Cancer **__S__**urvivors (TRACKS) Trial. In preparation for the physical activity program, we ask that you complete a few forms before you start.

You will find the following documents enclosed in this package:

- Study Consent Form
- Physical Activity Readiness Questionnaire (PAR-Q and You)
- Baseline Questionnaire
- Participant Instructions for Fitness Testing
- Directions to the Behavioural Medicine Fitness Centre

Please complete the study consent form, baseline questionnaire, and PAR-Q and You form and bring them with you to your **__fitness testing appointment [insert date and time].__** Please allow 2 hours for fitness testing.

If you have any further questions about the TRACKS Trial or form completion, please contact my Research Co-ordinator, Linda Trinh, at (780) 492-2829 (call collect from out of town) or e-mail Ltrinh1@ualberta.ca for more information.

Sincerely,

Kerry S. Courneya, PhD	Scott North, MD
Professor and Canada Research Chair in PA and Cancer	Medical Oncologist
University of Alberta	Cross Cancer Institute

Appendix H

TRACKS Trial Telephone Script to Determine Eligibility (Study 2)

Telephone Script

First Contact With Interested Participant:

Since an invitation letter was sent out the participants to aid with recruitment, interested participants will be contacting the Research Co-ordinator for more information.

Once you are speaking with the participant, begin the script as follows:

1. *"Hello. My name is ____________ and I'm the Research Co-ordinator from the TRACKS Trial. We are trying to find volunteers to participate in a study on physical activity and its effects on health outcomes in kidney cancer survivors."*

2. *"The participants in this study will be assigned by chance to 1 of 2 physical activity groups to complete: (1) supervised physical activity plus exercise counselling or (2) supervised physical activity plus behavioral counselling. For both physical activity groups, you will be given a customized and supervised physical activity program depending on your fitness level. You will be asked to attend six individual supervised exercise sessions with a physical activity specialist that eventually tapers to a home-based program by the end of the program. Over the 4-week period, you will be asked to attend two sessions per week for the weeks 1-2, and one session per week for weeks 3-4. In order to achieve the physical activity guidelines established by the current public health recommendations, at least 2 or more sessions will be unsupervised home-based sessions, in addition to the facility-based sessions. You will also be asked to complete fitness testing prior to the start of the program and at the end of 12 weeks. In addition, you will be asked to complete questionnaires prior to the start of the program, at the end of 4 weeks, and at the end of 12 weeks. Would that be a program that you might be interested in participating?"*

- ☐ If no, *"Thank you for your time. Have a nice _________ (time of day).*

- ☐ If yes, *"Great!"* [proceed to Question #3]

3. *"We are looking for volunteers who fit a certain criteria. Would it be alright if I ask you a few questions to see if you may be eligible?*

- ☐ If yes, proceed to Question #3a

- ☐ If no, *"Is there a better time to call you?"*

Date:_________________ Time:_______________

a) *"Was your kidney cancer localized or did it spread to other parts of your body?"*

- ☐ If localized, proceed to Question #3b

- ☐ If metastasized, *"Because you do not meet our staging criteria, you are ineligible for this study. Thank you very much for your time. Good-bye."*

b) *"Are you currently on any treatments for kidney cancer or planning to receive treatment in the next 3 months?"*

- ☐ If no, proceed to Question #3c

- ☐ If yes, *"Because we are looking for kidney cancer survivors who have completed their treatments, you are ineligible for this study. Thank you very much for your time. Good-bye."*

c) *"Are you planning to be away on holidays over the next 3 months?*

- ☐ If no, proceed to Question #3d

- ☐ If yes, *"Because we are looking for kidney cancer survivors who will not be away for three consecutive days for the duration of the program, you are ineligible for this study. Thank you very much for your time. Good-bye."*

d) *"Are you interested in increasing your physical activity levels?*

- ☐ If yes, proceed to Question #4

- ☐ If no, *"Because we are looking for kidney cancer survivors who are interested in increasing their physical activity, you are ineligible for this study. Thank you very much for your time. Good-bye."*

4. *"You have met our eligibility criteria for our study. We will be sending you an information package with further details about the TRACKS Trial, consent form, and physical activity readiness questionnaire. When you receive the package, please fill out the appropriate forms and send it back to us in the postage-paid envelope. When we have received your forms, we will be contacting you to book in your fitness testing date. Thank you very much for your interest in the program and I will contact you shortly. If you have any questions regarding the Trial, please do not hesitate to contact the Research Co-oordinator, ____________, at (780) 492-2829."*

Appendix I

TRACKS Trial Consent Form (Study 2)

Alberta Health Services [logo]

Cross Cancer Institute
11560 University Avenue Edmonton, Alberta
T6G 1Z2 Tel 780.432.8771

<u>Tr</u>ying <u>Ac</u>tivity in <u>K</u>idney Cancer <u>S</u>urvivors: The TRACKS Trial

CONSENT FORM

This form is part of the process of informed consent. It is designed to explain this research study and what will happen to you 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 anytime regarding this research study, please be sure to ask your doctor, nurse, or Research Co-ordinator [Linda Trinh, Tel: (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.

<u>"WHY IS THIS STUDY BEING DONE?"</u>

You are being asked to take part in this study because you had kidney cancer which is cured or in remission.

Many studies have shown that physical activity improves quality of life, physical fitness and fatigue for cancer survivors, and a recent study has shown these benefits in kidney cancer survivors as well. Studies have also shown that only a small percentage of cancer survivors, including kidney cancer survivors, are getting enough physical activity for health benefits. In fact, in a recent study it was found that over half of kidney cancer survivors are completely sedentary (do not engage in any moderate or vigorous exercise at all). The purpose of this study is to find out if a new program can help kidney cancer survivors increase their physical activity and improve their quality of life. This program has been developed specifically for kidney cancer survivors.

This study is being done because we do not have any programs designed specifically to help kidney cancer survivors increase their physical activity levels.

Dr. Kerry Courneya of the University of Alberta and Dr. Scott North of the Cross Cancer Institute are conducting this study that will examine the effects of a supervised physical activity program plus exercise counselling versus a supervised physical activity program plus behavioural counselling. The study is the first in the world to investigate this question.

<u>"WHAT DO WE HOPE TO LEARN?"</u>

We hope to learn what type of counselling, in addition to supervised physical activity, is best for helping kidney cancer survivors increase their physical activity and improve their quality of life, physical fitness, and health.

This is a Phase II study which is designed to identify the feasibility and efficacy of two supervised physical activity programs through a comparison process, may be suitable for further testing in future studies.

Phase II study: The primary purpose of the <u>Tr</u>ying <u>Ac</u>tivity in <u>K</u>idney Cancer <u>S</u>urvivors (TRACKS) Trial is to compare the effects of a supervised physical activity program plus traditional exercise counselling (SPA) versus a supervised physical activity plus motivationally-enhanced behavioural counselling (SPA+BC) on change in self-reported moderate/vigorous physical activity at the beginning of the program, after the 4-week supervised physical activity program, and 12-week follow-up among kidney cancer survivors. The secondary outcomes are changes in self-reported quality of life, body composition, cardiorespiratory fitness, physical function, and motivational variables.

<u>"WHAT IS INVOLVED IN THIS STUDY?"</u>

In this study, you may receive one of two supervised physical activity groups. You will be "randomized" to receive one of the groups described below. Randomization means the program that you are assigned to will be determined by chance. It is like flipping a coin. Randomization is done by using an envelope method. Neither you nor the researcher will choose which treatment 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 1 of 2 physical activity groups to complete: (1) supervised physical activity plus exercise counselling or (2) supervised physical activity plus behavioural counselling.

For both physical activity groups, you will be given a customized and supervised physical activity program. You will be given an individualized prescription at a moderate-to-vigorous intensity where the duration and intensity will be increase slowly over the 4 week program. Depending on your fitness level, you may begin the physical activity program at 15-20 minutes on the aerobic equipment of your choice (e.g., treadmill, stationary bicycle, elliptical trainers). You will be asked to attend six individual supervised exercise sessions with a physical activity specialist that eventually tapers to a home-based program by the end of the program. Over the 4-week period, you will be required to attend two sessions per week for the weeks 1-2, and one session per week for weeks 3-4. In order to achieve the physical activity guidelines established by the current public health recommendations, at least 2 or more sessions will be unsupervised home-based sessions, in addition to the facility-based sessions. You will be randomized to one of the following groups:

(1) <u>Supervised Physical Activity plus Exercise Counselling Group</u>: In addition to the supervised physical activity sessions, you will receive six individual "face-to-face" exercise counselling sessions with a physical activity specialist. These counselling sessions will be combined with the supervised physical activity sessions. These exercise counselling sessions will include training in proper physical activity technique, how to monitor intensity, and to progress PA safely and effectively to achieve the public health PA guidelines.

(2) Supervised Physical Activity plus Behavioural counselling Group: In addition to the supervised physical activity sessions, you will receive six individual “face-to-face” behavioural counselling sessions with a physical activity specialist. These counselling sessions will be combined with the supervised physical activity sessions. These behavioural counselling sessions will include training in behavioural strategies to promote the adoption and long-term maintenance of PA.

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

Overall, we have invited over 100 kidney cancer survivors in Edmonton, Alberta to take part in this study, and we hope that approximately 50 kidney cancer survivors will participate.

“WHAT WILL MY PARTICIPATION INVOLVE?”

You will be asked to complete the following tasks over the course of your involvement in the study:

- You will have an exercise test that involves walking on a treadmill with a gradual increase in speed and elevation. Your heart rate, blood pressure and how hard you feel you are working will be watched by the physical activity specialist throughout the test. You can request to stop this test at any time. You will be required to complete at least 2 stages of the treadmill test in order to proceed to randomization into 1 of the 2 physical activity programs. Please note that not all participants will proceed past the initial/baseline assessment. The purpose of this first exercise test is to make sure that you are physically able to safely exercise at a moderate intensity level. You will be required to complete two treadmill test assessments, one at the beginning (baseline) and one at the end of the physical activity program (at 12 weeks). The treadmill test should take no more than 45 minutes to complete.
- 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 12 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 body composition assessments, one at the beginning (baseline), and one at the end of the physical activity program (at 12 weeks). Your body composition will 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 nonstretching tape measure. This assessment will take approximately 5 minutes to complete.
- Complete three 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), at the end of the supervised portion of the program (at 4 weeks), and at the end of the entire program (at 12 weeks).

For both physical activity groups, you will be given a customized and supervised physical activity program. You will be given an individualized prescription at a moderate-to-vigorous intensity where the duration and intensity will be increase slowly over the 4 week program. Depending on your fitness level, you may begin the physical activity program at 15-20 minutes on the aerobic equipment of your choice (e.g., treadmill, stationary bicycle, elliptical trainers). You will be asked to attend six individual supervised exercise sessions with a physical activity specialist that eventually tapers to a home-based program by the end of the program. Over the 4-week period, you will be required to attend two sessions per week for the weeks 1-2, and one session per week for weeks 3-4. In order to achieve the physical activity guidelines established by the current public health recommendations, at least 2 or more sessions will be unsupervised home-based sessions, in addition to the facility-based sessions.

All physical activity sessions will take place at the Behavioural Medicine Fitness Centre (University of Alberta campus) for the 4-week program. Physical activity training sessions will be available any time between 7am and 7 pm, Monday to Friday and 9am to 12pm Saturday, and is flexible depending on when you want to come in. Each physical activity training session will take about 90 minutes. Trained staff will supervise all physical activity training sessions.

"HOW LONG WILL I BE INVOLVED IN THE STUDY?"

Both physical activity groups will undergo fitness testing at the beginning of the program (baseline) and after 12 weeks. Completion of the questionnaires will be done at the beginning of the program (baseline), at the end of the program (at 4 weeks) and at 12 weeks. The supervised physical activity program is 4 weeks in duration and you will be asked to exercise on your own for 8 weeks. In total, the research study will last about 14 weeks.

"WHAT ARE THE SIDE EFFECTS?"

There are a few risks associated with participating in this research. Some risk is associated with adoption of physical activity. It is possible that some people will experience muscle soreness and fatigue in the beginning of the program, particularly following the fitness testing. This type of response is usual, 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.

There is some risk associated with the aerobic and 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 (1 per 20,000 in testing facilities) 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 hard exercise.

Unique Side Effects/Special Precaution

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, undergo all of the procedures, and complete all of the questionnaires described above. It is very important that you inform the physical activity specialist and Research Co-ordinator 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.

"WHAT ARE MY ALTERNATIVES?"

Your doctor will discuss with you other options for increasing your physical activity and enhancing quality of life, and explain the risks and benefits of these options to you. Current options are for you to exercise on your own or join a private fitness center, or for you to not exercise.

"ARE THERE ANY BENEFITS TO PARTICIPATING IN THIS STUDY?"

Participation in this study may or may not be of personal benefit to you. However, based on the results of this study, it is hoped that, in the long-term, patient care can be improved. Being a part of this study will allow you to receive a free 4-week exercise program including a personal fitness trainer and access to a well-equipped fitness facility at no cost. If you follow the program, it is likely that your fitness level, quality of life and your health may improve with participation.

"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 Co-ordinator first.

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.

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.

"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 physical activity program are free. We will also pay for your parking at the Behavioural Medicine Fitness Centre when you come for your physical activity training sessions as well as your parking at the Cross Cancer Institute when coming for exercise testing. Your personal physical activity trainer, supervised physical activity program, and counselling 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).

If new information becomes available or there are changes to the study that may affect your health or willingness to continue in the study, you will be told in a timely manner.

"WILL MY PERSONAL INFORMATION BE KEPT CONFIDENTIAL?"

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 Alberta Cancer Research Ethics 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
- Alberta Cancer Research Ethics Committee, the institutional review board at this centre
- Members of the Regulatory/Audit team at the Cross Cancer Institute for quality assurance purposes

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 - Alberta Cancer Research Ethics 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, your responses to the questionnaires and your diaries will be kept confidential in a secure AHS facility.

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. Your identifiable health information collected as part of this study, which includes responses to the questionnaires, will be kept confidential. We will be retaining the anonymous data file for a period of 25 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.

Although absolute confidentiality can never be guaranteed, 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.

The information collected during this study will be used in analyses and will be published and/or presented to the scientific community at meetings and in journals, but your identity will remain confidential. This information may also be used as part of a submission to regulatory authorities around the world to support the approval of the drug used in this research. It is expected that the study results will be published as soon as possible after completion.

"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, the Research Co-ordinator, Linda Trinh at 780-492-2829 or Co-Investigator, Dr. Scott North at (780) 432-8762, 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 Concerns Department toll free at 1-866-561-7578.

UNDERSTANDING OF PARTICIPANTS

I can refuse to take part or withdraw from this study at any time without jeopardizing my health care. If I continue to take part in the study, I will be kept informed of any important new developments and information learned after the time I gave my original consent.

I also give consent for the Principal Investigator and Alberta Health Services (the Custodian) to disclose identifiable health information, as per the Alberta Health Information Act, to the organizations mentioned on the previous pages.

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

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

Appendix J

TRACKS Trial Program Content for the Supervised Physical Activity and Exercise Counselling (SPA+EC) Group (Study 2)

INTRODUCTION

Week 1, Session #1
Total time: 1 hour and 25 minutes

<u>Introduction to the Physical activity specialist and Developing Rapport (10-15 minutes):</u>

Establish a relationship with the participant by developing rapport. Begin the first session by getting to know the participant by asking questions such as: "tell me about yourself," "where were you born and raised," and "what is your occupation." Following this conversation, introduce yourself by disclosing information about where you are from, your education, previous work experience, and anything else that might be of interest to the participant. At all times, look for opportunities to start up 'small talk' to try and find topics of conversation and similarities. **Throughout each session, be sure to ask if the participant if s/he has any questions regarding the trial and/or physical activity in general.**

<u>Learning Objectives</u>

1. Learn about the fitness facility
2. Learn how to monitor intensity
3. Learn proper stretching routine
4. Learn about the TRACKS trial

<u>Facility Tour (10 minutes):</u>
Explain to the participant what s/he should do when s/he arrive at the facility for each session, such as where to park, where to place their belongings, where to change and any proper etiquette for the fitness facility. At this point s/he will be asked to change into appropriate workout attire if s/he needs to do so. You will then provide the participant with a tour of the fitness center and the equipment. The participant will also be shown where the spray bottles are and how to clean off the machines when s/he has completed their workout.

<u>Orientation To Aerobic Equipment (15-20 minutes):</u>
Provide and explain the aerobic equipment options available to the participant (treadmill, bike, elliptical, row) and show him/her the proper way to get on and off the equipment. You can then explain the different programs available on the specific equipment and how to get started. Also, show the participant how to properly put on a heart rate monitor and how it works. You can explain the importance of a structured warm up and cool down while the participant is warming up. The actual workout itself will be based on the participant's overall health and baseline fitness test.

How To Monitor Exercise Intensity (10 minutes-while participant is on the aerobic equipment):
While the participant is exercising, you will explain the importance of exercise intensity and how to monitor it. You will explain how to use a heart rate to monitor intensity. Also, explain how to use the Rating of Perceived Exertion (RPE) to monitor intensity. Refer to the Borg Rating scale in their physical activity manual and how it is used. Explain to the participant what heart rate range s/he should be exercising at for this week. Ensure that s/he reach this range and have him/her take note of how it feels based on the RPE scale.

Safety (5 minutes):
Explain the signs and symptoms of when to terminate physical activity.

Chest Pain/Discomfort

What: Uncomfortable feelings of pressure, pain, squeezing or heaviness.

Where: In the center of the chest, spread through the front of the chest or radiating to the shoulder(s), arm(s), neck and back.

What To Do: Stop, sit or lay down- if it does not stop after 2-4 minutes go to the emergency room. If it goes away but returns each time you exercise, go to the doctor.

Severe Nausea, Shortness Of Breath, Sweating Or Dizziness: Call your doctor.

If exercising outdoors, try to always exercise with a partner or let someone know where you are going.

Introduction To Stretching (10-15 minutes):
After the exercise session, discuss the benefits of stretching and when to perform a stretching program. Demonstrate a basic stretching program to the participant and explain that the participant should hold the stretch for 30 to 60 seconds in a position where s/he can feel a good stretch with no pain. Demonstrate each stretch to ensure that the participant is aware of which muscle group it is for and that s/he has proper technique. Refer the participant to the stretching program in their physical activity manual for reference.

What to Wear During Physical Activity (5 minutes):
Briefly explain what the best things to wear during physical activity are. Refer to the section in the participant's physical activity manual regarding what to wear when exercising and have him/her read over it on their own.

Shoes
Explain to participants that shoes are the most important piece of equipment for physical activity. A good pair of shoes can provide support

and cushioning and help to prevent injuries; therefore, it is important to identify a proper fitting good shoe.

Clothing
Wear comfortable shorts, t-shirts or workout pants for physical activity. Clothing should be breathable, cool and that will allow you to move unrestricted.

Hydration Before, During, and After Physical Activity (5 minutes):
Explain to the participant that drinking plenty of fluids on a regular basis is a healthy habit to establish. During exercise, drinking fluids allows the blood to move easier through the body to the working muscles. A lack of proper hydration causes your heart to work harder, decreased performance, fatigue, and muscle cramping. Hydration is also important to maintain cardiovascular health, proper body temperature and muscle function.
The participant should:

Drink plain water or fluids without sugar, caffeine, or alcohol
Drink 2 cups of water 2 hours before exercise
Drink every 15 minutes during exercise
Drink after exercise
Keep fluids cooler than air temperature and close at hand (it is always a good idea to have a water bottle with you)
Do not wait until you feel thirsty!
If you exercise LONGER than 60 minutes you may benefit from drinking sports drinks

Purpose of the TRACKS Trial (less than 5 minutes):
Explain to the participant that the goal for the trial is to increase their leisure-time physical activity from baseline (determined by the baseline questionnaire at the time of randomization documenting weekly average physical activity for the month prior to the start of the trial). Specifically, the goal of the intervention, based on current public health recommendations, will be to gradually increase all participants by at least 60 minutes of moderate intensity physical activity or 30 minutes of vigorous intensity physical activity to a minimum of 150 minutes of moderate intensity physical activity or 75 minutes of vigorous intensity physical activity per week.

Participant Physical activity manual (less than 5 minutes):
Provide the TRACKS trial physical activity manual to the participant and briefly explain its contents. Ask the participant to read through the material in the physical activity manual before the next session and ask for any clarification if necessary.

Make Next Appointment (less than 5 minutes):
Make an appointment for Session #2 with the participant with a very specific date, time, and location. Provide contact information to the fitness facility/physical

activity specialist in the event that the participant needs to reschedule or running late. Thank the participant for their important contribution to the trial.

Handouts:

- TRACKS Trial Physical Activity Manual
- Fitness Facility/Physical activity specialist contact information

EXERCISE COUNSELLING

Week 1, Session #2
Total time: 25 minutes

Review Past Week (5 minutes):
Ask the participant if s/he have any questions regarding the TRACKS Trial physical activity manual or physical activity in general.

Adjust the participant’s workout by increasing or decreasing intensity based on how the s/he is feeling.

Learning Objectives:
1. Learn how to monitor intensity using heart rate and RPE
2. Learn what to wear when exercising
3. Learn about the warm-up and cool-down
4. Learn about the different types of aerobic equipment

Exercise Education (15 minutes):
Continue providing the participant with information about how to begin his/her physical activity program based on general principles of exercise and the learning objectives mentioned above.

Make Next Appointment (less than 5 minutes):
Make an appointment for Session #3 with the participant with a very specific date, time, and location. Thank the participant for their important contribution to the trial.

EXERCISE COUNSELLING

Week 2, Session #3
Total time: 25-30 minutes

Review Past Week (5 minutes):
Ask the participant if s/he have any questions regarding the TRACKS Trial physical activity manual or physical activity in general.

Adjust the participant's workout by increasing or decreasing intensity based on how the s/he is feeling.

Learning Objectives:
1. Learn how to monitor intensity using heart rate and RPE
2. Learn what to wear when exercising
3. Learn about the warm-up and cool-down
4. Learn about the different types of aerobic equipment

Exercise Education (15 minutes):
Continue providing the participant with information about how to begin his/her physical activity program based on general principles of exercise and the learning objectives mentioned above.

Discussion of Home-Based Workouts (5 minutes):
As part of the TRACKS trial, participants are asked to complete some home-based workouts. During week 2, participants are asked to complete one workout on their own, followed by two workouts on their own in weeks 3 and 4. Ensure that the participant is aware that these workouts must involve aerobic activities that increase his/her heart rate to a moderate-to-vigorous intensity. **Have the participant complete one additional home-based workout for Week 2.**

Make Next Appointment (less than 5 minutes):
Make an appointment for Session #4 with the participant with a very specific date, time, and location. Thank the participant for their important contribution to the trial.

EXERCISE COUNSELLING

Week 2, Session #4
Total time: 25-30 minutes

Review Past Week (5 minutes):
Ask the participant if s/he have any questions regarding the TRACKS Trial physical activity manual or physical activity in general. Ask the participant "How did it go in terms of the home-based sessions?" (if s/he has already completed one). Address any concerns that s/he may have related to general exercise at this point.

Adjust the participant's workout by increasing or decreasing intensity based on how the s/he is feeling.

Learning Objectives:
1. Learn how to monitor intensity using heart rate and RPE
2. Learn what to wear when exercising
3. Learn about the warm-up and cool-down
4. Learn about the different types of aerobic equipment

Exercise Education (15 minutes):
Continue providing the participant with information about how to begin his/her physical activity program based on general principles of exercise and the learning objectives mentioned above.

Discussion of Home-Based Workouts (5 minutes):
If the participant has not already completed a home-based workout, remind the participant that as part of the TRACKS trial, participants are asked to complete one workout this week on their own.

Make Next Appointment (less than 5 minutes):
Make an appointment for Session #5 with the participant with a very specific date, time, and location. Thank the participant for their important contribution to the trial.

EXERCISE COUNSELLING

Week 3, Session #5
Total time: 25-30 minutes

Review Past Week (5 minutes):
Ask the participant if s/he have any questions regarding the TRACKS Trial physical activity manual or physical activity in general. Ask the participant "How did it go in terms of the home-based sessions?" Address any concerns that s/he may have related to general exercise at this point.

Adjust the participant's workout by increasing or decreasing intensity based on how the s/he is feeling.

Learning Objectives:
1. Learn how to monitor intensity using heart rate and RPE
2. Learn what to wear when exercising
3. Learn about the warm-up and cool-down
4. Learn about the different types of aerobic equipment

Exercise Education (15 minutes):
Continue providing the participant with information about how to begin his/her physical activity program based on general principles of exercise and the learning objectives mentioned above.

Discussion of Home-Based Workouts (5 minutes):
As part of the TRACKS trial, participants are asked to complete some home-based workouts. During week 2, participants are asked to complete one workout on their own, followed by two workouts on their own in weeks 3 and 4. Ensure that the participant is aware that these workouts must involve aerobic activities that increase his/her heart rate to a moderate-to-vigorous intensity. **Have the participant complete two additional home-based workout for Week 3.**

Make Next Appointment (less than 5 minutes):
Make an appointment for Session #6 with the participant with a very specific date, time, and location. Thank the participant for their important contribution to the trial.

EXERCISE COUNSELLING

Week 4, Session #6
Total time: 25-30 minutes

Review Past Week (5 minutes):
Ask the participant if s/he have any questions regarding the TRACKS Trial physical activity manual or physical activity in general. Ask the participant "How did it go in terms of the home-based sessions?" Address any concerns that s/he may have related to general exercise at this point.

Adjust the participant's workout by increasing or decreasing intensity based on how the s/he is feeling.

Learning Objectives:
1. Learn how to monitor intensity using heart rate and RPE
2. Learn what to wear when exercising
3. Learn about the warm-up and cool-down
4. Learn about the different types of aerobic equipment

Exercise Education (15 minutes):
Continue providing the participant with information about how to begin his/her physical activity program based on general principles of exercise and the learning objectives mentioned above.

Discussion of Home-Based Workouts (5 minutes):
As part of the TRACKS trial, participants are asked to complete some home-based workouts. During week 2, participants are asked to complete one workout on their own, followed by two workouts on their own in weeks 3 and 4. Ensure that the participant is aware that these workouts must involve aerobic activities that increase his/her heart rate to a moderate-to-vigorous intensity. **Have the participant complete two additional home-based workout for Week 4. For the next 8 weeks (Weeks 5-12), participants will be asked to complete home-based workouts on their own.**

Make Next Appointment (less than 5 minutes):
Make an appointment with the participant for the 12-week follow-up testing. Thank the participant for their important contribution to the trial.

Handouts:
- Hand out the TRACKS Trial post-intervention questionnaire and have participants complete it at home and mail it back to the physical activity specialist in the enclosed postage-paid envelope

Appendix K

TRACKS Trial Program Content for the Supervised Physical Activity Plus Behavioural Counselling (SPA+BC) Group (Study 2)

INTRODUCTION

Week 1, Session #1
Total time: 1 hour and 25 minutes

Introduction to the Physical activity specialist and Developing Rapport (10-15 minutes):

Establish a relationship with the participant by developing rapport. Begin the first session by getting to know the participant by asking questions such as: “tell me about yourself,” “where were you born and raised,” and “what is your occupation.” Following this conversation, introduce yourself by disclosing information about where you are from, your education, previous work experience, and anything else that might be of interest to the participant. At all times, look for opportunities to start up ‘small talk’ to try and find topics of conversation and similarities. **Throughout each session, be sure to ask if the participant if s/he has any questions regarding the trial and/or physical activity in general.**

Learning Objectives

5. Learn about the fitness facility
6. Learn how to monitor intensity
7. Learn proper stretching routine
8. Learn about the TRACKS trial
9. Learn how to complete the daily physical activity log.

Facility Tour (10 minutes):
Explain to the participant what s/he should do when s/he arrive at the facility for each session, such as where to park, where to place their belongings, where to change and any proper etiquette for the fitness facility. At this point s/he will be asked to change into appropriate workout attire if s/he needs to do so. You will then provide the participant with a tour of the fitness center and the equipment. The participant will also be shown where the spray bottles are and how to clean off the machines when s/he has completed their workout.

Orientation To Aerobic Equipment (15-20 minutes):
Provide and explain the aerobic equipment options available to the participant (treadmill, bike, elliptical, row) and show him/her the proper way to get on and off the equipment. You can then explain the different programs available on the specific equipment and how to get started. Also, show the participant how to properly put on a heart rate monitor and how it works. You can explain the importance of a structured warm up and cool down while the participant is warming up. The actual workout itself will be based on the participant’s overall health and baseline fitness test.

How To Monitor Exercise Intensity (10 minutes-while participant is on the aerobic equipment):
While the participant is exercising, you will explain the importance of exercise intensity and how to monitor it. You will explain how to use a heart rate to monitor intensity. Also, explain how to use the Rating of Perceived Exertion (RPE) to monitor intensity. Refer to the Borg Rating scale in their physical activity manual and how it is used. Explain to the participant what heart rate range s/he should be exercising at for this week. Ensure that s/he reach this range and have him/her take note of how it feels based on the RPE scale.

Safety (5 minutes):
Explain the signs and symptoms of when to terminate physical activity.

Chest Pain/Discomfort

What: Uncomfortable feelings of pressure, pain, squeezing or heaviness.

Where: In the center of the chest, spread through the front of the chest or radiating to the shoulder(s), arm(s), neck and back.

What To Do: Stop, sit or lay down- if it does not stop after 2-4 minutes go to the emergency room. If it goes away but returns each time you exercise, go to the doctor.

Severe Nausea, Shortness Of Breath, Sweating Or Dizziness: Call your doctor.

If exercising outdoors, try to always exercise with a partner or let someone know where you are going.

Introduction To Stretching (10-15 minutes):
After the exercise session, discuss the benefits of stretching and when to perform a stretching program. Demonstrate a basic stretching program to the participant and explain that the participant should hold the stretch for 30 to 60 seconds in a position where s/he can feel a good stretch with no pain. Demonstrate each stretch to ensure that the participant is aware of which muscle group it is for and that s/he has proper technique. Refer the participant to the stretching program in their physical activity manual for reference.

What to Wear During Physical Activity (5 minutes):
Briefly explain what the best things to wear during physical activity are. Refer to the section in the participant's physical activity manual regarding what to wear when exercising and have him/her read over it on their own.

Shoes

Explain to participants that shoes are the most important piece of equipment for physical activity. A good pair of shoes can provide support and cushioning and help to prevent injuries; therefore, it is important to identify a proper fitting good shoe.

Clothing

Wear comfortable shorts, t-shirts or workout pants for physical activity. Clothing should be breathable, cool and that will allow you to move unrestricted.

Hydration Before, During, and After Physical Activity (5 minutes):

Explain to the participant that drinking plenty of fluids on a regular basis is a healthy habit to establish. During exercise, drinking fluids allows the blood to move easier through the body to the working muscles. A lack of proper hydration causes your heart to work harder, decreased performance, fatigue, and muscle cramping. Hydration is also important to maintain cardiovascular health, proper body temperature and muscle function.

The participant should:

Drink plain water or fluids without sugar, caffeine, or alcohol
Drink 2 cups of water 2 hours before exercise
Drink every 15 minutes during exercise
Drink after exercise
Keep fluids cooler than air temperature and close at hand (it is always a good idea to have a
water bottle with you)
Do not wait until you feel thirsty!

Purpose of the TRACKS Trial (less than 5 minutes):

Explain to the participant that the goal for the trial is to increase their leisure-time physical activity from baseline (determined by the baseline questionnaire at the time of randomization documenting weekly average physical activity for the month prior to the start of the trial). Specifically, the goal of the intervention, based on current public health recommendations, will be to gradually increase all participants by at least 60 minutes of moderate intensity physical activity or 30 minutes of vigorous intensity physical activity to a minimum of 150 minutes of moderate intensity physical activity or 75 minutes of vigorous intensity physical activity per week.

How To Complete PA Daily Log (5 Minutes):

Explain how to use the physical activity log. Use the physical activity done during the today's session as an example by recording it in the log. Reinforce the importance of recording every physical activity session in the log. Explain to the participant that keeping a record of their daily physical activity is essential to determine their adherence to the program and progressing through the physical activity prescription at an appropriate rate.

Participant Physical activity manual (less than 5 minutes):
Provide the TRACKS trial physical activity manual to the participant and briefly explain its contents. Ask the participant to read through the material in the physical activity manual before the next session and ask for any clarification if necessary. Explain to the participant that the sessions will refer to the content in the physical activity manual.

Make Next Appointment (less than 5 minutes):
Make an appointment for Session #2 with the participant with a very specific date, time, and location. Provide contact information to the fitness facility/physical activity specialist in the event that the participant needs to reschedule or running late. Thank the participant for their important contribution to the trial.

Handouts:
- Physical Activity Log
- TRACKS Trial Physical Activity Manual
- Fitness Facility/Physical activity specialist contact information

BENEFITS OF PHYSICAL ACTIVITY

Week 1, Session #2
Total Time: 35 minutes

Review Past Week (5 minutes):
Ask the participant if s/he have any questions regarding the TRACKS Trial physical activity manual or physical activity in general. Address any concerns that s/he may have at this point.

Learning Objectives:
1. To understand the benefits of physical activity to the general population
2. To learn more about the benefits of physical activity specific to kidney cancer survivors
3. To learn about the benefits of cross training

Benefits of Physical Activity (15 minutes):
Ask what are the most important benefits for participant participating in physical activity and why? Let the participant discuss as many benefits as are important to him/her. Once s/he is done, review the benefits of physical activity in the general population where exercise may also help:

- Improve physical fitness and functioning
- Improves kidney function
- Improve muscle strength and bone density
- Reduce fatigue and increase energy
- Helps control and manage weight
- Helps control blood pressure and prevents high blood pressure
- Improves flexibility
- Prevents chronic diseases like cancer, type 2 diabetes and heart disease
- Reduce stress

Discuss how these benefits can affect the day to day life of the participant (immediate benefits such as feeling energized) as well as long term health benefits (e.g., prolonged independence with older age).

Then, discuss specifically about the unique benefits of physical activity for kidney cancer survivors. Let s/he know that physical activity is especially important for him/her and has additional benefits for kidney cancer survivors. Specifically, these benefits include:

- Helps control and manage weight
- Improve energy levels
- Helps you feel good about yourself
- Improves quality of life

- Improve strength and fitness
- Helps you feel healthier and improve your health
- Helps you lower/control your blood pressure and cholesterol
- Increase flexibility
- Improves sleep quality

Cross Training (5-10 minutes):

Discuss the importance of cross training since performing the same exercise every day can lead to overuse injuries, fatigue, and boredom. Discuss possible cross training activities such as swimming, biking, skiing, skating, and dancing. Create a list of cross training activities that the participant is interested in. Explain that cross training allows for different muscles to be used, which allows the other muscle group time to rest and repair.

Make Next Appointment (less than 5 minutes):

Make an appointment for Session #3 with the participant with a very specific date, time, and location. Thank the participant for their important contribution to the trial.

Note for physical activity specialist: This session targets the TPB construct of instrumental attitude.

OVERCOMING BARRIERS TO PHYSICAL ACTIVITY

Week 2, Session #3
Total Time: 30 minutes

Review Past Week (5 minutes):
Ask the participant if s/he have any questions regarding the TRACKS Trial physical activity manual or physical activity in general. Address any concerns that s/he may have at this point. After a brief discussion decide if s/he is:

READY TO INCREASE THEIR PHYSICAL ACTIVITY
Explain how much the physical activity should be increased. Discuss ideas to increase the frequency, duration, and/or intensity of the physical activity to achieve the new physical activity goal.

NOT READY TO INCREASE THEIR PHYSICAL ACTIVITY
If the participant hesitates about a further increase in physical activity at this time, tell him/her that it is reasonable for him/her to do the same level of physical activity for another week, and that the increase can be delayed until s/he feel ready. Discuss strategies to maintain current physical activity levels.

Learning Objectives:
1. To learn some of the barriers that kidney cancer survivors face when participating in physical activity
2. To learn what the participants personal barriers are to participate in a physical activity program
3. To work through, and brainstorm ideas on how to overcome possible barriers
4. To develop a plan for the home-based workouts

Common Barriers Among Kidney Cancer Survivors (10 minutes):
Discuss some common barriers that kidney cancer survivors face when participating in a physical activity program. Brainstorm some ideas on how to overcome these barriers.

Barrier	Solutions
Presence of medical or health problems	• Exercise in 10 minute bouts throughout the day to accumulate towards the daily physical activity goal • Begin a physical activity program that is light-to-moderate in intensity for a shorter duration • Choose activities that are low impact such as swimming and the recumbent bike

Lack of time	• Exercise first thing in the morning so that you have less time to talk yourself out of doing it • Schedule physical activity in your day rather than wait to see where it will fit in • Perform the 10-minute solution, especially on busy days. Try building in 10 minutes of exercise 3 times a day to accumulate 30 minutes of physical activity • Add physical activity to your daily routine such as walking or riding your bike to work and when you run errands • Use exercise as transportation
Fatigue	• Studies have shown that as little as 30 minutes of brisk walking can reduce tiredness. It doesn't have to be completed all at once and can even be broken up into three, 10-minute sessions • Notice the days and times you feel most tired. Perform physical activity on days and during times when fatigue is lowest • Try interval training when continuous aerobic training is difficult to complete
Poor weather	• Develop a set of regular activities that are always available regardless of weather such as stair climbing, mall walking, indoor swimming, etc. **<u>Cold weather</u>** • Be active in the middle of the day when it is the warmest • Dress in appropriate attire right from head to toe if you are doing physical activity outdoors • Locate an indoor walking track or try mall walking • Join a fitness club or sign up for fitness classes • Purchase home equipment such as a treadmill or bike **<u>Hot weather</u>** • Drink water before, during and after being active. • On hot, humid days, be active early or late in the day avoiding the hottest part of the day. • Don't overdo it. Go at your own pace. • Try swimming to keep yourself cool

Lack of motivation	• Review the benefits of physical activity and know your personal reasons for participation • Exercise with a friend--when you make plans with someone, you become accountable to someone and more likely to stick with it • Train for an event such as a local 5K or 10K walk or run in your area • Join a group exercise class such as aerobics or a spin class • Reward yourself when you reach your short-term or long-term goals
Limited or no access to recreation facilities	• Select activities that require minimal facilities or equipment such as walking, jogging, or jumping rope • Locate parks and trails in your neighbourhood to be physically active • Design your own walking circuit in your neighbourhood

Personal Barriers (10 minutes):
Brainstorm with the participant about possible unique barriers to physical activity. Ask about main barriers that the participant is currently facing as well as anticipated barriers. Discuss about the importance of having a plan to address the barrier. Develop some solutions to overcome these barriers.

Discussion of Home-Based Workouts (5 minutes):
As part of the TRACKS trial, participants are asked to complete some home-based workouts. During week 2, participants are asked to complete one workout on their own, followed by two workouts on their own in weeks 3 and 4. Ensure that the participant is aware that these workouts must involve aerobic activities that increase his/her heart rate to a moderate-to-vigorous intensity. Develop a plan with the participant as when, where, how, and what the participant will do for these workouts. **Complete a physical activity prescription form with the participant for one additional home-based workout for Week 2.**

Make Next Appointment (less than 5 minutes):
Make an appointment for Session #4 with the participant with a very specific date, time, and location. Thank the participant for their important contribution to the trial.

Handouts:
- Physical activity prescription for the home-based workout

Note for physical activity specialist: This session targets the TPB constructs of PBC and planning.

STIMULUS CONTROL

Week 2, Session #4
Total Time: 35 minutes

Review Past Week (5 minutes):
Ask the participant if s/he have any questions regarding the TRACKS Trial physical activity manual or physical activity in general. Ask the participant "How did it go in terms of the home-based sessions?" (if s/he has already completed one). Address any concerns that s/he may have at this point. After a brief discussion decide if s/he is:

READY TO INCREASE THEIR PHYSICAL ACTIVITY
Explain how much the physical activity should be increased. Discuss ideas to increase the frequency, duration, and/or intensity of the physical activity to achieve the new physical activity goal.

NOT READY TO INCREASE THEIR PHYSICAL ACTIVITY
If the participant hesitates about a further increase in physical activity at this time, tell him/her that it is reasonable for him/her to do the same level of physical activity for another week, and that the increase can be delayed until s/he feel ready. Discuss strategies to maintain current physical activity levels.

Learning Objectives

1. Learn what stimulus control is and how it influences behaviour.
2. Learn how to establish appropriate stimuli.
3. Develop appropriate rewards.

Stimulus Control (10 minutes):
Stimulus control methods can be used to increase a desired response by manipulating and seeking cues in the environment to perform the behaviour. For example, looking at the weather report for rain all week is a cue to decide about alternatives to exercising outdoors. It involves strengthening cues for the target behaviour and minimizing cues for competing beahaviours. Eating a snack and watching television are competing behaviours for going for a walk in the neighbourhood. Keeping the television turned off when you come home can minimize the cue for sedentary activity. We now all know 'HOW' to engage in physical activity, but the questions that remains is 'WHEN?' We can try to control this by using prompts or stimuli in the environment.

Ideas For Stimulus Control:
The idea is to establish stimuli in your environment to encourage physical activity. Some examples of what the participant can do at home are:

- Put your running shoes by the side of your bed or lay your workout clothes the night before if you would like to do physical activity when you wake up in the morning. Ensure that that these items are in plain sight.
- Prompt yourself with a water bottle or gym bag near the door.
- Write and stick a positive message on your milk or something else you take out frequently asking ‘have I done my exercise today?’
- Schedule your workout in your agenda similar to a business meeting.
- Get a friend to call and prompt you to get active.
- Create a buddy system where you and a friend can exercise at a set day and time every week.
- Exercise at the same time and same location because cues for exercise are strengthened when they are repeatedly linked to the target behaviour.

The cues are very important but so is the reward. Rewards help reinforce the behaviour and acknowledge that the participant is one step closer to reaching your goals. It also serves as motivation to the participant to continue the physical activity program. Rewards can be either intrinsic or extrinsic or both. Intrinsic benefits include more energy, elevation of mood, decrease stress, decrease, and improve fitness, as some examples. Extrinsic rewards for doing physical activity include purchasing new workout attire, reading a book, or having a piece of chocolate cake, as some examples.

Creating Personalized Stimulus Control (10 minutes):
Discuss with the participant some appropriate stimuli for his/her physical activity routine, as well as appropriate reward systems.

Discussion of Home-Based Workouts (5 minutes):
If the participant has not already completed a home-based workout, remind the participant that as part of the TRACKS trial, participants are asked to complete one workout this week on their own.

Make Next Appointment (less than 5 minutes):
Make an appointment for Session #5 with the participant with a very specific date, time, and location. Thank the participant for their important contribution to the trial.

Note for physical activity specialist: This session targets the TPB constructs of PBC and planning.

SOCIAL SUPPORT AND HOW TO MAKE PHYSICAL ACTIVITY FUN

Week 3, Session #5
Total Time: 35 minutes

Review Past Week (5 minutes):
Ask the participant if s/he have any questions regarding the TRACKS Trial physical activity manual or physical activity in general. Ask the participant "How did it go in terms of the home-based sessions?" Address any concerns that s/he may have at this point. After a brief discussion decide if s/he is:

READY TO INCREASE THEIR PHYSICAL ACTIVITY
Explain how much the physical activity should be increased. Discuss ideas to increase the frequency, duration, and/or intensity of the physical activity to achieve the new physical activity goal.

NOT READY TO INCREASE THEIR PHYSICAL ACTIVITY
If the participant hesitates about a further increase in physical activity at this time, tell him/her that it is reasonable for him/her to do the same level of physical activity for another week, and that the increase can be delayed until s/he feel ready. Discuss strategies to maintain current physical activity levels.

Learning Objectives For The Current Session:

1. Learn the importance of social support for maintaining a physical activity program.
2. Learn what social support is available (e.g., their support person, the Buddy System, walking groups) and how s/he can incorporate it into their program.
3. Determine what makes physical activity fun for participant?
4. Learn ways to increase the enjoyment of physical activity.

Support System (10 minutes):
Discuss the importance of family/friend support for lifestyle changes. Having a supportive social environment is crucial for the participant in attaining goals. Discuss how the support person can aid in lifestyle change of participant. Examples can be: planning active outings, being a role model, encouragement, and support. Discuss what activities the participant and his/her support person can do together. Raise the possibility of joining a group fitness class or walking group if the participant cannot think of a support person that would be beneficial at this time.

Brainstorm How To Make Physical Activity More Enjoyable (10 minutes):

- **Music** – Try listening to music or an audio book while exercising

- **New Locations** – Find new locations in the neighbourhood such as a new park or walking trail to exercise. Try a drop-in pass at a new fitness facility
- **New Activities** – Implement cross training in your physical activity routine. Adding a variety of activities to your routine will not only allow you to work different muscle groups, but it will also be more exciting
- **Active Vacations** – Plan active outings with your friends and family to achieve your fitness goals. Some examples include: hiking, canoeing, biking, and walking
- **Add A Friend** - Pick someone who is full of energy, fun and who you look forward to spending time with
- **Group Fitness** - Group fitness classes are a great way to keep motivated and to meet new workout buddies. A perk is that you have an instructor to teach you proper technique.
- **Play Something** - A great way to do a lot of physical activity and make it fun instead of work. Join a sports league or gather some friends and play a game of baseball
- **Television** - Adding your favorite shows to your workout routine can motivate you to get through the workout and it saves time

Discussion of Home-Based Workouts (5 minutes):
As part of the TRACKS trial, participants are asked to complete some home-based workouts. During week 2, participants are asked to complete one workout on their own, followed by two workouts on their own in weeks 3 and 4. Ensure that the participant is aware that these workouts must involve aerobic activities that increase his/her heart rate to a moderate-to-vigorous intensity. Develop a plan with the participant as when, where, how, and what the participant will do for these workouts. **Complete a physical activity prescription form with the participant for two additional home-based workouts for Week 3.**

Make Next Appointment (less than 5 minutes):
Make an appointment for Session #6 with the participant with a very specific date, time, and location. Thank the participant for their important contribution to the trial.

Handouts:
- Physical activity prescription for the home-based workout

Note for physical activity specialist: This session targets the TPB constructs of affective attitude and subjective norm.

GOAL SETTING AND PLANNING

Week 4, Session #6
Total Time: 45 minutes

Review Past Week (5 minutes):
Ask the participant if s/he have any questions regarding the TRACKS Trial physical activity manual or physical activity in general. Ask the participant "How did it go in terms of the home-based sessions?" Address any concerns that s/he may have at this point. After a brief discussion decide if s/he is:

READY TO INCREASE THEIR PHYSICAL ACTIVITY
Explain how much the physical activity should be increased. Discuss ideas to increase the frequency, duration, and/or intensity of the physical activity to achieve the new physical activity goal.

NOT READY TO INCREASE THEIR PHYSICAL ACTIVITY
If the participant hesitates about a further increase in physical activity at this time, tell him/her that it is reasonable for him/her to do the same level of physical activity for another week, and that the increase can be delayed until s/he feel ready. Discuss strategies to maintain current physical activity levels.

Learning Objectives For The Current Session:

1. Learn how to create short and long term goals based on the SMART principle.
2. Learn how to create a detailed plan for achieving a physical activity goal.
3. Develop a plan for physical activity for the home-based workouts for the next 8 weeks.
4. Understand how self monitoring can be used to set goals, evaluate progress, and provide reinforcement in order to optimize motivation and progression of the physical activity program.

Goal Setting (5 minutes):
Explain to participants the importance of having goals. It is essential to set both short term and long term goals that are performance or fitness based to provide a sense of direction, purpose and motivation when working towards change. Reaching health or performance goals can be extremely rewarding. Short-term goals are based on something that the participant will achieve in the near future such as within a few weeks or months. Long-term goals are goals that the participant will achieve over a longer duration such as within 3 to 6 months, a year, or five years from now. Long term goals provide focus while short-term goals are the building blocks to get there. When setting physical activity goals, be sure to follow the "**SMART**" guidelines described below:

<u>S</u>pecific: Determine exactly how much physical activity you want to do.
<u>Example:</u> My goal is to walk for 30 minutes continuously, three mornings each week by the end of the month.

<u>M</u>easurable: Measure your progress towards your goal.
<u>Example:</u> Measure goals by time or distance or recording workouts in the physical activity log.

<u>A</u>ttainable: Set a goal that is realistic for you to achieve based on your skills, resources, and barriers to activity. Set goals that are challenging to you, but achievable. Set yourself up for success.

<u>R</u>eward: Plan to reward yourself when you meet your goal and have something to look forward to.
<u>Example:</u> Treat yourself to something that you enjoy such as a manicure, massage, reading a book, or buying a new pair of running shoes.

<u>T</u>ime Frame: Set a time frame for achieving your goal so that you know when to celebrate your success.

<u>Create Exercise Goals (5 minutes):</u>
Ask the participant to set some short term and long term goals. It is very important that the participant takes the lead in creating goals and action plans, as having a sense of control over goals is linked to success. Congratulate the participant for setting important and challenging goals

<u>Detailed Planning Activity (5 minutes):</u>
Explain to participants the importance of having a detailed plan for achieving their physical activity goal. Research has shown that people with a general goal (i.e., to try and increase my physical activity) do not do as well as people who have a detailed plan for achieving their physical activity goal. A detailed plan includes the who, what, when, where, and how of the PA goal. Without detailed plans, it is easy for participants to lose motivation and direction for physical activity.

<u>Create a Detailed Plan (15 minutes):</u>
Work with the participant to establish a detailed plan for how s/he is going to achieve their physical activity goal using the Detailed Planning worksheet. This can also act as their physical activity prescription for the next 8 weeks for their home-based workouts. Create a detailed plan to achieve their physical activity goal. It is very important that the participant takes the lead in developing the plan. Where possible, encourage the participant to provide specific details on the who, what, when, where, and how rather than general goals.

Importance Of Self Monitoring Physical Activity (5 minutes):
Keeping a written record of physical activity allows the participant to see where s/he started, the progress s/he have made, and how close s/he are to achieving their goal. This helps maintain motivation for staying with a physical activity program for long periods of time. Remind the participant to keep track of the workouts over the next 8 weeks and after the intervention in his/her physical activity log.

Discussion of Home-Based Workouts (5 minutes):
As part of the TRACKS trial, participants are asked to complete some home-based workouts. During week 2, participants are asked to complete one workout on their own, followed by two workouts on their own in weeks 3 and 4. Ensure that the participant is aware that these workouts must involve aerobic activities that increase his/her heart rate to a moderate-to-vigorous intensity. Develop a plan with the participant as when, where, how, and what the participant will do for these workouts. **Complete a physical activity prescription form with the participant for two additional home-based workout for Week 4. At this point, you can use the Detailed Planning worksheet as the particpant's physical activity prescription for their home-based workouts for this week and the next 8 weeks (Weeks 5-12).**

Make Next Appointment (less than 5 minutes):
Make an appointment with the participant for the 12-week follow-up testing. Thank the participant for their important contribution to the trial.

Handouts:
- Detailed planning worksheet
- Physical activity prescription for the home-based workout
- Hand out the TRACKS Trial post-intervention questionnaire and have participants complete it at home and mail it back to the physical activity specialist in the enclosed postage-paid envelope

Note for physical activity specialist: This session targets the TPB constructs of PBC and planning.

Appendix L

Table of Contents for TRACKS Trial Program Manual for the Supervised Physical Activity and Behavioural Counselling (SPA+BC) Group (Study 2)

Please note that a condensed version of this manual has been provided to the supervised physical activity plus exercise counselling (SPA+EC) group, but only includes exercise training principles and does not include behavioural counselling strategies.

Trying **Ac**tivity for **K**idney Cancer **S**urvivors Trial:

The TRACKS Trial Physical Activity Manual

Prepared By:

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&
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SPA+BC

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Appendix M

TRACKS Trial Physical Activity Log the Supervised Physical Activity Plus Behavioural Counselling (SPA+BC) Group (Study 2)

TRACKS Trial

Please start a new page each week! **Name:**______________________

Start on SUNDAY (fill in date): ______/______/______
Day Month Year

Day	Activity	Exercise Time	Heart Rate	RPE	Comments
☐	Treadmill (walk or run) Bike (recumbent or upright) Elliptical Rowing Other (specify below): ______________	☐☐☐ minutes	☐☐☐ beats per minute	☐☐ on a scale of 6-20	
☐	Treadmill (walk or run) Bike (recumbent or upright) Elliptical Rowing Other (specify below): ______________	☐☐☐ minutes	☐☐☐ beats per minute	☐☐ on a scale of 6-20	
☐	Treadmill (walk or run) Bike (recumbent or upright) Elliptical Rowing Other (specify below): ______________	☐☐☐ minutes	☐☐☐ beats per minute	☐☐ on a scale of 6-20	
☐	Treadmill (walk or run) Bike (recumbent or upright) Elliptical Rowing Other (specify below): ______________	☐☐☐ minutes	☐☐☐ beats per minute	☐☐ on a scale of 6-20	
☐	Treadmill (walk or run) Bike (recumbent or upright) Elliptical Rowing Other (specify below): ______________	☐☐☐ minutes	☐☐☐ beats per minute	☐☐ on a scale of 6-20	
☐	Treadmill (walk or run) Bike (recumbent or upright) Elliptical Rowing Other (specify below): ______________	☐☐☐ minutes	☐☐☐ beats per minute	☐☐ on a scale of 6-20	
☐	Treadmill (walk or run) Bike (recumbent or upright) Elliptical Rowing Other (specify below): ______________	☐☐☐ minutes	☐☐☐ beats per minute	☐☐ on a scale of 6-20	

For DAY, please fill in the following: 1=Monday, 2=Tuesday, 3=Wednesday, 4=Thursday, 5=Friday, 6=Saturday, 7=Sunday

Appendix N

TRACKS Trial Home-Based Workouts for the Supervised Physical Activity Plus Behavioural Counselling (SPA+BC) Group (Study 2)

Physical Activity Prescription For Home-Based Workouts

Week #:	**Number of home-based sessions required:**

***I will be physically active _______ days a week for _______ minutes a day at moderate intensity**

AND/OR

***I will be physically active _______ days a week for _______ minutes a day at vigorous intensity**

***My TARGET HEART RATE ZONE is ____________ beats per minute and I should be working at a RATING OF PERCEIVED EXERTION of __________.**

Activities	**When will I do it?**							
	Mon	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**	**Sun**	**Total minutes**

I will complete my activities at the following location(s):___________________________________

I am planning on being physically active with:____

List your own personal BARRIERS to being physically active and STRATEGIES to overcome them:

BARRIERS: ____
Strategies:____
____
____

Appendix O

TRACKS Trial Planning Worksheet for the Supervised Physical Activity Plus Behavioural Counselling (SPA+BC) Group (Study 2)

Goal Setting and Detailed Planning Activity

Now that you are aware of how much physical activity you need to do to get health benefits, the next step is to set your own physical activity goal and a detailed plan for how to achieve your goal. *You will be asked to do physical activity on your own for the next 8 weeks*, and research has consistently shown that setting a goal and having a detailed plan of how to reach your goal is one of the best ways to be successful.

When setting your physical activity goal be sure to follow the "**SMART**" guidelines described below:

Specific: Determine exactly how much physical activity you want to do.

Example: My goal is to walk for 30 minutes continuously, three mornings each week by the end of August.

Measurable: Measure your progress towards your goal.
Example: Measure goals by time or distance or recording workouts in the physical activity log.

Attainable: Set a goal that is realistic for you to achieve.

Realistic: Goals should be relevant to the direction you want your physical activity program to take.
Example: If you want to improve walking, you should set walking-based goals.

Before setting a new physical activity goal, write down what you are currently doing:

I am currently physically active on ___________ days a week.

My physical activity sessions last ___________ minutes a day.

I am usually physically active at a ____________________ intensity. (moderate/ vigorous)

Remember that the TRACKS Trial goal is to gradually increase physical activity by at least 60 minutes of moderate intensity physical activity or 30 minutes of vigorous intensity physical activity to a minimum of 150 minutes of moderate intensity physical activity or 75 minutes of vigorous intensity physical activity per week. Think about goals that will help you achieve this over the next 8 weeks.

Now let's set some short term and long term physical activity goals: Here are a few examples:

Short-term goal: Fred's goal is to be physically active **5 days** a week for **30 minutes** a day at a **moderate intensity** for a **total of 150 moderate minutes per week**.

Long-term goal: Fred will participate in a 10K walk from the local walking group by the September 30.

Short-term goal: Denise's goal is to be physically active **2 days** a week for **50 minutes** at a moderate intensity and 1 day a week for 25 minutes at **vigorous intensity for a total of 150 "exercise" minutes (i.e., 100 minutes of moderate plus 25 minutes of vigorous where vigorous minutes count double)**.

Long-term goal: Denise will run 5K, non-stop, in 45 minutes by September 30.

For the next 8 weeks, I will be physically active __________ days a week for __________ minutes a day at moderate intensity and/or __________ days a week for __________ minutes a day at vigorous intensity.

My long-term goals are

____

____

______________.

Now that you have a goal, let's set out a detailed plan of how you are going to achieve your goal. Let's start with the type of activity you will do to meet your goal. Here are a few examples:

> **Fred** loves to walk so he is planning on reaching his goal by brisk walking (a moderate intensity activity).
>
> **Joe** loves to golf as his main activity but he will also play tennis when he gets a chance (moderate intensity activities).
>
> **Denise** prefers variety in her activities and she also likes vigorous activity. She plans to get her exercise by a combination of swimming, running, and cycling.

WHAT activities are you going to engage in to meet your physical activity goal in the next 8 weeks?

____
____
____
____
____
____

Now that you have a goal and have determined what type of activities you will do, let's make a detailed plan on **WHEN** (time and days of the week) you will do them. Specific days and times are the best! Here are a few examples:

> **Fred** will do his 5 days of brisk walking for 30 minutes each day at noon because he has a 1 hour lunch break at work.
>
> **Joe** will golf on Tuesdays and Thursdays at 8:00am, and then play tennis of Saturday mornings at 10:00am because he is retired.
>
> **Denise** will exercise Monday, Wednesday, and Friday at 7:00am before work because she is a morning person.

WHEN are you planning on being physically active in the next 8 weeks?

____

Now think about **WHERE** you are going to be physically active. Here are a few examples:

__Fred__ will walk outside around his office.

__Joe__ will golf and play tennis at his local country club where he is a member.

__Denise__ will get a membership at her local YMCA because they have facilities and equipment where she can swim, cycle, and run.

WHERE are you planning on being physically active in the next 8 weeks?

____

Now think about **HOW** you are going to be physically active. Here are a few examples:

__Fred__ is going to walk during his lunch break at work because he has an hour break and some nice walking paths.

__Joe__ will book his tee times every Saturday morning for the week. His wife will book the tennis court every week.

Denise is able to start work late on Monday, Wednesday, and Friday to fit in her physical activity and the YMCA is on her way to work.

HOW are you going to be physically active in the next 8 weeks?

____

Having an exercise buddy has been shown to help individuals reach their goals. Think about whether having an exercise buddy will help you stick to your new physical activity program. Here are some examples:

Fred is going to invite a co-worker to walk with him who he knows is also trying to get more exercise.

Joe is going to golf with his buddies and play tennis with his wife.

Denise is going to exercise alone although she likes the company at the fitness center.

WHO are you planning to be physically active with in the next 8 weeks?

____

Finally, sticking to a regular physical activity program is not easy. After all, there are plenty of potential barriers to stand in your way of reaching your goal. What are the main barriers that might interfere with the achievement of your physical activity goal? How could you overcome those barriers? Here are a few examples:

Fred:
Barrier— boredom.
Strategy to overcome boredom is to walk with his co-worker John.

Joe:
Barrier— bad weather.
Strategy to overcome bad weather is finding an indoor driving range.

Denise:
Barrier— lack of time in the morning.
Strategy to overcome lack of time is to set her alarm clock 30 minutes earlier so she is not rushed at her morning workout.

Now, list your own personal **BARRIERS** to being physically active over the next 8 weeks, and **STRATEGIES** to overcome them:

BARRIER 1:
____

Strategy 1:____
____
____
____

BARRIER 2:____
Strategy 2:____
____
____
____

BARRIER 3:
____

Strategy 3:____
____
____

Now you have a great plan for achieving your realistic physical activity goal! To make sure you don't forget it, let's summarize your detailed plan and then place it somewhere where you will see it often (e.g., your fridge or nightstand).

My goal for the next 8 weeks is to exercise:

______ days each week for ________ minutes each day **at a moderate intensity** and/or ______ days each week for ________ minutes each day **at a vigorous intensity**.

In the next 8 weeks…..

The activity or activities I plan to do are:

____

________________.

I will do these activities on the following days and times of the week:

____

_______________ .

I will complete my activities at the following location(s):

____

_______________.

I am planning on being physically active with:

____

________________.

I will overcome my most likely barrier by:

____

________________.

Appendix P

TRACKS Trial Baseline Questionnaire (Study 2)

Please note that this was the same questionnaire delivered to both the SPA+EC and SPA+BC groups

Date Completed: ___________________ Identification #__________

TRACKS Trial: Trying Activity in Kidney Cancer Survivors

Investigators: Kerry S. Courneya, PhD, University of Alberta
Scott North, M.D., Cross Cancer Institute

BASELINE QUESTIONNAIRE

Instructions

Thank you for agreeing to participate in this study. In this questionnaire, we are going to ask you a series of questions about yourself. Many of the questions ask you about your physical and mental health, and some may be viewed as personal. It is important to answer as many of these questions as possible, 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. Many of the questions may seem similar but it is important to treat each question separately and provide an answer for each. 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 Linda Trinh (Research Co-ordinator) at (780) 492-2829 (call collect from out of town) or Ltrinh1@ualberta.ca.

Below is a list of statements that people with kidney cancer have said are important to their quality of life. Please indicate the extent to which you have experienced each of the statements <u>during the past 7 days</u> by circling the appropriate number using the following scale. Please complete the questions even if you believe the symptom(s) are not associated with your previous kidney cancer diagnosis and even if it has been many years since your kidney cancer diagnosis. If you do not experience any of the particular symptoms, please indicate so by circling 0 (not at all).

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 a lack of energy	0	1	2	3	4
2. I have nausea	0	1	2	3	4
3. Because of my physical condition, I have trouble meeting the needs of my family	0	1	2	3	4
4. I have pain	0	1	2	3	4
5. I am bothered by side effects of treatment	0	1	2	3	4
6. I feel ill	0	1	2	3	4
7. I am forced to spend time in bed	0	1	2	3	4
8. I feel close to my friends	0	1	2	3	4
9. I get emotional support from my family	0	1	2	3	4
10. I get support from my friends	0	1	2	3	4
11. My family has accepted my illness	0	1	2	3	4
12. I am satisfied with family communication about my illness	0	1	2	3	4
13. I feel close to my partner (or the person who is my main support)	0	1	2	3	4

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

14. I feel sad	0	1	2	3	4
15. I am satisfied with how I am coping with my illness	0	1	2	3	4
16. I am losing hope in the fight against my illness	0	1	2	3	4
17. I feel nervous	0	1	2	3	4
18. I worry about dying	0	1	2	3	4
19. I worry that my condition will get worse	0	1	2	3	4
20. I am able to work (include work at home)	0	1	2	3	4
21. My work (include work at home) is fulfilling	0	1	2	3	4
22. I am able to enjoy life	0	1	2	3	4
23. I have accepted my illness	0	1	2	3	4
24. I am sleeping well	0	1	2	3	4
25. I am enjoying the things I usually do for fun	0	1	2	3	4
26. I am content with the quality of my life right now	0	1	2	3	4
27. I get tired easily	0	1	2	3	4
28. I feel weak all over	0	1	2	3	4
29. I have a good appetite	0	1	2	3	4
30. I have pain in my joints	0	1	2	3	4
31. I am bothered by the chills	0	1	2	3	4
32. I am bothered by fevers (episodes of high body temperature)	0	1	2	3	4

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

33. I am bothered by sweating	0	1	2	3	4
34. I have trouble concentrating	0	1	2	3	4
35. I have trouble remembering things	0	1	2	3	4
36. I get depressed easily	0	1	2	3	4
37. I get annoyed easily	0	1	2	3	4
38. I have emotional ups and downs	0	1	2	3	4
39. I feel motivated to do things	0	1	2	3	4
40. I am losing weight	0	1	2	3	4
41. I have bone pain	0	1	2	3	4
42. I have been short of breath	0	1	2	3	4
43. I have been coughing	0	1	2	3	4
44. I have had blood in my urine	0	1	2	3	4

The following section asks about any fatigue that you may 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 <u>PAST WEEK</u>:

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 starting things because I am tired	0	1	2	3	4
6. I have trouble finishing 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 things I want to do	0	1	2	3	4
13. I have to limit my social activities because I am tired	0	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. <u>Compared to one year ago</u>, how would you rate your health in general <u>now</u>?

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 <u>your health now limit you</u> in these activities? If so, how much?

		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, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

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

	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

IMPORTANT: This next set of questions focus on 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 remember:

- 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 first three categories is the intensity of the endurance (aerobic) PA and 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 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?

	Times 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).	__________	__________

For the rest of this survey, we will ask you about regular PA. We define regular PA as moderate intensity PA (e.g., brisk walking) done for at least 150 minutes per week (2.5 hours) OR vigorous intensity PA (e.g., jogging) done for at least 75 minutes per week (1.25 hours).

The following questions ask you to rate how you feel about regular PA over the next month, which includes the supervised PA sessions in the TRACKS trial that you are involved in. Please pay careful attention to the words at each end of the scale and circle the number that best represents how you feel. Please answer all items.

I think that for me to participate in regular PA over the next month would be:

	1	2	3	4	5	6	7
(a)	extremely useless	quite useless	slightly useless		slightly useful	quite useful	extremely useful
(b)	extremely unenjoyable	quite unenjoyable	slightly unenjoyable		slightly enjoyable	quite enjoyable	extremely enjoyable
(c)	extremely harmful	quite harmful	slightly harmful		slightly beneficial	quite beneficial	extremely beneficial
(d)	extremely painful	quite painful	slightly painful		slightly pleasureable	quite pleasureable	extreme pleasureable
(e)	extremely unimportant	quite unimportant	slightly unimportant		slightly important	quite important	extremely important
(f)	extremely boring	quite boring	slightly boring		slightly fun	quite fun	extremely fun

I think that if I participated in regular PA over the next month, most people who are important to me would be:

	1	2	3	4	5	6	7
(a)	extremely disapproving	quite disapproving	slightly disapproving		slightly approving	quite approving	extremely approving
(b)	extremely discouraging	quite discouraging	slightly discouraging		slightly encouraging	quite encouraging	extremely encouraging

(c) 1	2	3	4	5	6	7
extremely unsupportive	quite unsupportive	slightly unsupportive		slightly supportive	quite supportive	extremely supportive

I think that over the next month, most people who are important to me will be:

(a) 1	2	3	4	5	6	7
extremely inactive	quite inactive	slightly inactive		slightly active	quite active	extremely active

I think that over the next month, most people who are important to me will themselves participate regularly in PA.

(a) 1	2	3	4	5	6	7
strongly disagree	moderately disagree	slightly disagree		slightly agree	moderately agree	strongly agree

I think that over the next month, the PA levels of most people who are important to me will be:

(a) 1	2	3	4	5	6	7
extremely low	quite low	slightly low		slightly high	quite high	extremely high

These next questions ask you to rate how likely you feel it is that <u>you would be able</u> to participate in regular PA over the next month <u>if you were really motivated</u>. Pay careful attention to the words in each scale. Circle the number that best represents how you feel.

If you were really motivated…

1. How much control would you have over doing regular PA over the next month?

1	2	3	4	5	6	7
very little control			some control			complete control

2. Whether or not I engage in regular PA over the next month is completely up to me.

1	2	3	4	5	6	7
strongly disagree	moderately disagree	slightly disagree		slightly agree	moderately agree	strongly agree

3. How much do you feel that engaging in PA over the next month is beyond your control?

1	2	3	4	5	6	7
Not at all						Very much

4. For me, participating in regular PA over the next month would be...

1	2	3	4	5	6	7
extremely difficult	quite difficult	slightly difficult	neither	slightly easy	quite easy	extremely easy

5. If I wanted to, I could easily engage in regular PA over the next month.

1	2	3	4	5	6	7
strongly disagree	moderately disagree	slightly disagree		slightly agree	moderately agree	strongly agree

6. How confident are you that you could do regular PA over the next month?

1	2	3	4	5	6	7
not at all confident		somewhat confident		quite confident		completely confident

This next set of questions asks you about your motivation and plans to do regular PA over the next month. Pay careful attention to the words at the end of each scale.

1. Do you intend to do regular PA over the next month?

1	2	3	4	5	6	7
no, not really			somewhat intend			strongly intend

2. How motivated are you to do regular PA over the next month?

1	2	3	4	5	6	7
not at all motivated		somewhat motivated		quite motivated		extremely motivated

3. How much **vigorous** intensity PA do you intend to do over the next month?

____ days per week for ____ minutes each day (write in numbers including 0)

4. How much **moderate** intensity PA do you intend to do over the next month?

____ days per week for ____ minutes each day (write in numbers including 0)

5. I have made plans concerning ‘when’ I am going to engage in regular PA over the next month. Circle the number that best represents how you feel:

1	2	3	4	5	6	7
No plans						**Detailed plans**

6. I have made plans concerning ‘where’ I am going to engage in regular PA over the next month. Circle the number that best represents how you feel:

1	2	3	4	5	6	7
No plans						**Detailed plans**

7. I have made plans concerning ‘what’ kind of regular PA I am going to engage in over the next month. Circle the number that best represents how you feel:

1	2	3	4	5	6	7
No plans						**Detailed plans**

8. I have made plans concerning ‘how’ I am going to get to a place to engage in regular PA over the next month. Circle the number that best represents how you feel:

	1	2	3	4	5	6	7
No plans							**Detailed plans**

9. I have made plans concerning ‘who’ I am going to be physically active with over the next month. Circle the number that best represents how you feel:

	1	2	3	4	5	6	7
No plans							**Detailed plans**

Please use the scale below to guide your responses to the next set of 8 questions.

1	2	3	4	5	6	7
extremely unlikely	quite unlikely	slightly unlikely		slightly likely	quite likely	extremely likely

If you were to do regular PA over the next month, do you think you would…

1. lose weight/control your weight	1	2	3	4	5	6	7
2. improve your energy level	1	2	3	4	5	6	7
3. feel good/better	1	2	3	4	5	6	7
4. improve strength	1	2	3	4	5	6	7
5. feel healthier/improve your health	1	2	3	4	5	6	7
6. improve fitness	1	2	3	4	5	6	7
7. lower blood pressure	1	2	3	4	5	6	7
8. increase flexibility	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 8 questions.

1	2	3	4	5	6	7
extremely unlikely	quite unlikely	slightly unlikely		slightly likely	quite likely	extremely likely

If you were to do regular PA over the next month, do you think you would…

1. exercise with other people	1	2	3	4	5	6	7
2. do a variety of activities 1	2	3	4	5	6	7	
3. get outdoors for fresh air/scenery	1	2	3	4	5	6	7
4. exercise in good weather	1	2	3	4	5	6	7

5. participate in team sports	1	2	3	4	5	6	7
6. exercise to music	1	2	3	4	5	6	7
7. do an activity that is fun/ enjoyable	1	2	3	4	5	6	7
8. do an activity that is pain-free	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 9 questions.

1	2	3	4	5	6	7
not at all confident	somewhat confident		quite confident		completely confident	

If you were really motivated, how confident are you that you could do regular PA over the next month even if…

1. you felt tired or fatigued	1	2	3	4	5	6	7
2. you had medical/health problems	1	2	3	4	5	6	7
3. you were very busy/had limited time	1	2	3	4	5	6	7
4. you had long work hours	1	2	3	4	5	6	7
5. you had pain or soreness	1	2	3	4	5	6	7
6. you had family responsibilities	1	2	3	4	5	6	7
7. the weather was bad	1	2	3	4	5	6	7
8. you had other commitments	1	2	3	4	5	6	7
9. you had limited or no access to recreation facilities/gym	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 7 questions.

1	2	3	4	5	6	7
extremely unsupportive	quite unsupportive	slightly unsupportive		slightly supportive	quite supportive	extremely supportive

How supportive do you think each of the following people would be if you tried to do regular PA over the next month?

1. spouse / partner (if applicable)	1	2	3	4	5	6	7
2. family members	1	2	3	4	5	6	7
3. friends	1	2	3	4	5	6	7
4. coworkers (if applicable)	1	2	3	4	5	6	7

5. medical team (e.g., doctor, nurse)	1	2	3	4	5	6	7
6. neighbours	1	2	3	4	5	6	7
7. church group (if applicable)	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 5 questions.

1	2	3	4	5	6	7
extremely unlikely	quite unlikely	slightly unlikely		slightly likely	quite likely	extremely likely

How likely do you think it is that each of the following people would engage in PA over the next month?

1. spouse / partner (if applicable)	1	2	3	4	5	6	7
2. family members	1	2	3	4	5	6	7
3. friends	1	2	3	4	5	6	7
4. coworkers (if applicable)	1	2	3	4	5	6	7
5. neighbours	1	2	3	4	5	6	7

This next part of the questionnaire is needed to help understand the medical profile 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 kidney cancer (month/year)? ____________ DK

2. Did your cancer involve the lymph nodes (please circle)? Yes No DK

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

Localized Metastasized DK

4. If your cancer was described as metastasized, where else in your body was it? (check all that apply)

_____ Lung _____ Lymph nodes _____ Brain _____ Liver

_____ Bone _____ Other (Please specify:___________) _____ Don't know

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

5b. If yes, what type of surgery did you have?

_____ Partial nephrectomy (removed part of the kidney)

_____ Radical nephrectomy (removed the entire kidney)

_____ Don't know/not sure

5c. If yes, what type of incision was used to remove your kidney or part of it?

_____ Laparoscopic (small incisions) _____ Open cut (large long incision)

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

7a. Did your treatment include drug therapy (please circle)? Yes No

7b. If yes, what kind of drug therapy did you receive? (check all that apply)

_____ Sunitinib (Sutent) _____ Sorafenib (Nexavar) _____ Temsirolimus (Torisel)

_____ Everolimus (Afinitor) _____ Interleukin-2 (IL-2) _____ Interferon

_____ Don't know/not sure

8. What is the <u>current status</u> of your cancer treatments?

_____ I am not currently receiving any treatments.

_____ I am currently still receiving cancer treatments.

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

10. What is the <u>current status</u> of your kidney 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. (a) Age: ______ (b) Sex: _____ Male _____ Female

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 ___________________________

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	______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 (chest pains)	______No	______Yes	Arthritis	______No	______Yes

Any other long term health condition?____

Appendix Q

TRACKS Trial Post-Intervention Questionnaire (Study 2)

Please note that this was the same questionnaire delivered to both the SPA+EC and SPA+BC groups

Date Completed: ___________________ Identification #__________

TRACKS Trial: Trying Activity in Kidney Cancer Survivors

Investigators: Kerry S. Courneya, PhD, University of Alberta
Scott North, M.D., Cross Cancer Institute

POST-INTERVENTION QUESTIONNAIRE

Instructions

Thank you for your continued participation in this study. At this post-intervention questionnaire, we are going to ask you many of the same questions as in the first questionnaire. 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. It is important to answer as many of these questions as possible, 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. Many of the questions may seem similar but it is important to treat each question separately and provide an answer for each. 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 Linda Trinh (Research Co-ordinator) at (780) 492-2829 (call collect from out of town) or Ltrinh1@ualberta.ca.

<u>IMPORTANT</u>: This next set of questions focus on leisure-time physical activity. Leisure time means activity done during your free time and does <u>not</u> 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 **<u>PA</u>** 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 <u>during the past month</u>.

When answering these questions please remember:

- 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 first three categories is the intensity of the endurance (aerobic) PA and 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 PA in one of the categories, please write in "0".

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

	Times 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).	___________	___________

For the rest of this survey, we will ask you about regular PA. We define regular PA as moderate intensity PA (e.g., brisk walking) done for at least 150 minutes per week (2.5 hours) OR vigorous intensity PA (e.g., jogging) done for at least 75 minutes per week (1.25 hours).

The following questions ask you to rate how you feel about doing regular PA on your own over the next 8 weeks now that the supervised program is over. Please pay careful attention to the words at each end of the scale and circle the number that best represents how you feel. Please answer all items.

I think that for me to participate in regular PA over the next 8 weeks would be:

	1	2	3	4	5	6	7
(a)	extremely useless	quite useless	slightly useless		slightly useful	quite useful	extremely useful
(b)	extremely unenjoyable	quite unenjoyable	slightly unenjoyable		slightly enjoyable	quite enjoyable	extremely enjoyable
(c)	extremely harmful	quite harmful	slightly harmful		slightly beneficial	quite beneficial	extremely beneficial
(d)	extremely painful	quite painful	slightly painful		slightly pleasureable	quite pleasureable	extreme pleasureable
(e)	extremely unimportant	quite unimportant	slightly unimportant		slightly important	quite important	extremely important
(f)	extremely boring	quite boring	slightly boring		slightly fun	quite fun	extremely fun

I think that if I participated in regular PA over the next 8 weeks, most people who are important to me would be:

	1	2	3	4	5	6	7
(a)	extremely disapproving	quite disapproving	slightly disapproving		slightly approving	quite approving	extremely approving
(b)	extremely discouraging	quite discouraging	slightly discouraging		slightly encouraging	quite encouraging	extremely encouraging

(c) 1	2	3	4	5	6	7
extremely unsupportive	quite unsupportive	slightly unsupportive		slightly supportive	quite supportive	extremely supportive

I think that over the next month, most people who are important to me will be:

(a) 1	2	3	4	5	6	7
extremely inactive	quite inactive	slightly inactive		slightly active	quite active	extremely active

I think that over the next 8 weeks, most people who are important to me will themselves participate regularly in PA.

(a) 1	2	3	4	5	6	7
strongly disagree	moderately disagree	slightly disagree		slightly agree	moderately agree	strongly agree

I think that over the next 8 weeks, the PA levels of most people who are important to me will be:

(a) 1	2	3	4	5	6	7
extremely low	quite low	slightly low		slightly high	quite high	extremely high

These next questions ask you to rate how likely you feel it is that <u>you would be able</u> to participate in regular PA over the next month <u>if you were really motivated</u>. Pay careful attention to the words in each scale. Circle the number that best represents how you feel.

If you were really motivated…

1. How much control would you have over doing regular PA over the next 8 weeks?

1	2	3	4	5	6	7
very little control			some control			complete control

2. Whether or not I engage in regular PA over the next 8 weeks is completely up to me.

1	2	3	4	5	6	7
strongly disagree	moderately disagree	slightly disagree		slightly agree	moderately agree	strongly agree

3. How much do you feel that engaging in PA over the next 8 weeks is beyond your control?

1	2	3	4	5	6	7
Not at all						Very much

4. For me, participating in regular PA over the next 8 weeks would be...

1	2	3	4	5	6	7
extremely difficult	quite difficult	slightly difficult	neither	slightly easy	quite easy	extremely easy

5. If I wanted to, I could easily engage in regular PA over the next 8 weeks.

1	2	3	4	5	6	7
strongly disagree	moderately disagree	slightly disagree		slightly agree	moderately agree	strongly agree

6. How confident are you that you could do regular PA over the next 8 weeks?

1	2	3	4	5	6	7
not at all confident		somewhat confident		quite confident	completely confident	

This next set of questions asks you about your motivation and plans to do regular PA over the next month. Pay careful attention to the words at the end of each scale.

1. Do you intend to do regular PA over the next 8 weeks?

1	2	3	4	5	6	7
no, not really			somewhat intend			strongly intend

2. How motivated are you to do regular PA over the next 8 weeks?

1	2	3	4	5	6	7
not at all motivated		somewhat motivated		quite motivated	extremely motivated	

3. How much **vigorous** intensity PA do you intend to do over the next 8 weeks?

____ days per week for ____ minutes each day (write in numbers including 0)

4. How much **moderate** intensity PA do you intend to do over the next 8 weeks?

____ days per week for ____ minutes each day (write in numbers including 0)

5. I have made plans concerning ‘when’ I am going to engage in regular PA over the next 8 weeks. Circle the number that best represents how you feel:

1	2	3	4	5	6	7
No plans						**Detailed plans**

6. I have made plans concerning ‘where’ I am going to engage in regular PA over the next 8 weeks. Circle the number that best represents how you feel:

1	2	3	4	5	6	7
No plans						**Detailed plans**

7. I have made plans concerning ‘what’ kind of regular PA I am going to engage in over the next 8 weeks. Circle the number that best represents how you feel:

1	2	3	4	5	6	7
No plans						**Detailed plans**

8. I have made plans concerning 'how' I am going to get to a place to engage in regular PA over the next 8 weeks. Circle the number that best represents how you feel:

	1	2	3	4	5	6	7
No plans							**Detailed plans**

9. I have made plans concerning 'who' I am going to be physically active with over the next 8 weeks. Circle the number that best represents how you feel:

	1	2	3	4	5	6	7
No plans							**Detailed plans**

1	2	3	4	5	6	7
extremely unlikely	quite unlikely	slightly unlikely		slightly likely	quite likely	extremely likely

If you were to do regular PA over the next 8 weeks, do you think you would…

1. lose weight/control your weight	1	2	3	4	5	6	7
2. improve your energy level	1	2	3	4	5	6	7
3. feel good/better	1	2	3	4	5	6	7
4. improve strength	1	2	3	4	5	6	7
5. feel healthier/improve your health	1	2	3	4	5	6	7
6. improve fitness	1	2	3	4	5	6	7
7. lower blood pressure	1	2	3	4	5	6	7
8. increase flexibility	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 8 questions.

1	2	3	4	5	6	7
extremely unlikely	quite unlikely	slightly unlikely		slightly likely	quite likely	extremely likely

If you were to do regular PA over the next 8 weeks, do you think you would…

1. exercise with other people	1	2	3	4	5	6	7
2. do a variety of activities	1	2	3	4	5	6	7
3. get outdoors for fresh air/scenery	1	2	3	4	5	6	7
4. exercise in good weather	1	2	3	4	5	6	7
5. participate in team sports	1	2	3	4	5	6	7

6. exercise to music	1	2	3	4	5	6	7
7. do an activity that is fun/ enjoyable	1	2	3	4	5	6	7
8. do an activity that is pain-free	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 9 questions.

1	2	3	4	5	6	7
not at all confident	somewhat confident		quite confident		completely confident	

If you were really motivated, how confident are you that you could do regular PA over the next 8 weeks even if…

1. you felt tired or fatigued	1	2	3	4	5	6	7
2. you had medical/health problems	1	2	3	4	5	6	7
3. you were very busy/had limited time	1	2	3	4	5	6	7
4. you had long work hours	1	2	3	4	5	6	7
5. you had pain or soreness	1	2	3	4	5	6	7
6. you had family responsibilities	1	2	3	4	5	6	7
7. the weather was bad	1	2	3	4	5	6	7
8. you had other commitments	1	2	3	4	5	6	7
9. you had limited or no access to recreation facilities/gym	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 7 questions.

1	2	3	4	5	6	7
extremely unsupportive	quite unsupportive	slightly unsupportive		slightly supportive	quite supportive	extremely supportive

How supportive do you think each of the following people would be if you tried to do regular PA over the next 8 weeks?

1. spouse / partner (if applicable)	1	2	3	4	5	6	7
2. family members	1	2	3	4	5	6	7
3. friends	1	2	3	4	5	6	7
4. coworkers (if applicable)	1	2	3	4	5	6	7
5. medical team (e.g., doctor, nurse)	1	2	3	4	5	6	7

6. neighbours	1	2	3	4	5	6	7
7. church group (if applicable)	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 5 questions.

1	2	3	4	5	6	7
extremely unlikely	quite unlikely	slightly unlikely		slightly likely	quite likely	extremely likely

How likely do you think it is that each of the following people would engage in PA over the next 8 weeks?

1. spouse / partner (if applicable)	1	2	3	4	5	6	7
2. family members	1	2	3	4	5	6	7
3. friends	1	2	3	4	5	6	7
4. coworkers (if applicable)	1	2	3	4	5	6	7
5. neighbours	1	2	3	4	5	6	7

Appendix R

TRACKS Trial Final Follow-Up Questionnaire for the Supervised Physical Activity Plus Behavioural Counselling (SPA+BC) Group (Study 2)

Please note that a variation of this questionnaire was delivered to the SPA+EC group, but did not include programming evaluation for the behavioural counselling sessions.

B

Date Completed: ___________________ Identification #__________

TRACKS Trial: Trying Activity in Kidney Cancer Survivors

Investigators: Kerry S. Courneya, PhD, University of Alberta
Scott North, M.D., Cross Cancer Institute

FINAL FOLLOW-UP QUESTIONNAIRE

Instructions

Thank you for your continued participation in this study. In this final questionnaire, we are going to ask you many of the same questions as in 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 ask you about your physical and mental health, and some may be viewed as personal. It is important to answer as many of these questions as possible, 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. Many of the questions may seem similar but it is important to treat each question separately and provide an answer for each. 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 Linda Trinh (Research Co-ordinator) at (780) 492-2829 (call collect from out of town) or Ltrinh1@ualberta.ca.

Below is a list of statements that people with kidney cancer have said are important to their quality of life. 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. Please complete the questions even if you believe the symptom(s) are not associated with your previous kidney cancer diagnosis and even if it has been many years since your kidney cancer diagnosis. If you do not experience any of the particular symptoms, please indicate so by circling 0 (not at all).

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

During the PAST WEEK:

1. I have a lack of energy	0	1	2	3	4
2. I have nausea	0	1	2	3	4
3. Because of my physical condition, I have trouble meeting the needs of my family	0	1	2	3	4
4. I have pain	0	1	2	3	4
5. I am bothered by side effects of treatment	0	1	2	3	4
6. I feel ill	0	1	2	3	4
7. I am forced to spend time in bed	0	1	2	3	4
8. I feel close to my friends	0	1	2	3	4
9. I get emotional support from my family	0	1	2	3	4
10. I get support from my friends	0	1	2	3	4
11. My family has accepted my illness	0	1	2	3	4
12. I am satisfied with family communication about my illness	0	1	2	3	4
13. I feel close to my partner (or the person who is my main support)	0	1	2	3	4

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

14. I feel sad	0	1	2	3	4
15. I am satisfied with how I am coping with my illness	0	1	2	3	4
16. I am losing hope in the fight against my illness	0	1	2	3	4
17. I feel nervous	0	1	2	3	4
18. I worry about dying	0	1	2	3	4
19. I worry that my condition will get worse	0	1	2	3	4
20. I am able to work (include work at home)	0	1	2	3	4
21. My work (include work at home) is fulfilling	0	1	2	3	4
22. I am able to enjoy life	0	1	2	3	4
23. I have accepted my illness	0	1	2	3	4
24. I am sleeping well	0	1	2	3	4
25. I am enjoying the things I usually do for fun	0	1	2	3	4
26. I am content with the quality of my life right now	0	1	2	3	4
27. I get tired easily	0	1	2	3	4
28. I feel weak all over	0	1	2	3	4
29. I have a good appetite	0	1	2	3	4
30. I have pain in my joints	0	1	2	3	4
31. I am bothered by the chills	0	1	2	3	4
32. I am bothered by fevers (episodes of high body temperature)	0	1	2	3	4

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

33. I am bothered by sweating	0	1	2	3	4
34. I have trouble concentrating	0	1	2	3	4
35. I have trouble remembering things	0	1	2	3	4
36. I get depressed easily	0	1	2	3	4
37. I get annoyed easily	0	1	2	3	4
38. I have emotional ups and downs	0	1	2	3	4
39. I feel motivated to do things	0	1	2	3	4
40. I am losing weight	0	1	2	3	4
41. I have bone pain	0	1	2	3	4
42. I have been short of breath	0	1	2	3	4
43. I have been coughing	0	1	2	3	4
44. I have had blood in my urine	0	1	2	3	4

The following section asks about any fatigue that you may 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 <u>PAST WEEK</u>:

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 starting things because I am tired	0	1	2	3	4
6. I have trouble finishing 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 things I want to do	0	1	2	3	4
13. I have to limit my social activities because I am tired	0	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. <u>Compared to one year ago</u>, how would you rate your health in general <u>now</u>?

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 <u>your health now limit you</u> in these activities? If so, how much?

		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, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

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

	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

IMPORTANT: This next set of questions focus on 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 remember:

- 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 first three categories is the intensity of the endurance (aerobic) PA and 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 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?

	Times 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).	__________	__________

For the rest of this survey, we will ask you about regular PA. We define regular PA as moderate intensity PA (e.g., brisk walking) done for at least 150 minutes per week (2.5 hours) OR vigorous intensity PA (e.g., jogging) done for at least 75 minutes per week (1.25 hours).

The following questions ask you to rate how you feel about regular PA over the next month, which includes the supervised PA sessions in the TRACKS trial that you are involved in. Please pay careful attention to the words at each end of the scale and circle the number that best represents how you feel. Please answer all items.

I think that for me to participate in regular PA over the next 3 months would be:

(a) 1	2	3	4	5	6	7
extremely useless	quite useless	slightly useless		slightly useful	quite useful	extremely useful

(b) 1	2	3	4	5	6	7
extremely unenjoyable	quite unenjoyable	slightly unenjoyable		slightly enjoyable	quite enjoyable	extremely enjoyable

(c) 1	2	3	4	5	6	7
extremely harmful	quite harmful	slightly harmful		slightly beneficial	quite beneficial	extremely beneficial

(d) 1	2	3	4	5	6	7
extremely painful	quite painful	slightly painful		slightly pleasureable	quite pleasureable	extreme pleasureable

(e) 1	2	3	4	5	6	7
extremely unimportant	quite unimportant	slightly unimportant		slightly important	quite important	extremely important

(f) 1	2	3	4	5	6	7
extremely boring	quite boring	slightly boring		slightly fun	quite fun	extremely fun

I think that if I participated in regular PA over the next 3 months, most people who are important to me would be:

(a) 1	2	3	4	5	6	7
extremely disapproving	quite disapproving	slightly disapproving		slightly approving	quite approving	extremely approving

(b) 1	2	3	4	5	6	7
extremely discouraging	quite discouraging	slightly discouraging		slightly encouraging	quite encouraging	extremely encouraging

(c) 1	2	3	4	5	6	7
extremely unsupportive	quite unsupportive	slightly unsupportive		slightly supportive	quite supportive	extremely supportive

I think that over the next month, most people who are important to me will be:

(a) 1	2	3	4	5	6	7
extremely inactive	quite inactive	slightly inactive		slightly active	quite active	extremely active

I think that over the next month, most people who are important to me will themselves participate regularly in PA.

(a) 1	2	3	4	5	6	7
strongly disagree	moderately disagree	slightly disagree		slightly agree	moderately agree	strongly agree

I think that over the next month, the PA levels of most people who are important to me will be:

(a) 1	2	3	4	5	6	7
extremely low	quite low	slightly low		slightly high	quite high	extremely high

These next questions ask you to rate how likely you feel it is that <u>you would be able</u> to participate in regular PA over the next month <u>if you were really motivated</u>. Pay careful attention to the words in each scale. Circle the number that best represents how you feel.

If you were really motivated…

1. How much control would you have over doing regular PA over the next 3 months?

1	2	3	4	5	6	7
very little control			some control			complete control

2. Whether or not I engage in regular PA over the next 3 months is completely up to me.

1	2	3	4	5	6	7
strongly disagree	moderately disagree	slightly disagree		slightly agree	moderately agree	strongly agree

3. How much do you feel that engaging in PA over the next 3 months is beyond your control?

1	2	3	4	5	6	7
Not at all						Very much

4. For me, participating in regular PA over the next 3 months would be...

1	2	3	4	5	6	7
extremely difficult	quite difficult	slightly difficult	neither	slightly easy	quite easy	extremely easy

5. If I wanted to, I could easily engage in regular PA over the next 3 months.

1	2	3	4	5	6	7
strongly disagree	moderately disagree	slightly disagree		slightly agree	moderately agree	strongly agree

6. How confident are you that you could do regular PA over the next 3 months?

1	2	3	4	5	6	7
not at all confident		somewhat confident		quite confident	completely confident	

This next set of questions asks you about your motivation and plans to do regular PA over the next 3 months. Pay careful attention to the words at the end of each scale.

1. Do you intend to do regular PA over the next 3 months?

1	2	3	4	5	6	7
no, not really			somewhat intend			strongly intend

2. How motivated are you to do regular PA over the next 3 months?

1	2	3	4	5	6	7
not at all motivated		somewhat motivated		quite motivated	extremely motivated	

3. How much **vigorous** intensity PA do you intend to do over the next 3 months?

____ days per week for ____ minutes each day (write in numbers including 0)

4. How much **moderate** intensity PA do you intend to do over the next 3 months?

____ days per week for ____ minutes each day (write in numbers including 0)

5. I have made plans concerning 'when' I am going to engage in regular PA over the next 3 months. Circle the number that best represents how you feel:

1	2	3	4	5	6	7
No plans						**Detailed plans**

6. I have made plans concerning 'where' I am going to engage in regular PA over the next 3 months. Circle the number that best represents how you feel:

1	2	3	4	5	6	7
No plans						**Detailed plans**

7. I have made plans concerning 'what' kind of regular PA I am going to engage in over the next 3 months. Circle the number that best represents how you feel:

1	2	3	4	5	6	7
No plans						**Detailed plans**

8. I have made plans concerning 'how' I am going to get to a place to engage in regular PA over the next 3 months. Circle the number that best represents how you feel:

	1	2	3	4	5	6	7
No plans							**Detailed plans**

9. I have made plans concerning 'who' I am going to be physically active with over the next 3 months. Circle the number that best represents how you feel:

	1	2	3	4	5	6	7
No plans							**Detailed plans**

Please use the scale below to guide your responses to the next set of 8 questions.

1	2	3	4	5	6	7
extremely unlikely	quite unlikely	slightly unlikely		slightly likely	quite likely	extremely likely

If you were to do regular PA over the next 3 months, do you think you would…

1. lose weight/control your weight	1	2	3	4	5	6	7
2. improve your energy level	1	2	3	4	5	6	7
3. feel good/better	1	2	3	4	5	6	7
4. improve strength	1	2	3	4	5	6	7
5. feel healthier/improve your health	1	2	3	4	5	6	7
6. improve fitness	1	2	3	4	5	6	7
7. lower blood pressure	1	2	3	4	5	6	7
8. increase flexibility	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 8 questions.

1	2	3	4	5	6	7
extremely unlikely	quite unlikely	slightly unlikely		slightly likely	quite likely	extremely likely

If you were to do regular PA over the next 3 months, do you think you would…

1. exercise with other people	1	2	3	4	5	6	7
2. do a variety of activities	1	2	3	4	5	6	7
3. get outdoors for fresh air/scenery	1	2	3	4	5	6	7
4. exercise in good weather	1	2	3	4	5	6	7

5. participate in team sports	1	2	3	4	5	6	7
6. exercise to music	1	2	3	4	5	6	7
7. do an activity that is fun/ enjoyable	1	2	3	4	5	6	7
8. do an activity that is pain-free	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 9 questions.

1	2	3	4	5	6	7
not at all confident	somewhat confident		quite confident		completely confident	

If you were really motivated, how confident are you that you could do regular PA over the next 3 months even if…

1. you felt tired or fatigued	1	2	3	4	5	6	7
2. you had medical/health problems	1	2	3	4	5	6	7
3. you were very busy/had limited time	1	2	3	4	5	6	7
4. you had long work hours	1	2	3	4	5	6	7
5. you had pain or soreness	1	2	3	4	5	6	7
6. you had family responsibilities	1	2	3	4	5	6	7
7. the weather was bad	1	2	3	4	5	6	7
8. you had other commitments	1	2	3	4	5	6	7
9. you had limited or no access to recreation facilities/gym	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 7 questions.

1	2	3	4	5	6	7
extremely unsupportive	quite unsupportive	slightly unsupportive		slightly supportive	quite supportive	extremely supportive

How supportive do you think each of the following people would be if you tried to do regular PA over the next 3 months?

1. spouse / partner (if applicable)	1	2	3	4	5	6	7
2. family members	1	2	3	4	5	6	7
3. friends	1	2	3	4	5	6	7
4. coworkers (if applicable)	1	2	3	4	5	6	7

5. medical team (e.g., doctor, nurse)	1	2	3	4	5	6	7
6. neighbours	1	2	3	4	5	6	7
7. church group (if applicable)	1	2	3	4	5	6	7

Please use the scale below to guide your responses to the next set of 5 questions.

1	2	3	4	5	6	7
extremely unlikely	quite unlikely	slightly unlikely		slightly likely	quite likely	extremely likely

How likely do you think it is that each of the following people would engage in PA over the next 3 months?

1. spouse / partner (if applicable)	1	2	3	4	5	6	7
2. family members	1	2	3	4	5	6	7
3. friends	1	2	3	4	5	6	7
4. coworkers (if applicable)	1	2	3	4	5	6	7
5. neighbours	1	2	3	4	5	6	7

The next set of questions on this page relate to how you felt about taking part in the TRACKS trial. Please answer each one as honestly as possible using the following scale:

1	2	3	4	5	6	7
not at all		somewhat		a fair bit		very much

1. How much of a burden was it for you to complete each of the following assessments in the TRACKS trial?

(a) the treadmill fitness test	1	2	3	4	5	6	7
(b) the physical function test	1	2	3	4	5	6	7
(c) the questionnaires	1	2	3	4	5	6	7
(d) the counselling sessions	1	2	3	4	5	6	7
(e) the supervised PA sessions	1	2	3	4	5	6	7

2. With hindsight, how do you feel about participating in the TRACKS trial?

(a) rewarding	1	2	3	4	5	6	7
(b) a waste of my time	1	2	3	4	5	6	7
(c) useful for research helping others	1	2	3	4	5	6	7

(d) useful for me personally	1	2	3	4	5	6	7
(e) something that I would recommend to other kidney cancer survivors	1	2	3	4	5	6	7

3. How often have you read the physical activity manual developed specifically for kidney cancer survivors over the past month?

1	2	3	4	5
never	rarely	about once per week	2-3 times per week	almost everyday

4. Did you find the manual helpful in increasing your physical activity level?

1	2	3	4	5	6	7
Not at all helpful		somewhat helpful		quite helpful		extremely helpful

5. Did you find the supervised PA sessions helpful in increasing your physical activity level?

1	2	3	4	5	6	7
Not at all helpful		somewhat helpful		quite helpful		extremely helpful

6. Did you find the counselling sessions helpful in increasing your physical activity level?

1	2	3	4	5	6	7
Not at all helpful		somewhat helpful		quite helpful		extremely helpful

The next set of questions asks you to rate the individual behavioural counselling sessions included in the TRACKS trial. Please answer each one as honestly as possible using the following scale:

1	2	3	4	5	6	7
Not at all helpful		somewhat helpful		quite helpful		extremely helpful

7. How helpful were each of the following behavioural counselling topics in increasing your physical activity level? If you have missed a session, please just skip it.

(a) the benefits of PA	1	2	3	4	5	6	7
(b) how to make PA fun/enjoyable	1	2	3	4	5	6	7
(c) identifying/obtaining social support	1	2	3	4	5	6	7
(d) overcoming barriers to PA	1	2	3	4	5	6	7
(e) stimulus control	1	2	3	4	5	6	7
(f) how to set goals for PA	1	2	3	4	5	6	7
(g) detailed planning for PA	1	2	3	4	5	6	7

8. The TRACKS Trial included 6 supervised exercise and counselling sessions delivered over a 4-week period. How many sessions and number of weeks would you have preferred?

I would have preferred __________ sessions over ____________ weeks

(indicate number) (indicate number)

The next set of questions asks you to rate the physical activity manual included in the TRACKS trial. Please answer each one as honestly as possible.

9. Was the manual easy to read?

1	2	3	4	5	6	7
Not at all easy		somewhat easy		quite easy		extremely easy

10. The TRACKS Trial physical activity manual was 43 pages in length. Was the manual too long or too short? (circle the response that best represents how you feel)

Too long About right Too short

a) If it was too long/short, how many pages would you have preferred? ____(indicate number)

11. Was the manual interesting to read?

1	2	3	4	5	6	7
Not at all interesting		somewhat interesting		quite interesting		extremely interesting

12. Were the topics in the manual clear?

1	2	3	4	5	6	7
Not at all clear		somewhat clear		quite clear		extremely clear

13. Would you recommend this manual to other kidney cancer survivors?

1	2	3	4	5	6	7
not at all		somewhat		a fair bit		very much

14. Did you learn new information from reading this manual?

1	2	3	4	5	6	7
not at all		somewhat		a fair bit		very much

15. Were you satisfied with the topics covered in the manual?

1	2	3	4	5	6	7
not at all		somewhat		a fair bit		very much

16. Would you have liked to see more topics in the manual? Yes or No

a) If yes, what other topics would you have liked to see?

____
____
____